

THE INFLUENCE OF DESIGN TEAM COMMUNICATION/CONTENT
UPON THE ARCHITECTURAL DECISION MAKING/PROCESS
IN THE PRE CONTRACT DESIGN STAGES.

By

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For Mary.

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LIST OF DESIGN PROJECTS

In order to ensure confidentiality, no further details can be given.

Main Longitudinal Study

A. A University new engineering department.

Pilot Study

B. A University new technological department.

Cross-sectional Studies

- C. A new advanced factory complex.
- D(a) A housing refurbishment.
- D(b) A new housing development (City Centre).
- D(c) A new housing development (Suburban).
- E. A new nuclear reactor simulator.
- F. A new Police headquarters.
- G. A new workshops complex.
- H. A sports arena refurbishment.
- I. A new disabled childrens hostel.
- J. A new specialist accommodation complex.
- K. An office refurbishment.
- L. A bank refurbishment.

- M. A new supermarket.
- N. A new hospital extension.
- O. A public house refurbishment.
- P. A University new administrative department.

Note: The letter symbols given for each project are used throughout the thesis. They are also used in the figures section.

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ABSTRACT

Patterns of communication in the decision-making process of Design Team Architects are considered. Variations in the verbal content of Architect and other Design Team member interaction behaviour are analysed over the various stages of the design process.

A pilot study building design and a main subject study building design are investigated on a longitudinal basis. Fourteen other building designs are investigated on a cross sectional basis. The presented results represent a data collection period of approximately eighteen months.

Design Team interaction is measured using content analysis. The measurement scales used are largely based upon existing methodologies, although some measurement scales are developed specifically for this research. Quantitative data analysis is by mainframe computer, using analysis programs which are developed specifically for this research. Additional qualitative substantiations are provided by extracts of supportive interview responses.

The results show pronounced patterns of variation in the interaction content of Design Team members throughout the design process over a range of design types. The conclusions are of use to Design Team members since they illustrate the likely patterns of future interaction for the future stages of any design

process. Potential areas of interaction conflict are presented, together with likely variations in Design Team member preoccupations as the design develops. Reference to the results allow the Designer to design in order to avoid likely design interaction problems associated with long term variations in Design Team interaction behaviour.

Results indicate that the Architect becomes less assertive during the middle stages of the design, as does the influence of the initial brief. The Architect is consistently the most creative Design Team member, although cost considerations increasingly influence the decision-making process of the Architect, largely at the expense of aesthetic considerations. The professional Design Team members increasingly form a coalition against the Client Representative, to some extent as a defence against late stage disruptive cost reduction exercises, as construction factors increasingly influence interaction behaviour.

CHAPTER ONE

INTRODUCTION

1.1. INTRODUCTION.

This research is concerned with the Architectural decision making process. When an Architect undertakes to design a building for a Client he or she is becoming involved in a highly complex process with a wide range of influencing factors and variables. The design process is subject to overriding parameters such as cost limits and time constraints within which the entire design process must evolve. In addition, the choices of design solutions are limited by external influences such as the availability of materials or likely materials price fluctuations. In addition, the Architect has a professional responsibility to produce a building which is visually acceptable, and which will perform satisfactorily in terms of user satisfaction and running costs. The Architect also has to design within a multidisciplinary design team. The design has to be compatible with the requirements of other specialist designers and a Client who is probably a layman in construction design terms.

These forces and influences all operate in addition to the highly complex problems of designing a building which interrelates and works as a unit. The Architect is therefore subject to a multitude of influencing factors when developing a design solution. Architects achieve an eventual solution effectively by designing sections and acting upon subsequent feedback from other members of the design team. The design

process is therefore highly interactive and the design decision making process of the Architect cannot be regarded as an individualistic progression. Architects cope with this procedure as a result of their Architectural training and subsequent experience. However, the design-feedback-redesign process necessarily involves a degree of abortive design effort and consequent disruption of the design program. The Client "discovers" new design requirements as he or she sees the developing designs and seeks to impose these on the design, again causing redesign work.

This research is concerned with examining this interactive design process in terms of isolating the major interaction patterns which occur throughout it's duration, including the variations in forces which are imposed on the Architect at each stage and how these affect the subsequent and eventual design. It is submitted that such an understanding could help alleviate much of the conflict and abortive work which is characteristic of current design team practice.

1.2.OBJECTIVES.

The primary research objective of this research can be stated as follows;

To observe the process of design team interaction in relation to the decision making process in order to determine the relative influences of each design team member upon the evolution of the eventual design solution.

The primary applicational objective of this research can be stated as follows;

To produce a theory of the Architectural decision making process which can be applied to the Industry and which will assist and improve the design process as a function of design team communication and interaction.

This objective is viewed particularly from the point of view of the Architect. In the majority of "traditional" design teams, the Architect is appointed to the role of design team leader, and is seen as leading the design process. The analysis of the objective shows the extent to which the design decision making process of the Architect is influenced by the interactive contributions of the other members of the design team.

The primary objective is achieved by the analysis of a series of supportive secondary objectives which may be stated as follows;

1.To determine the relative prominence of the Architect in the design team interaction process as a function of design development stage.

2.To determine the patterns of design objective variations as a function of individual member prominence.

3.To determine variations in the patterns of inter-member conflict and cooperation and the effects of these patterns upon the evolution of the design.

4.To monitor the stages of goal initiation, establishment and substitution as a function of inter-member variations in value judgements, and corresponding influences on the design.

1.3.LIMITATIONS.

1.3.1.SAMPLE COMPATIBILITY.

A subsidiary objective of this research is that it should be generalisable and applicable to design teams in general as opposed to design teams working in one particular aspect of construction. For this reason it was decided to observe as wide a range of design types as possible with regard to;

A.Design characteristics and complexity.

B.Design team assembly.

C.Form of contract and regulatory procedures.

D.Design process duration.

E.Client body characteristics.

The results obtained from this research therefore relate to a wide range of design types and design team characteristics. A result which is present across a range of the subject designs observed in this research can therefore be considered as universal and to act regardless of the complexity of the design, the form of contract to which the design team is working and the characteristics of the Client body. This includes the relative degree of design "sophistication" exhibited by Client bodies.

Subject design complexities therefore range from simple housing to a nuclear reactor simulator while Client bodies range from Housing Associations to Major Government Departments. Forms of contract range from Joint Contracts Tribunal Private with Quantities to G.C. Works 1. Client sophistication ranges from negligible, in the case of Academic Departments moving into new premises, to considerable, in the case of the major Government bodies.

Preliminary analyses suggested that research of this type would involve a considerable commitment in terms of data collection and processing. It was therefore decided to restrict the data collection and processing approaches to the Architect, Client and Quantity Surveyor. The research did include the influence of the various specialist Engineering Consultants, but these were regarded as "others" as opposed to individual data source units. This limitation was purely a product of time and resource limitations. It was fully taken into account in the methodology which was designed for the research.

1.3.2. TIMESCALE STANDARDISATION.

The research was standardised against the R.I.B.A. plan of work. This design process time scale or similar standardisations are widely recognised throughout the construction industry. The R.I.B.A. plan of work was adhered to by all the design teams used as data sources in this research. The plan of work may be summarised as follows;

- A. Inception.
- B. Feasibility.
- C. Outline Proposals.
- D. Scheme Design.
- E. Detailed Design.
- F. Production Information.
- G. Bills of Quantities.
- H. Tender Action.
- J. Project Planning.
- K. Operations on Site.
- L. Completion.
- M. Feedback.

The durations of the research involvement in each subject design team were standardised according to this scale. A detailed breakdown of the proposed purpose and tasks involved in each of these stages is presented in appendix four.

1.3.3. SUBJECT CLASSIFICATION.

The design process was analysed in terms of the input and influence of individual design team members. Client Representatives, Architects and Quantity Surveyors were analysed as individuals. Engineering Consultants were classified collectively. This was necessary due to resource limitations. The research therefore does not provide a detailed individual examination in relation to Services, Structural or Electrical Engineering Consultants.

1.3.4. RESEARCH CONTRIBUTION.

This research examines the process of design decision making as a function of design team interaction. It does so by a detailed quantitative analysis of the interaction procedure over a standardised period of time. Exhaustive literature searches have shown this approach to be innovatory in the construction field. The findings therefore provide a combined qualitative and quantitative analysis of the design process. While this approach is unique in the study of building design, it is complementary in relation to a range of previous building design research approaches, as detailed in chapter two.

The research therefore provides a unique and innovatory contribution to the study of the building design process. The findings provide a measured and verified theory of the Architectural decision making process as a function of design team interaction. A number of professional and Industrial bodies, together with individual researchers, have recognised the importance of design team communications in relation to the Architectural design process. This research represents the first attempt to scientifically analyse this process using replicable methodologies.

1.4. THESIS FORMAT.

The thesis is structured so as to present the research in the most logical and readable way. The text is divided into a series of chapters, each of which present component sections of the research. The chapters are structured so as to support and interrelate with each other and to lead towards subsequent

sections.

Chapter two reviews the literature on the design process and Architectural decision making. This chapter forms the basis for the research and establishes a framework for the theoretical development of a general theory of the design team interaction process in relation to the Architectural decision making process which follows.

Chapters three and four review the literature on group theory in relation to multidisciplinary teams and individual versus group theory respectively. These chapters further develop the general theory in relation to more specific aspects of interaction and decision making theory.

Chapter five synthesises the preceding review chapters in order to highlight the principal themes which relate to the general theory. These are then linked in with the main experimental section, by relating them to the findings of an initial pilot study. This acts as the basis of the methodology and the formulation of main research hypotheses. These hypotheses are stated in the light of an overall literature and pilot study results synthesis.

Chapter six describes the methodology used in the pilot, main and validation studies. The primary available methodologies are discussed and the resultant chosen methodology is detailed.

Chapter seven presents the main results obtained from the design teams used as data sources. The results are presented graphically with text descriptions.

Chapter eight re-evaluates the literature in the light of the main results and develops a full theory of the design team interaction and decision making process.

Chapter nine states the final findings and conclusions of the research and suggests potential areas for further research.

Appendix one gives details of the interview questions used in order to obtain the qualitative responses given as part of the results in chapter seven.

Appendix two gives details of the codes used as part of the methodology detailed in chapter six, in order to allow a quantitative analysis of meetings contributions and interview responses.

Appendix three gives complete print outs and explanations of the computer programs used in order to process the quantitative data, including example data files and results print outs.

Appendix four provides a full description of the R.I.B.A. plan of work, which acts as a timescale standardisation for the research.

Appendix five contains the graphical presentation of results for use with the qualitative results presented in chapter seven.

NOTE: The graphical representations of quantitative results were placed in appendix five in order to minimise the interruption of the the text flow in the main results chapter.

CHAPTER TWO

THE DESIGN PROCESS AND ARCHITECTURAL DECISION MAKING.

2.1. INTRODUCTION.

This chapter reviews the limited literature on the design process and Architectural decision making. The objective is to establish an overall framework for the development of a general theory of the Architectural decision making process as a product of a succession of communication events and interactions.

2.2. DESIGN TEAM COMMUNICATIONS.

Any building design process is essentially based upon the synthesis of ideas and restrictions provided by a series of contributors. The classical "design team" in the construction industry consists of Architectural, Engineering and Cost specialists, and as such must be regarded as a multidisciplinary team. The Architect may be aware of the basic concepts of Engineering design, but the primary input to the design evolution is provided by the Specialist. This process of conceptualisation and transfer to the main design can only be achieved by communication. The various specialisms may develop independently to a certain extent, but ultimately must be combined with other specialisms to produce a mutually acceptable design result.

The process of communication also relates to interaction relationships within any group. A group will be subject to a number of influences which may determine the nature, distribution and influences of individual communication

patterns. In addition, as groups develop and evolve some kind of solution, the communication patterns themselves might be expected to change, both in response to the evolution of the solution itself, and in response to changing group influences. For example, as a building design becomes increasingly refined, one might expect the freedom of communication content to become increasingly constrained, and therefore the pattern and effects of communications may alter accordingly.

A number of researchers have reported findings in these areas. The significant differences between previously reported findings and this research lie in specific interest areas and methodology. This research is the first to consider the Architectural decision making process from the point of view of design team interaction, in relation to the qualitative and quantitative measurement of the actual communications content.

Clark(1) reported that the influence of design team members varied over the course of the evolution of the design. He considered patterns of communication variation from the point of view of four variables;

1. What decisions were made.
2. Who made the decisions.
3. When the decisions were made.
4. The time and degree of interaction spent on making the decisions.

(Clark(1:5))

Clark's(1) results suggest that the relative influence of design team members varied over the course of the design process, and that the decision making behaviour of a design team

relative to its communication characteristics was not constant. One reason put forward for communication variations was that the objectives of design team members may vary throughout the course of the evolution of a design, with consequent effects upon the characteristics of the individual's communication patterns. Clark(1) referred to the characteristics of an individual's communication content as being related to the formation and reinforcement of "discreet channels"* of information which originate at one design team member. These channeled communications are then directed to other design team members for action or are combined with channels from other individuals in order to provide a mutually acceptable solution.

Clark's(1) discreet channels therefore represent the passage of information around the various members of a design team in terms of information origin, direction, emphasis and availability for combination with other items of information. For example a piece of information which is not available for compromise would be transferred around the design team in a different channel to a piece of information which was put forward for discussion and possible adjustment. A channel represents the degree of control imposed upon a communication by its originator.

Derbyshire(2) has also referred to this approach, considering the building design process as being based upon the balancing

* A channel being a representation of the direction and degree of emphasis or commitment of an item of communication. Channels may therefore contain communication which is protected by strong emphasis, or put forward deliberately for debate.

of individual objectives or goals. Each member of the design team has a range of goals at the outset. These are input to the design at the appropriate stage in channels which indicate their importance to originator and possibly to the design itself. Derbyshire(2) suggested that there are essentially two groups of objectives inherent in any building design process. Firstly the design team itself has an overall goal, largely based upon meeting the requirements put forward by the Client. Secondly each individual member of the design team has individual goals which he or she seeks to impose or implement upon the design as it evolves. Derbyshire(2) suggested that a typical objective or goal of the Architect is that of aesthetic optimisation, while a typical objective or goal of the Client is that of capital cost minimisation.

Individual objectives are put forward in channels at the appropriate time (Clark(1)) and are then balanced by a process of design team interactive communication (Derbyshire(2)). The process of balancing depends upon the stage of the design process which is being considered. Derbyshire(2) noted that different design stage related factors influence the balancing process at different stages in the design evolutionary process. One example quoted was the balance "paradox" caused by heightened feedback. As the design process continues, the level of information available to the design team necessarily increases. As the design becomes established, the Quantity Surveyor can produce more detailed and accurate cost analyses which can be related to the initial cost plans and the cost efficiency or otherwise of the design can be evaluated. However, as the design does produce more and more feedback, it also becomes increasingly difficult to make

modifications. Late stage design changes have a number of important implications for the overall design program for example. Balancing therefore becomes influenced by other factors in the later stages of the design. The time delay implications of making a design variation may begin to outweigh the potential capital cost savings to the Client.

This simple example illustrates how the objectives of the Client may vary over the course of a design process as a result of factors which are not even directly related to the design itself. As a result the consequent communication patterns of the Client will tend to be channelled differently to other members of the design team (Clark(1)). The Client may have strongly maintained the importance of minimising capital costs in the early stages, only to have this perceived objective superceded by that of program time delay avoidance.

The importance of feedback in relation to design team objective balancing has been noted by N.J.C.C.(3) and N.E.D.O.(4) in Client advice publications. Both bodies have stressed the impact potential of cost related feedback upon Client bodies, in relation to the variation or even complete reversion of objectives which may result, with potentially disruptive consequences in the later stages of the design.

Feedback and particularly cost related feedback is therefore an example of the importance of design team communications in relation to the evolution of the overall design. The level of feedback, and hence the likely effects upon objective balancing and subsequent communication patterns also varies as a function of design stage. Higgin and Jessop(5) also noted this probability of objective or goal variation and observed the impact of design stage upon it, in relation to the patterns of

communication which are likely to be exhibited as a result. Their results suggest that goal or objective variation disruption could be minimised by the introduction of a "sponsor" (an Architect) at an early stage. This again highlights the importance of the communication system, in that if an Architect is involved at an early stage, he or she can influence the early objective formation of the Client via the interactive communication system (Higgin and Jessop(5:19)).

A second aspect of communication also raised by Higgin and Jessop(5) and N.E.D.O.(4) was that of Client requirements communication. The multidisciplinary nature of the design team means that the Client is usually relatively non-specialised in terms of construction and design philosophy. This presents the obvious problem of a relatively "ignorant" and inexperienced individual attempting to communicate his or her user requirements to a highly specialised and experienced design team*. Higgin and Jessop(5) suggested that the Client typically forms an "idealised" objective judgement of the eventual building which is typically incorrectly communicated or

* Client design awareness or sophistication will clearly vary from design team to design team. The results in this research were found to apply regardless of this variation in subject characteristics. Some subject Client bodies exhibited a relatively high degree of sophistication, while others were specialists in unrelated fields and were almost completely ignorant of the complexities of building design.

channelled to the design team at the outset, and to a lesser extent throughout the early stages of the design (Clark(1), Derbyshire(2)). Higgin and Jessop(5) suggested that this early lack of effective communication is a primary source of design team design related conflict in subsequent stages of the design.

Conflict itself is another form of design team communication which directly affects the evolution of the design. Conflict is simply information presented in an "assertive channel" which is responded to by information in a "counter channel", and is characterised by mutually unacceptable objectives (Clark(1), (Derbyshire(2))). Higgin and Jessop(5) suggested that conflict typically increases towards the later stages of the design, and appears to be related to the degree of complexity and establishment of the design and the magnitude of subsequent feedback availability and appearance in communication content.

The appearance of conflict in communication content does appear to be related to design stage. Higgin and Jessop(5) suggested that it tends to occur as the communication content in relation to the evolution of the design changes from the strategical to the tactical. Using their own design plan of work terminology, they suggested that conflict typically increases in the later stages of the design, but could appear as early as stage 2 (Sponsor investigating and preparing the brief) or stage 3 (Preparing and obtaining Client's approval for sketch plans). These stages correspond to the Outline Proposals and Scheme Design stages of the R.I.B.A.(6) plan of work respectively.

Clark(1) and Higgin and Jessop(5) noted an increase in cost related decisions and consequent cost related communications

towards the later stages of the design process. This ties in with objective reversal or modification by the Client towards the later stages as the level of cost related feedback increases. In most design teams, the cost information is largely provided by the Quantity Surveyor. This in turn suggests that the communication content of the Quantity Surveyor will become increasingly important in terms of overall design team communication towards the later stages of the design process (Derbyshire(2)). Higgin and Jessop(5:20) associated this with the change in design philosophy from strategical to tactical. They suggested that the Architect designs with considerable freedom in the early stages, constrained only by the contents of the brief and any overriding cost limits imposed by the Client. They suggested that this situation can only continue until the Quantity Surveyor begins to provide detailed cost information as feedback. They suggested that this increase in cost related communication, with the Quantity Surveyor as the primary originator, tends to increase the overall level of communication between the Architect and the Quantity Surveyor.

Higgin and Jessop(5) went on to suggest that this increased level of Architect-Quantity Surveyor communication interaction is characterised by an increasing level of mutual communication cooperation between them, suggesting that the basis of this phenomenon could be the mutual design experience of these individuals as opposed to that of the Client.

Jepson(7) has also reported on the importance of experience in design team communication and the subsequent design process. He has suggested that the whole process of design team communication could be improved if more attention were paid to

the rate of conversion to material of the value of experience. In line with Higgin and Jessop(5) he suggested that Architects tend to use experience to a greater extent after the initial stages of the design in design team communications, although using it in varying and largely unmeasurable rates in their own minds throughout the design process. Experience was suggested to be particularly prevalent in design team and particularly Architect communication and decision making, in relation to decisions concerning innovatory construction techniques or new materials ((Jepson(7:46))).

Increased cost related communication towards the later stages therefore increases Quantity Surveyor design team influence, and a corresponding increase in Architect-Quantity Surveyor cooperation, partially based upon mutual experience.

Marvin and Mackinder(8) observed these patterns in relation to the use of experience in the design process from the viewpoint of Architects. In addition, they observed the increasing conflict effects towards the later stages of the design process and reported that experience was increasingly used in Architect communication as a "defence" against Client "attacks" on the design, as the overall level of conflict within the design team increases ((Higgin and Jessop(5))). They suggested three main types of experience used in such circumstances;

1. Experience of the decision making process.
2. Experience of building and general construction.
3. Experience of previously made design decisions.

(Marvin and Mackinder(8:10)).

In line with Derbyshire(2), Marvin and Mackinder(8:13) reported

on the increasing level of feedback in design team communication towards the later stages of the design. They suggested that virtually all attempts at design rationalisation follow the same basic process of "analysis-synthesis-evaluation" with a necessity for an increasingly communication defined return loop in order to provide the inevitable feedback and backtracking with associated reanalysis of the design problem which inevitably occurs when an initial design solution fails to work. They suggested that, because of the multidisciplinary nature of the building design team, and because the communication of each member becomes more and more channelled, it may be possible to rationalise one communication channel in relation to the design, but it becomes more and more difficult to rationalise them all coherently without modification of the individual elements. Hence the observed development of conflict towards the later stages of the design (Clark(1), Higgin and Jessop(5)).

Marvin and Mackinder(8:44) also noted that certain aspects of the design utilised a disproportionate amount of overall design time and design communication. They tied this back to their observations on the use of experience in Architect communications by suggesting that the "quick" decisions, and therefore those which do not feature prominently in design team communications, are those in which past experience can be used directly by the Architect. Longer decisional periods and a greater degree of consequent design team communication are needed for those decisions in which the Architect either cannot use past experience, for example new materials or where he or she is prevented from applying experience directly in order to

select a design solution by Client intervention, for example conflict (Higgin and Jessop(5), Jepson(7)).

Mackinder(9) has reported more specifically on Architect communication content in relation to aspects of the design. She contended that five major selection criteria in relation to design decision dominate Architect communication throughout the design process;

1. Cost.
2. Aesthetics.
3. Durability and adequate performance.
4. Supply and availability.
5. Replacement.

(Mackinder(9)).

Mackinder(9) reported that these five factors featured more prominently than others in the decision making processes of subject Architects as measured by communication. Cost was reported to be the main factor for consideration in most cases, increasing in importance towards the later stages of the design process. Aesthetics was reported to be of particular value in isolating possible component solutions from a range of acceptable alternatives. She suggested that the Architects in her sample considered and chose a component from a series of alternatives on the basis of aesthetic merit. The chosen component was then evaluated against other selection criteria, in order to see if it remained an acceptable choice. This phenomenon was measurable both by observation of the decision making procedure and by analysis of communication content. It was suggested that towards the later stages of the

design, the subject Architects increasingly considered the market availability and supply of elements of the design. Her observations let her to suggest that conflict within the design team leads to the disruption of these criteria in terms of individual objectives. The Client initially seeks a solution with at least some aesthetic merit, but this objective increasingly becomes superceded by the cost based objective as feedback increases (Derbyshire(2), Higgin and Jessop(5)).

Mackinder(9:110-111) went on to suggest that Clients initially sought maintenance and durability characteristics in the design, but cost reporting caused an objective reversal towards capital cost minimisation (Mackinder and Marvin(8)). In other words, Clients want long term performance and life cycle cost optimisation in the early stages, but increasingly argue against it in the later stages in order to reduce the initial cost of the building. Mackinders'(9) interviews with Her subject Architects further supported this. She suggested that Architects tend to choose materials and forms of construction with aesthetics, maintenance and durability in mind. However, during the design team communication process, the Client increasingly pressurises the Architect to adopt initially cheaper solutions. This process is again characterised by the evolving level of design team conflict towards the later stages of the design.

2.2.1. DESIGN TEAM COMMUNICATIONS SUMMARY.

The literature on design team communications suggests that the design process is essentially a function of the communication processes which take place within the design team over a period

of time. Individual design team members have individual objectives and goals which they seek to implement upon the design by communication. These objectives may be based upon a range of individual perceptual associations, ranging from experience of previous designs to idealised aspirations of the finished product.

Initially, these objectives are broadly compatible, while the design is relatively simple and the amount of feedback within the system is limited. As the complexity of the design increases, objectives begin to conflict, and the group as a whole tends towards communication conflict.

The decision making process of the Architect cannot therefore be considered in isolation. It must be regarded as a function of group interaction and communication. This relationship is considered and developed in the following section.

2.3. ARCHITECTURAL DECISION MAKING IN THE DESIGN PROCESS.

Architectural design processes and associated decision making have received considerably more attention in the literature than design team communication.

Alexander(10) suggested that any design problem may be considered in terms of a tree hierarchy. The design is initially simple and follows only one direct line of development. As the design is developed, it becomes increasingly complex, and branches out to form Alexander's "tree". This concept is compatible with Higgin and Jessop's(5) progression of the design from the strategical to the tactical and with Mackinder and Marvin's(8) observations on the increasing level of feedback evident in the later stages of the design. A given

design theme or solution to a specific design problem is thus represented by a branch of the tree. As the branch is extended and the design solution becomes increasingly developed, it divides into sub-branches. These sub-divisions correspond to the respective stages of work in the various plans of work (R.I.B.A.(6), Higgin and Jessop(5)). As a series of design solutions are developed, they become functionalities of each other. Development along one branch produces feedback to the design team which influences the development of other branches.

Alexander(11) later produced a refined model of this process. He moved away from the tree concept and represented the design process in terms of a "semi-lattice", in order to more fully represent the importance of feedback of different types, such as experience and cost (Mackinder and Marvin(8), Mackinder(9)). Alexander(11) suggested that as the design becomes more and more complex, the heightened level of design information available to the design team allows increasingly accurate cost reporting by the Quantity Surveyor. In turn, this increased cost reporting influences the design to a more and more significant extent towards the later stages.

Alexander(11) further developed this semi-lattice into a full "interaction matrix" which attempted to fully allow for the various levels of feedback which influence the design as it is evolved. This introduced the concept of "direct linkages" between different aspects of the design. For example, cost reporting may highlight a basic incompatibility between two design objectives (Derbyshire(2)). The Client may want a high quality cladding for the elevations of the building, but cost reporting may show that this cannot be achieved within the cost limits, while maintaining briefed requirements elsewhere. In line

with Mackinder's(9) observations, the Client may want long term durability, but may be unprepared to pay for it.

This idea of objective reversal in the light of feedback and mutual dependencies links the ideas of Derbyshire(2), Higgin and Jessop(5), Mackinder(9), and Alexander(10), (11). The process can be seen to be observable both in terms of design team communication and the design process itself.

The design lattice itself (Alexander(11)) is a direct function of design team communication, since the relative strength of each primary drive line in the matrix depends upon the level of communication emphasis placed upon it by its respective proponent. For example, the Architect will probably want to see an end product which has a certain aesthetic appeal (Jepson(7), Mackinder(9)). Initially, the Client may want this as well. However, increased cost reporting (Mackinder(9), Alexander(10), (11)) may cause objective reversal (Derbyshire(2)) on the part of the Client. This may lead on to conflict within the design team, since the basic design strategy of the Architect becomes undermined by the cost reduction requirements of the Client. (Mackinder(9), Higgin and Jessop(5)).

In this situation, the continued development of relative curtailment of a "contentious" design aspect or tactic will depend upon the subsequent semi-conflicting design team communication. This in turn depends upon a range of factors, including the relative status of each design team member within the group. The R.I.B.A.(6) plan of work indicates the generally accepted roles of the Client and the Architect. One would therefore expect the Client to "have the last word" in most conflicting situations, since the role of the Architect

would be expected to be that of "consultant". The sections of the design matrix which are Client-sponsored or defended would be expected to prevail (Alexander (11)).Hence Derbyshire's(2) objective reversal should be seen in the light of the relative status of the design team members, and it should be remembered that while the Architect is the designer,he or she is not the decider.

Rittel(12) and Johnson(13) have both stressed the importance of this consideration in any analysis of the design process.Rittel(12) suggested that the Architect's role in the design process is analagous to that of a midwife in enabling the Client to produce something more easily and efficiently by making use of his or her experience.Again this relates to the increasing use of experience towards the later stages of the design (Jepson(7),Mackinder(9)).Johnson(13) referred to the role of the Architect as being that of an enabler,again enabeling the Client to achieve that which he or she could not produce alone.Johnson (13:7) went on to suggest,in line with Rittel(12) that this concept is characterised by a relatively higher degree of Client Involvement in the earlier and later stages of the design,represented in part by the relatively greater influence of the design brief (R.I.B.A.(6)) at these times.

The degree of Client influence on the decision making process is therefore higher in the later stages of the design.Again this links in with Mackinder's(9) observations of cost based conflict and Higgin and Jessop's(5) general conflict in the later stages,simply caused by increased cost reporting showing the Client that the building is going to cost more than was initially thought (N.J.C.C.(3),N.E.D.O.(4)).These developments

are all a product of the increased level of feedback produced by the increasing complexity of the design (Alexander(10),(11)) and the deliniation of the previously separate design lines.

The Client and the design brief therefore play a more important role in the design process in the earlier and later stages. Initially the Client plays a prominent role in initiating the design and communicating strategic (Higgin and Jessop(5)) requirements. Towards the later stages, initial requirements become superceded by events (Derbyshire(2)). This suggests that during the middle stages, the Architect plays a more prominent role in the design process, acting more as pure designer than controlled enabler (Rittel(12), Johnson(13)). This concept has been put forward by Lawson(14), who particularly stressed the relative importance of the Client in the early stages in communicating the actual requirements to the Architect (Lawson(14)).

Lawson(14) also noted the effects of increasing cost feedback as the design becomes increasingly complex (Alexander(10),(11)). He suggested that the Architect becomes increasingly pressurised into making cost reduction so the design towards the later stages of it's development, and that this is reflected in design team communications. This again represents goal or objective reversal (Derbyshire(2)) but also a certain role reversal or transformation. The Architect becomes increasingly pressurised by the Architect away from the role of primary initiator and more towards the role of enabler or midwife (Rittel(12),(Johnson(13))). Lawson suggested that towards the later stages of the design process, the Architect and the Quantity Surveyor have to work more closely together in order to keep control of the design in the light of increasingly

detailed and accurate cost reporting.

Lawson(14) drew on his own earlier work (Lawson(15)) in order to more fully analyse this apparent role reversal. He suggested that the Architect effectively moves through a series of reversals of procedure in terms of his or her decision making processes. This occurs as the Architect moves away from solving the primary design functions of solving what is to be achieved, towards the secondary design functions of solving how these requirements are to be achieved. In solving the primary functional requirements, the Architect relies heavily upon the design brief and the Client, corresponding to the provisions of the briefing and outline proposals stages of the R.I.B.A.(6) plan of work or the earlier sections of Higgin and Jessop's(5) classification. Towards the middle stages of the design, the brief no longer provides sufficient information to act as the main design solution function. Consequently, the Architect has to obtain potential design solutions and related information from elsewhere. Lawson(15) suggested that he or she achieves this by making greater use of past design experience (Jepson(7), Mackinder and Marvin(8)). Towards the later stages, the Architect has to resort to the brief or Client communication in order to design the finer points, since these are different in every design and each Client necessarily has differing requirements, for example in relation to the type of light fittings required in the building. This will in most cases be a function of individual Client requirements, as opposed to a function of experience on the part of the Architect. This corresponds to the transition from strategical to tactical and to the developing complexity and interrelatedness of the design (Higgin and Jessop(5), Alexander(10), (11)) .

Jepson(7) also noted this apparent variation in the use of experience by the Architect in the middle stages of the design process. He suggested that in many respects, experience forms the basis of most elements of the Architectural decision making process, but that this tends to be compromised and to some extent eliminated by pressure from other design team members, particularly in the later stages of the design. Again, this transformation is a function of the amount of informational feedback in the system (Mackinder and Marvin(8)) and the increasing degree of interrelatedness between the various lines of action in the overall design process (Alexander(10),(11)).

Lawson(16) explored this concept further, and considered the transition in terms of sequentially dividing the design problem into a series of analysable "isolates" and then grouping these isolates into a related set which illustrates the functionalities and interdependencies between them. This again relates to Alexander's(10),(11) representations, and in particular to Herbert's(17) "hierarchy of the design process", and the approach favoured by Miller, Galanter and Pribram(18). These approaches all consider the design process in relation to design isolates which link together and which directly influence the development and treatment of each other, and which can be analysed within the design process to a relatively high level of definition, for example down to the detail of an individual design goal or objective.

Lawson(14) suggested that the extent to which these isolates are maintained, developed and expanded within the design process depends largely upon the design team interaction process. This links in with the individual status of design team members and

any shifts or reversals of goals or roles which occur during the interaction process throughout the course of the design (Derbyshire(2), Rittel(12), Johnson(13)).

Gelernter(19) referred to these changing goal priorities as variations in "value judgements". He suggested that each member of the design team necessarily contributed a set of a priori conceptions to his or her lists of perceptions which apply to the solution of a given design problem. He related these value judgements to the work of Jepson(7) and Mackinder and Marvin(8) by noting the extent to which the relative importance of each value judgement is weighted by experience. He suggested that the Architect and the Quantity Surveyor tend to have comparable experience, and therefore tend to weight their value judgements in at least a reasonably compatible way. The Client however does not share this professional experience in most cases, and may tend to give different value judgement weightings to different goals or objectives (Derbyshire(2)). This results in a relative isolation of the Client in terms of value judgement weightings. In addition, because the compatibility of such weightings depends upon the use of experience, and because the use of experience varies at different stages of the design process, one would expect this relative isolation of the Client to occur when the use of experience by the Architect is greatest, that is towards the middle stages of the design.

The Architect then must expect that the design will not be under his or her complete control. He or she will be given an initial design brief or instructions and will be expected to develop a solution from that. However, different members of the design team will have different value judgements and objectives, which will change over the course of the design

process. This will lead to the Architect being subjected to external influences which may force changes to his or her preferred design. Darke(20) recognised this in suggesting that the ideal decision making process would consist of;

1. Listing out all the factors to be considered in achieving a required design.
2. Consideration of all the various interactions between these factors.
3. Agreeing upon the most favourable and mutually compatible design solution at the outset.

Darke(20) suggested that this procedure, if properly utilised and applied could "almost automatically" generate a design solution which would avoid most of the usual conflict in the later stages, with the associated objective reversal and subsequent role reversal (Derbyshire(2), Higgin and Jessop(5), Mackinder and Marvin(8), Rittel(12), Johnson(13), Lawson(14)).

Yeomans(21) also considered the design process from the point of view of value judgements, and in particular how the level of information present in the system could influence them. He recognised the general pattern of evolving design information and feedback towards the later stages of the design process and the increasing level of Client influence (Alexander(10),(11), (Rittel(12), Johnson(13), Lawson(14),(15)). He suggested that as a general rule, the more information which acts upon a value judgement, the more likely that value judgement is to change as a result. This agrees with Lawson(14),(15),(16) in that the Architect is effectively more and more influenced in terms of his decision making process as the design evolves by other

members of the design team, and that the main reason or justification of this is the increased level of information available to the design team within the system (Alexander(10),(11)).

Yeomans(21:1-17-3) suggested that personal preferences or weightings (Gelernter's(19) value judgement weightings) will be used in predictable ways. He suggested that broad decisional theory predicts that the Architect will use his discretion in a quasi-rational way which is appropriate to the design problem in question. Yeomans(21) suggested that in many cases this assumption may be inappropriate, and that it is quite feasible that the Architect may act in an illogical and irrational manner in relation to the design problem. He suggested that the main reason for this was conflict. An Architect may perceive with a design concept or goal even when it has been condemned by the Client for example. He or she might do this for "face saving" reasons. The Architect may attempt to impose a set of design constraints upon the problem which are entirely his or her own, and which do not specifically or necessarily relate to the design problem itself.

This explains the variations in objectives (Derbyshire(2)) reported by Mackinder and Marvin(8) and Mackinder(9). For example the characteristic high aesthetic content of initial designs being superceded by simpler, less expensive designs as a result of subsequent Client pressure. Such preferences are generally overcome by a process of design team conflict (Higgin and Jessop(5), Lawson(14),(15)).

Mann(22) suggested that the eventual design decision depends to a significant extent upon the types of argument and defences put forward by design team members. Assuming a reasonable

degree of democracy in the group, any outcome should be a function of the argument weightings put forward by the various design team members. In line with Rittel and Kunz(23) he suggested that the Architectural design process could be basically viewed as an argumentative process, with the general level of argumentation and conflict increasing with the level of information available to the system(Higgin and Jessop(5), Alexander(10),(11), Gelernter(19)).

Mann(22:2-25-1) also suggested that the conflict stage of any design process is characterised by new potential design solutions being put forward as alternatives to existing ones. This led him to suggest, in line with Lawson(16) and Rittel and Kunz(23) that conflict may be a fundamental requirement for efficient and wide ranging solution development and factor consideration in decision making. The concept of conflict being necessary in order to produce an effective group solution is well developed in psychology theory, but is perhaps less well appreciated or understood in relation to design teams in the construction industry.

2.3.1. ARCHITECTURAL DECISION MAKING SUMMARY.

The literature suggests that the Architectural decision making process is influenced by the group decision making process. Initially, the Architect is given considerable design freedom as a strategic design approach is developed. The lack of design feedback allows the Architect and group to remain compatible. As the design becomes more tactical and the level of design feedback increases, the objectives of individual design team members become increasingly conflicting. The level of group

conflict necessarily increases.

The initial leader role of the Architect, characterised by considerable design influence and group prominence, becomes increasingly suppressed in favour of an enabler role, characterised by group pressure compliance. This is again characterised by communication conflict and is a function of the level of information available within the system.

These themes are integrated with the design team communication themes in the following section.

2.4.CHAPTER SUMMARY.

The design process is a function of design team communications. Individual goals and objectives are included in the design by a process of communication. When the group is first formed, the Architect assumes the role of team leader and develops the design including a considerable degree of his or her own objectives in the strategic development. As the design process continues, the objectives of the Architect increasingly clash with those of the group. The initially included objectives are revealed to be incompatible with the developing objectives of the design team as a whole. These new goals are implanted on the design via a process of increasingly conflicting communication, and originate from design feedback enhancement as a function of the amount of design information available within the system.

The Architectural decision making process is therefore a function of group communication behaviour. The extent to which Architectural decision making is influenced by the group must therefore be a function of the characteristics of the group,

and how these vary over time. It is therefore important to develop an understanding of the group process, in order to assess it's influence upon the Architect. The literature on group characteristics and behaviour is reviewed in the following chapter.

CHAPTER THREE

GROUP THEORY AND MULTIDISCIPLINARY TEAMS.

3.1. INTRODUCTION.

This chapter considers the Architectural decision making process as a function of group interaction, from the point of view of the group itself. Any group develops over a period of time as the individual members get to know each other and as they work collectively at a task. Therefore the behaviour and characteristics of the group cannot be regarded as constant, nor the likely influence of the group upon an individual member. This chapter considers the theoretical development of the group in relation to time and specific characteristics, such as individual member specialisation.

3.2. GROUP THEORY.

Group theory summarises the various aspects of group analysis and appraisal. Groups can be considered from a number of points of view in relation to the characteristics or behaviours which are being studied. Shadish(24:103-105) has suggested five main areas which are central to group theory;

1. Phenomenology.

The phenomenological aspect relates to the subjective experiences of the members of the group and the role of these experiences in the functioning and characteristics of the

group. In a building design team this relates to the past experiences of the Architect, both from the point of view of actual design experience, and from the point of view of previous design team interaction experience.

It includes the meaning of the group from the point of view of the individual in terms of the perceptions of the individual as to the purpose of the group and what it is trying to achieve and the role of individual motives (Lieberman, Lakin and Whitaker(25), Cartwright and Zander(26)). It also includes the effects of individual perceptions within the group framework (Napier and Gershenfeld(27)). Therefore in terms of the building design team, phenomenology is concerned with the Architect's perceptions of what the finished building should be like, prior to any design team influence and conflict and what the Architect actually wants to see produced, for example a building with a high level of aesthetic appeal, and the extent to which the Architect is pressurised into changing these initial ideals by other members of the design team (Mackinder(9), Lawson(16), Gelernter(19), Mann(22), Rittel and Kunz(23)).

2. Group structure.

Group structure relates to the physical structure of the group. The traditional building design team consists of an Architect, Quantity Surveyor, Client and other specialist consultants as its basic group structure

It includes group task and group boundaries, lifespan and target population (Cartwright and Zander(26), Hoffman and Arsenian(28), Lieberman(29)). It also includes group composition and group rules and standards (Napier and Gershenfeld(27),

Hare(30)).Therefore in terms of the building design team,group structure relates to the complexity of the design and how many group members and specialists are consequently required.It relates to the lifespan of the group.Some design teams may stay in operation for years while others may only meet once (R.I.B.A.(6)).It includes the composition of the group.Some building design teams could have two Architects in order to provide a balance,or two or more structural consultants as a function of design complexity.Group standards and rules are largely variable,although broad guidelines exist in addition to professional and ruling body regulations (R.I.B.A.(6)).

3.Group process.

Group process relates to the nature of the group activity,together with the variable effects of how group members think,feel and act in the group.In the building design team it would include the perceived power of the Architect,to what extent he or she feels in control of the design and how pleased or otherwise he or she is with the situation.

It includes decision processes, group norms and regulatory mechanisms and problem solving procedures (Cartwright and Zander(26), Napier and Gershenfeld(27), Hare(30)). It also relates to group developmental stages and group interaction and communication processes (Schutz(31), Egan(32)).In terms of the building design team it relates to the decision making processes of the Architect in relation to the regulatory forces applied during communication by the Client, in order to bring the Architect's value judgements and objectives into line. It also relates to the various developmental stages experienced by the group over a period of time.Regulatory and decision making

procedures may change in a group as its existence lengthens (Clark(1), Derbyshire(2), Higgin and Jessop(5), Jepson(7), Gelernter(10), Hoffman and Arsenian(28)). It also relates to the ways in which information is allowed to pass around the group. The Quantity Surveyor may have much more cost information available in the later stages but he or she can only pass it to the Architect if the group process allows him or her to do so Alexander(10),(11)).

4. Leadership.

Leadership relates to the minority of group members who exert a disproportionately high level of influence upon the development of the group. In most building design teams, the Architect adopts the role of team "leader", at least until he is subjected to role readjustment in the later stages (Rittel(12), Johnson(13), Lawson(14),(15),(16)).

It includes the role of the leader and leadership style, including specific aspects of leadership style, such as socio-emotional and task-oriented leadership characteristics (Shaffer and Galinsky(33), Lewin Lippitt and White(34), Bales(35)). In terms of the building design team it relates to the perceived and actual authority of the Architect, together with the degree of authority he or she commands over the other design team members.

5. Learning.

Learning relates to a process of group disapproval and subsequent correction. Undesirable behaviour is identified and

subjected to some form of corrective group pressure. If the Architect refuses to accept an instruction from the Client he or she would be pressurised, in all probability, by the other professionals in the design team.

It includes physiological and psychological bases, general productivity, the transfer of learning, and to the benefits or deficits of various group interventions (Lieberman, Lakin and Whitaker(25), Hare(30), Schutz(31)). In terms of the building design team it relates to unacceptable behaviour by a member being corrected by group pressure. Gross misconceptions by the Client may be attacked by the professional design team members (Mackinder(9)). If a member of the design team does not produce information at the required time, the rest of the group are likely to voice their disapproval and will learn what type of corrective intervention is most useful or effective.

These five categories form the basis of group theory. The literature suggests that most groups can be effectively analysed according to these classifications. They are all applicable to the analysis of a building design team and determine the patterns of group communication and interaction.

3.2.1. GROUP THEORY SUMMARY.

Group theory describes the group characteristics. The group develops perceptions of itself in relation to this theory. The design team is characterised by phenomenological, structural, procedural, leadership and learning factors. The imposed alteration of Architect status from originator towards enabler is a characteristic of the learning process giving rise to

variations in leadership recognition, in the light of the initial and subsequent phenomenological and structural characteristics. The group theory therefore clearly influences fundamental nature of the group, and this will reflect in the patterns of communication within the group.

It is therefore necessary to consider the specific factors which influence the patterns of participational communication within groups. The literature on group participation is reviewed in the next section.

3.3.GROUP PARTICIPATION.

Group participation as an aspect of group theory is central to the methodology of this research, and as such it requires further elaboration. Group participation is simply the patterns of communication within a group of individuals or sub-groups. Much of the theory on group participation links in with the more general aspects of group theory.

Burke(36:832) suggested that the distribution of participation and turn-taking in groups are related, and that leadership roles and participation levels arise from the group driving for coordination and overall consensus. He pointed out that traditional studies have used three primary units of analysis;

- 1.The participation. (e.g.Stephen and Mishler(37)).
- 2.The act.(e.g.Bales(38)).
- 3.The minute.(e.g.Chapple and Arensberg(39)).

Analysis by participation, act and minute refer to

observational methodologies based upon communication content, bodily movements and records of group interactions respectively. Burke's(36) findings suggest that a complex structure of group processes determine the pattern of group participation, the primary processes being leadership style and group forces and regulatory norms (Shadish(24), Cartwright and Zander(26), Napier and Gershenfeld(27), Shaffer and Galinsky(33), Lewin, Lippitt and White(34)).

Duncan(40) suggested that there is a subtle yet extremely complex mechanism inherent in Western cultures which regulates group participation procedure. He suggested that an individual's participation in an overall group participation depends upon the type of feedback or response received in relation to previously made contributions. He identified three types of signal which are primarily responsible in this respect;

1. Turn-yielding signals.
2. Attempt-suppressing signals.
3. Back-channel signals.

The first two signal types are given by the current speaker in order to defend the right to continue speaking, either on the same subject or with the same level of emphasis. Back-channel signals represent communications which are indirect, such as agreeing with the speaker. Clearly, these types of signal and the rate at which they are used relate to the underlying group process, particularly the group regulatory forces. The team leader, which in the building design team is initially perceived to be the Architect will perceive his or her role

definition as allowing him or her a certain level of participation communication and emphasis by default (R.I.B.A.(6), Mackinder and Marvin(8), lawson(14),(15),(16), hadish(24), Lieberman,Lakin and Whitaker(25), Cartwright and Zander(26), Napier and Gershenfeld(27)). This will continue until the group regulatory forces impose a change in the situation,perhaps through a process of design team conflict (Higgin and Jessop(5)).This is a time related factor,and therefore will be a function of the time for which the group has existed.In effect,the group process will impose a process of learning on the group,by which the prcieved structure may have to be re-evaluated,as the group moves through a range of socio-emotional developmental stages (Shadish(24), Napier and Gershenfeld(27), Hoffman and Arsenian(28), Schutz(31), Bales(35)).

An obvious influence upon group participation which lies outside the direct influence of the group process is that of an individual's willingness to speak.Willard and Strodbeck(41) referred to this as an individual's characteristic verbal latency.Burke(36:841) suggested that this factor accounts for most of an individual's participation during group interaction,assuming the group is reasonably democratic and there are no outside requirements forcing contributions.It is suggested that this is not a major factor in the building design team,with the possible exeption of the Client,since the professional design team members are highly trained and experienced group members (Clark(1),R.I.B.A.(6),Mackinder and Marvin(8),Mackinder(9)).

Participatory behaviour in groups also appears to be a function of the level of conflict present within the group

interaction. Gustafson(42);(43) considered the effects of cooperative and clashing interests in small groups upon related participation behaviour. He reported that subsequent participatory behaviour is directly related to current cooperation or conflict. In other words if the Architect and the Client argue about something today, there is a good chance that they will argue about it again tomorrow. This ties in with a range of findings from Mackinder and Marvin(8) and Mackinder(9). They quoted an range of examples of this type of behaviour. An argument in relation to some aspect of the design tends to propagate future arguments in relation to the same or similar subject matter in future.

Hancock and Sorrentino(44) reported on a similar study and suggested that a group member who has previously received support from other group members is more likely to participate in a conformist manner on that subject during future group participation interaction (Lieberman, Lakin and Whitaker(25), Cartwright and Zander(26)) .

The findings of Gustafson(42),(43) and Hancock and Sorrentino(44) support the assertions of Higgin and Jessop(5), Jepson(7), Mackinder and Marvin(8) and Mackinder(9) in that design team conflict increases towards the later stages of the design. Alexander's(10),(11) and Lawson's(14),(15),(16) results suggest that this is caused by the increased level of information available to the design team, agreeing with Gelernter's(19) and Yeomans'(21) assertions that the more information available in relation to value judgement, the more likely it is to be changed. However, the findings of Gustafson(42),(43) and Hancock and Sorrentino(44) suggest that this late stage upsurge in conflict may be self propagating as

a result of an argument or conflict being carried forward and expanded into other conflict extensions which originated further back in the interaction process.

The literature reviewed in this section suggests that there is a strong time related element in action in relation to group participation. The group development process as a function of time will therefore be considered in more detail.

3.3.1. GROUP DEVELOPMENTAL INFLUENCE ON GROUP PARTICIPATION.

Schutz(31) has identified the general characteristics of group development, while Hoffman and Arsenian(28) have considered more specifically the effects of group lifespan upon the participation process. The literature is in overall agreement that as groups continue to exist, they undergo changes in terms of their approach to the problem for which a solution is required, and in terms of attitudes and behaviours towards each other. This developmental process essentially relates to the group learning process. Learning itself is a function of timespan which again indicates the importance of the time for which a group has existed in relation to the observed participation process (Lieberman, Lakin and Whitaker(25), Hare(30), Schutz(31)).

Hoffman and Arsenian(28) suggested that the two primary variables in terms of group development as a function of individual participation are;

- 1.The length of time for which the group has existed.
- 2.The number of occasions on which the group has met.

Borgatta and Bales(46) have reported on these effects.They suggested that if group members have experience in taking part in a series of meetings on related subjects,where each previous meeting has consisted of assemblies of different group members,then the effect on group participation is the same as if the group had met for the first time.In other words,the fact that the Architect and Quantity Surveyor have attended numerous design team meetings for different Clients in the past,does not influence their participation at a given design team meeting for a new Client,provided they have not worked together in the past.

This is an important consideration in this research. The subject design teams were all chosen so that the individual design team members had not previously worked together collectively as a group. Individuals had of course worked separately on other designs, but this did not affect the group process of the subject groups (Hoffman and Arsenian(28), Bales(35), Borgatta and Bales(46)).

The literature suggests that this phenomenon is due to an underlying group process of socio-emotional development. Experience of previous meetings will give the design professionals a task-oriented basis,but each group initialisation necessitates the formation of a new and unique socio-emotional structure and decisional-participational strategy (Shadish(24), Cartwright and Zander(26), Napier and Gershenfeld(27), Hare(30), Egan(32)). The task-executive element may be present but the socio-emotional element is not

(Bales(35)).For example it takes time for the conflict escalation phenomenon to develop (Gustafson(42),(43)).

It can therefore be taken that design team participation will be unaffected by previous design team experience in the case of the design team professionals. The fact that the design professionals have worked on previous designs will not influence their participational behaviour in a study design group. This will only become a problem if the design professionals have previously worked together as a group (as opposed to individually with other designers) on another design. The next point for consideration is what stages the group develops through after inception, and how participation behaviour can be expected to vary accordingly.

Tuckman(47) suggested a theory of group development which identifies four main stages in the developmental process;

1. Testing and development.
2. Intragroup conflict.
3. Development of group cohesion.
4. Functional role-relatedness.

Each of which consists of two component aspect elements;

1. Group structures.
2. Task relatedness.

Tuckman's(47) theory is in line with the themes developed so far in this review. It can be sequentially linked in with the preceding literature as follows;

1. Testing and development.

The group meets for the first time usually when the Client has formulated an effective brief. No socio-emotional group structure exists. The fact that the design professionals have attended numerous other design team meetings in the past does not affect this (R.I.B.A.(6), Hoffman and Arsenian(28), Borgatta and Bales(46)). A leader is appointed and establishes his or her own leadership style in relation to the perceived leadership role. Norms and regulatory procedures begin to come into force, as the objectives of each design team member become apparent (Derbyshire(2), Lawson(14), (15), (16), Shaffer and Galinsky(33), Lewin, Lippit and White(34)). Task behaviour is still largely perceived as the role of the Architect. He or she initiates the design in conjunction with the Client's guidance in a relatively free atmosphere, since the level of information in the system is still relatively low (R.I.B.A.(6), Alexander(10), (11), Rittel(12), Johnson(13)).

2. Intragroup conflict.

The basic group process becomes established and essential group structure consolidates. The learning process develops the initial perceptions of group meaning. The developing complexity of the design matrix produces increasing feedback. This development produces conflicting objectives and value judgements within the design team (Derbyshire(2), Mackinder and Marvin(8), Alexander(10), (11), Gelernter(19), Darke(20), Shadish(24), Hare(30)). This produces evolving conflict which

coupled with the developing level of information available in relation to design decisions, tends to lead to the abandonment of design concepts. Initial conflict tends to lead to subsequent conflict so that the conflict cycle becomes self propagating (Higgin and Jessop(5),Yeomans(21), Mann(22), Gustafson(42),(43)).

The Architect increasingly has to defend design concepts in the face of Client opposition and this is achieved in part by the use of experience. The Architect shares this with the Quantity Surveyor and they work more closely together (Jepson(7), Mackinder and Marvin(8), Mackinder(9)).

3.Development of group cohesion.

The group process develops further.A more defined group structure evolves through the group regulatory procedures which become more and more defined.The role of the Architect as team leader becomes adjusted from that of primary initiator, towards that of midwife or enabler (Rittel(12), Johnson(13), Shadish(24), Cartwright and Zander(26), Schutz(31), Shaffer and Galinsky(33)).This establishes further the Architect-Quantity Surveyor coalition. The Client becomes relatively alienated from the design participation process in that previously cooperative Architect-Client communication becomes more conflictive as a result of conflict propagation (Higgin and Jessop(5), Mackinder and Marvin(8), Gustafson(42),(43)). The conformity process becomes fixed into the group regulatory procedure as group members learn to expect conflict in certain areas (Lieberman, Lakin and Whitaker(25), Schutz(31), Hancock and Sorrentino(44), Slusher(45)).

4. Functional role relatedness.

Each member is now fully aware of the group overall socio-emotional processes. The socio-emotional establishment and subsequent reinforcement allow the group to become fully task related. This is necessary due to the increasing complexity of the design in the later stages (Alexander(10),(11), Lieberman, Lakin and Whitaker(25), Bales(35), Borgatta and Bales(46)). Conflict still occurs within the established group process as a continuation of earlier conflicts, although conformity to the established group norms becomes increasingly apparent (Higgin and Jessop(5), Shadish(24), Napier and Gershenfeld(27), Gustafson(42),(43)).

Within each developmental stage, elements of group structure and task relatedness developments are evident. The early phases of group development are dominated by group process establishment and the development of a workable socio-emotional framework. It is only when this is established, via a process of subsequently propagating conflict, that full task related development can take place. Participation at each stage is dominated by these developmental factors.

3.3.2. GROUP CHARACTERISTICS AND PARTICIPATION.

A second primary function of group participation is that of group characteristics. The rate and degree of group development will be a function of the individual and unique characteristics of the group. Tuckman's(47) intragroup conflict development stage has been explored further in terms of group characteristics by Baird(48). He suggested that the primary group characteristic which influences the conflictive or

cooperative participation within the group is that of group competitiveness. As any group develops and its objective becomes more clearly defined, there is a tendency for the socio-emotional and task oriented factors to lead to conflict and subsequently into a further group process development based upon competition. The extent to which this occurs directly influences the late stage participation characteristics of the group (Shadish(24), Bales(35), Gustafson(42),(43)).

Baird(48:266) suggested that this competitive or non-competitive characteristic of groups in the later stages is not simply a product of the increasing amount of information available in relation to the task oriented aspect of group attention, but is also related to the pseudo socio-emotional motives as influenced by the increasingly established and intransigent group regulatory procedures which have developed over a period of time (Yeomans(21), Mann(22), Cartwright and Zander(26), Hoffman and Arsenian(28), Bales(35)). In other words, the design team is established at the outset in order to produce a design to the Client's requirements. Each design team member has individual motives and objectives which are presented to the group as it develops in both a task-oriented and socio-emotional sense. Bales's (48) findings suggest that a group with a high initial individual participation emphasis in relation to individual motives, will tend to develop a more competitive and less cooperative participation characteristic in the later stages. (R.I.B.A.(6), Derbyshire(2), Bales(35), Gustafson(42),(43), Baird(48)). This agrees with the suggestions of Mackinder and Marvin(8).

Deutsch(49) has also noted this basic relationship. In addition he suggested that higher levels of late stage competition and

conflict tend to produce a greater level of diversification in group member participation. As the group becomes increasingly conflictive in its later stages, the participation of the group members tends to become more variable. This is due to a number of factors (Higgin and Jessop(5)).

The group learning process demonstrates which member of the design team is the actual leader as opposed to the initially perceived leader. The Client increasingly pressurises the Architect into design compromises as group value judgements are modified (Mackinder(9), Gelernter(19), Darke(20), Hare(30), Shaffer and Galinsky(33), Lewin, Lippit and White(34)). The Architect is effectively pressurised away from a perceived primary role into a secondary enabler role which, causes the whole participation format of the group to change. The Architect is forced to become more defensive with a corresponding rise in conflict levels, thereby causing an increase in competitive participation (Higgin and Jessop(5), Mackinder and Marvin(8), Rittel(12), Johnson(13), Gustafson(42), (43), Baird (48)).

Deutsch(49) also noted that competition between group members can produce cooperation between others. The increasing competition and conflict between the Architect and the Client effectively creates a coalition between the Architect and the Quantity Surveyor as they work more closely together and make use of their mutual design team experience (Jepson(7), Mackinder and Marvin(8), Mackinder(9)). Again, this serves to reinforce the alienation of the Client from the professional design team members towards the later stages of the design.

Stendler, Damrin and Haines(50) noted this characteristic and suggested that it could be observed by a measurable variation

in the type of participation and communication content during group interaction. This tendency towards late stage competition and conflict is characterised by an increase in the frequency of competitive and conflicting contributions made during the group interaction process. Similarly, the tendency for conflict between some group members to produce cooperation between others is characterised by a decrease in these types of contributions and a consequent increase in the frequency of supportive and non-competitive participation contributions.

A second group characteristic which has direct bearing upon the participation behaviour within a group is that of reciprocity. This relates to cooperation within a group and is a measure of the extent to which group members are seeking to obtain cooperation, and hence alleviate or reduce conflict. Oskamp(51) suggested that during group participation, an individual may attempt to secure group or respondent cooperation, and hence reduce the anticipated amount of response conflict or competition by using a degree of reciprocity, that is by imitating a previous cooperative response or conclusion on the subject under discussion or argumentation (Mann(22), Rittel and Kunz(23), Gustafson(42),(43), Baird(48), Deutsch (49)). In other words, one way of effecting a concession during group participation is to reciprocate the concession of the target group member. In the building design team this would be used in a competitive or conflicting situation. Design related concessions are increasingly made by the Architect as the design process continues, often in response to cost based arguments. In the late stage conflict phases of the group process, one would therefore expect the degree of Architect reciprocity in group participation to increase (Clark(1),

Higgin and Jessop(5), Mackinder and Marvin(8), Shadish(24)).

3.3.3.GROUP PARTICIPATION SUMMARY.

Group participation is a function of the underlying group characteristics. Participation varies in relation to the developing group process. The group process develops with time and follows recognisable sequence stages. Initially, the building design team has only a vaguely defined task oriented statement (the brief) and has no socio-emotional structure. This allows the characteristic early design "abandon" of the Architect and his or her adoption of the leadership role. In subsequent stages the design becomes more apparent and feedback increases, allowing a more clearly defined statement of "real" (group) objectives. At the same time, the group develops a socio-emotional structure which allows the discovered objectives to be imposed. This acts as the foundation for the conflict which is characteristic of the later stages of the group developmental process.

The construction design team is a special case in some respects, since it characteristically contains group members who specialise in widely different fields and disciplines. It is therefore important to make an assesment of the relevance of the multidisciplinary nature of the design team in relation to the group theory and participation literature. The literature on multidisciplinary teams is reviewed in the following section.

3.4. MULTIDISCIPLINARY TEAMS.

The building design team by definition consists of a number of individuals, each of whom has his or her own specialisations (N.J.C.C.(3), N.E.D.O.(4), R.I.B.A.(6)). The design team therefore represents a range of disciplines, assembled and developed together in order to produce a combination of expertise in relation to a complex problem. This situation represents a multidisciplinary team and the literature suggests that group participation and indeed the entire group process is fundamentally different in multidisciplinary teams as compared to unidisciplinary teams. For example one could expect a group consisting of three Architects to arrive at a different design solution compared to a group consisting of an Architect, Engineer and Quantity Surveyor.

There is a well developed literature on multidisciplinary groups although it is dominated by special education and health care research. Yoshida(52) has provided a recent comprehensive review.

The main point which emerges from the literature is that the group process of multidisciplinary teams in relation to the interaction and compatibility of group and individual goals and value judgements, is fundamentally different to the corresponding process in unidisciplinary groups (Gelernter(19), Darke(20), Lieberman, Lakin and Whitaker(25), Cartwright and Zander(26)). The literature suggests that in a unidisciplinary teams, the objectives of each individual are likely to be similar to those of the other members of the group. In multidisciplinary teams, there is likely to be larger variations between individual goals and objectives, with consequent

increased difficulties in establishing a team goal and reconciling the individual objectives with this overall group objective (Yoshida(52)).

Yoshida(52:222) suggested that this disparity of goals in a multidisciplinary team could lead to goal ambiguity. In other words each member of the design team has his or her own objectives which are individually perceived as being compatible with the overall group objectives. (Derbyshire(2), Mackinder(9), Lawson(14),(15),(16), Gelernter(19), Darke(20)), (Lieberman, Lakin and Whitaker(25), Cartwright and Zander(26)). If a team goal has not been clearly defined at the outset, then the group process is forced to implant a team goal upon the individuals via a process of conflict and competition, since a range of individual goals are unlikely to be fully compatible with eventual perceived group goals, due to variations in individual value judgements (Shadish(24), Lieberman, Lakin and Whitaker(25), Cartwright and Zander(26), Baird(48), Deutsch(49), Stendler, Damrin and Haines(50)).

Yoshida's(52) results suggest that this late stage increase in conflict and the consequent variations in participation such as Architect-Quantity Surveyor coalition and group process realignment, may be a result of relative goal ambiguity at the initialisation of the group. (Mackinder and Marvin(8), Slusher(45), Tuckman(47)). The level of information provided in the Client brief may be only a few lines of outline notes and no clear goal is established. Even a highly detailed brief may be subject to large scale changes once the design process is underway, rendering the briefed objectives redundant and effectively ambiguous. The Architect has a relatively free hand at designing a solution until the level of design information

increases to such an extent that feedback becomes available to the Client enabling him or her to appraise the proposed solution against his or her idealised requirements. The effects of the goal ambiguity then have to be corrected by the processes discussed with the consequent effects upon design team participation (Clark(1), R.I.B.A.(6), Jepson(7), Yoshida(52)).

In a goal-ambiguity initialisation situation a multidisciplinary team will develop along different group process lines than a unidisciplinary team. Yoshida's(52) results suggest that multidisciplinary group conflict may be a direct consequence. Yoshida, Fenton, Maxwell and Kaufman(53) have also stressed the potential effects of goal ambiguity in multidisciplinary teams, suggesting that this may affect the efficient development of both task-oriented and socio-emotional group processes (Shadish(24), Bales(35)).

A second factor which affects design team interaction and participation in addition to goal ambiguity is that of role ambiguity, or design team members not fully appreciating their role or position within the group. Bales(54) has suggested that role ambiguity may lead to a subsequent design team apathy towards overall team goals, suggesting that a lack of clearly defined member roles leads to a disruption of the testing and development stage of the group developmental process and particularly interfering with the establishment and implementation of a compatible group socio-emotional structure. Team apathy and group process interruption are clearly factors in the appearance of group conflict and group process realignment in the later stages, and therefore play an appreciable part in the subsequent interaction and

participation processes (Borgatta and Bales(46), Tuckman(47)).

As with goal ambiguity, role ambiguity is pronounced in building design teams. The Architect is officially the team leader, but the Client effectively has the last say since he or she is paying for the building and the Architect's commission (Mackinder and Marvin(8)). The late stage group process realignment effectively corrects the Architect's incorrectly perceived leadership role towards that of enabler with all the participational and interactional effects associated with this realignment. Additionally, the late stage Architect-Quantity Surveyor coalition formation could be a function of this role ambiguity correction. The Architect perceives his or her role as being threatened by the Client and attempts to defend it by working more closely with the Quantity Surveyor (Rittel(12), Johnson(13), Shadish(24), Cartwright and Zander(26), Shaffer and Galinsky(33), Baird(48), Deutsch(49), Stendler et al(50)).

A third factor for consideration in relation to multidisciplinary teams as opposed to unidisciplinary teams is that of participation in relation to the solution formulation. Ysseldyke, Algozzine and Mitchell(55) reported that multidisciplinary teams tend to consider a wider range of solution alternatives in attempting to arrive at an overall solution. They suggested that this wider ranging participation is caused by the combination of a greater and more varied range of experiences. This may seem clear, but it does have an implication in relation to role ambiguity. The results of Ysseldyke et al(55) suggested that this consideration of a wider range of variables could be related to goal and role ambiguity via the process of resultant conflict and competition.

Late stage group correction procedures in response to conflict propagation cause role realignment on the part of the Architect. this transition is caused by initial role ambiguity (R.I.B.A.(6), Rittel(12), Johnson(13), Cartwright and Zander(26), Shaffer and Galinsky(33)Gustafson(42),(43), Bales(54),Ysseldyke et al(55)). The Architect therefore enters a competitive situation. As a result he or she is forced to make design concessions at a relatively advanced stage of the design process. This means that the Architect must now consider a range of alternatives which will be compatible both with the rest of the design and with the modified requirements of the Client (Clark(1), Derbyshire(2), Mackinder and Marvin(8), Mackinder(9), Baird(48), Deutsch(49), Stendler et al(50), Oskamp(51)). This involves the consideration of a relatively wide range of alternatives in order to satisfy a range of increasingly complex parameters. The multidisciplinary team therefore may appear more productive in terms of the alternative solutions which appear in it's interactive participation content, but this could be a function simply of initial goal and role ambiguity which would not affect a unidisciplinary team to the same extent (Bales(54)).

Yoshida,Fenton,Maxwell and Kaufman(53) extended this slightly by considering these effects in relation to participation contribution content.They reported that participation frequency generally varied more in multidisciplinary teams than in unidisciplinary teams. In addition,individual perceptions of contribution frequency vary appreciably more in multidisciplinary teams. Yoshida et al(53) reported on five types of contribution;

1. Contributing information.
2. Processing information.
3. Proposing alternatives.
4. Evaluating alternatives.
5. Finalising decisions.

They reported that individuals in multidisciplinary teams perceived themselves as primarily proposers and evaluators in their own specialist field, with another major role being that of finalising decisions. Yoshida et al(53) found this not to be the case, suggesting that individual expertise and experience often become overruled by stronger and combined group forces in the conflict interaction. This again ties back to Mackinder's(9) observations on Architects being pressurised into changing specialised and highly developed sections of the design by the (inexperienced) Client (Cartwright and Zander(26), Gustafson(42),(43)).

3.4.1. MULTIDISCIPLINARY TEAMS SUMMARY.

The building design team is characteristically of a highly multidisciplinary nature. This enhances the initial role and goal ambiguities which form initially within the group due to the lack of clear task-oriented alignment and the lack of an adequate socio-emotional preventative mechanism. These initial ambiguities are corrected as the socio-emotional and task-oriented definitions become more established. The correction procedure is via a process of participative interaction which is increasingly based upon conflict and

competition.

These themes are integrated with the main themes from the group theory and group participation literature in the following section.

3.5.CHAPTER SUMMARY.

The building design team initially forms under circumstances of role and goal ambiguity. The Initially perceived role of the Architect as team leader and design initiator are acceptable without the presence of a clearly stated task-oriented objective and socio-emotional structure. As the group process develops, the initial phenomenological, structural, and leadership characteristics and treatments change. This change is characterised by increasing conflict as the established system is altered. The Architect is therefore forced into a secondary enabler role via the design team conflictive participative communication process.

These effects are present in all groups but are more pronounced in the building design team which is classically multidisciplinary, than they would be in a unidisciplinary group. The Architect must therefore be considered as an individual within a group when his or her decision making process is being considered. It is therefore important to develop an understanding of the characteristic interactions and interdependencies which occur between individual group members and their overall group. The literature on the individual and the group is reviewed in the next chapter.

CHAPTER FOUR.

THE INDIVIDUAL AND THE GROUP.

4.1.INTRODUCTION.

This chapter considers the literature on individual versus group performance and behaviour. The literature is developed in the light of the preceding section on group characteristics and behaviour, in order to build up an understanding of how the individual relates to the group influence. This is clearly of importance in relation to the building design team, since the Architect is only one member of a highly variable and multidisciplinary group, characteristically working on a relatively complex task.

The literature is dominated by two primary areas in relation to this research. These are performance and creativity.

4.2.INDIVIDUAL AND GROUP PERFORMANCE.

Extensive reviews on individual versus group performance have been produced by Davis(56), Dion,Baron and Miller(57), Duncan(58), and Hare(30).The general theme of the literature ties in with the previous chapter in that the judgements and decisions made by a group are more workable and accurate than those made by an individual (Duncan(58)).This is in general agreement with the concept of multidisciplinary teams considering a wider range of potential solutions in arriving at an eventual solution,due to the wider range of specialisms

which may be combined in an appraisal (Ysseldyke et al(55)).

Stroop(59) suggested that groups make more accurate,workable and rational decisions than individuals because the grouping effect of knowledge and related experience allows the aggregation of errors and acts with a moderating influence to restrict extreme views.Extreme in this context refers to those views which are deemed as unacceptable in terms of group norms and regulatory forces, for example individual objectives or motives which are incompatible with group goal perceptions. Stroop(59) pointed out that these basic moderators or limiting effects are again based upon conflict (Derbyshire(2), Cartwright and Zander(26), Napier and Gershenfeld(27), Hare(30), Gustafson(42),(43)).

Stroop(59) also suggested that group interaction produces a higher degree of creativity in relation to a potential solution than an individual.This relates to the participation structure of the group. Hare(30) stressed the familiarisation element (Hoffman and Arsenian(28)) in this respect,suggesting that the longer a group exists,the more creative it will become as compared to an individual. Borgatta and Bales(46) suggested that this judgement enhancement applies to most forms of decision making,and confirmed that it's effect is time related.

These suggestions relate back to a number of earlier sections of the review. They suggest that the design team develop a better design solution than the Architect could alone. Coupled with the literature on group process they suggest that the design team act upon the Architect via the process of conflict to produce a better design."Better" in this context meaning more compatible with the percieved collective group goal

(Mackinder and Marvin(8), Shadish(24), Cartwright and Zander(26), Napier and Gershenfeld(27) Gustafson(42),(43)). In the context of the late stage dominance of conflict as a function of objective reversal, and role adjustment, they suggest that the group influence on the Architect becomes more pronounced as a function of the time that the group has been in existence, and that this correlates with the developing conflict caused by enhanced feedback available to the design team (Derbyshire(2), Higgin and Jessop(5), Alexander(10),(11), Rittel(12), Johnson(13), Gelerenter(19), Yeomans(21), Cartwright and Zander(26), Napier and Gershenfeld(27), Gustafson(42),(43), Borgatta and Bales(46), Duncan(58)).The separate sections of literature do seem to support each other in the development of the general theory, fundamental to which is the basic group transition from cooperative to conflicting (Baird(48)).

The literature also suggests that this process is important in relation to the achievement of an acceptable design. The Architect alone would not produce a fully acceptable design, in relation to the relative weightings given to aspects of its development.

In addition, the literature suggests that the influence of the group on the individual may be particularly pronounced in the case of a building design team. Campbell(60) reported upon the relative influence of the group on an individual over a range of task complexities. He reported that the superior performance of groups over individuals is more pronounced in the case of highly complex tasks which require a multidisciplinary solution strategy. This suggests that the design of a building benefits

appreciably from the influence of the group upon the Architect. In addition, Laughlin and Jaccard(61) reported that with multidisciplinary teams working on highly complex tasks, a group took less time and required fewer trials to arrive at an acceptable solution. In other words, the influence of the group upon the Architect acts to produce not only a more workable and acceptable design, but also allows it to be achieved in less time and with less abortive work. Again, this all supports the basic concept of the Architect being an enabler, as opposed to the team leader (R.I.B.A.(6), Rittel(12), Johnson(13)).

Collins and Guetzcow(62) supported this view of group influence on the individual. They agreed with the basic theory of group-individual alignment (Cartwright and Zander(26)) and increased output efficiency (Yoshida(52)) and suggested that the two primary group processes which bring these about to be;

1. Pooling of separate items of information.
2. Integration of this information to form a solution.

The units or items of information which are available to the group varies in nature according to the design stage which is considered. Initially the available information will be dominated by the brief and subsequently by the Architect's conceptualisation of a possible solution in scheme design (N.J.C.C.(3), Higgin and Jessop(5), R.I.B.A.(6)). In the later stages the available information will be dominated by actual design feedback as the design becomes more and more established. This again supports the literature in terms of the higher degree of group correctiveness in the later stages of

the group's existence (Mackinder and Marvin(8), Alexander(10),(11), Borgatta and Bales(46),Yoshida(52), Collins and Guetzcow(62)). The magnitude of such influence will grow in the later stages. Lorge,Davitz,Fox and Harrold(63) reported that in a multidisciplinary group working on high complexity tasks less than 10% of ideas suggested by individual group members prior to the formation of the group,were ever actually incorporated into the group solution.In addition,30% of the concepts eventually incorporated into the group solution were not mentioned by any member of the group prior to formation.This implies that that the group is very active in terms of creativity.The pooling of resources (Collins and Guetzcow(62)) clearly has a creative implication as far as the evolution of the design is concerned.

4.3.INDIVIDUAL AND GROUP CREATIVITY.

Architects are trained to be creative.They have to be able to create a conceptual solution from the basic and characteristically underdeveloped information which the Client provides as the outset.The results of Lorge et al(63) suggest that this individual creativity is heavily influenced by the group interaction process. Golann(64) has produced a comprehensive review of the individual versus group creativity literature. Gordon(65:41) supported the group creativity-enhancing concept and suggested a number of reasons why the influence on individual and eventual group solutions is so pronounced.He suggested that individual creativity is a

subjective sub-conscious quality and cannot easily be communicated to other members of a group (Mackinder(9)). This problem is enhanced in the case of a multidisciplinary group where the individual concerned may be attempting to communicate the creative concept to an individual who is completely unenlightened in the discipline concerned (N.J.C.C.(3), Mackinder and Marvin(8), Yoshida(52)). In addition, Gordon(65:41) suggested that individual creativity in a group environment is strongly affected by group norms and regulatory procedures in that the creative individual learns to temper his or her creative concept communications in the light of previous group and leader responses to earlier creative concept communications, where reciprocity may be perceived as the safest course of action (Lieberman et al(25), Cartwright and Zander(26), Tuckman(47), Baird(48), Deutsch(49), Oskamp(51)).

It can therefore be seen that the late stage decline in Architect creative participation corresponds with the increasing level of conflict within the group as the group undergoes a transition from cooperative to competitive as perceived (inaccurate) roles are corrected through a process of personal value adjustment. The literature suggests that this process is necessary in order to arrive at a workable solution (Higgin and Jessop(5), Gelernter(19), Yeomans(21), Gustafson(42),(43), Bales(54), Gordon(65)).

4.4.CHAPTER SUMMARY.

The design team has a considerable influence upon the decision making process of the Architect. This influence is a function

of the group developmental process and is time-related. The group acts to correct initial goal and role ambiguities using conflictive participation. This changes the group leadership, structural and procedural approaches. The Architect is transferred to an enabler role or "more one of the group" by this process. Again, this effect is more pronounced in the building design team because of its multidisciplinary nature, and the group influence increases towards the later stages of the developmental process.

The group effect does increase the amount of information considered by the individual in arriving at a decision, although it does tend to restrict individual creativity as well. This may be due to the difficulties of a specialist attempting to adequately communicate creative perceptions to non-specialists and specialists in other fields.

These literature themes all clearly interrelate with each other. In order to build up a global perspective of the literature it is necessary to integrate the emergent themes from the three preceding chapters. This overall literature integration is presented in the following chapter.

CHAPTER FIVE.

SYNTHESIS OF THE LITERATURE AND REPORT ON PILOT STUDY.

5.1.INTRODUCTION.

This chapter integrates the major themes from the preceding review chapters, highlighting the important implications for design team interaction and decision making. These implications then act as a basis for a longitudinal descriptive report of the pilot study. The report on the pilot study refers back to both this integration section and to the preceding review chapters. The implications of the integration and the pilot study are then synthesised and developed as a basis for the formulation of hypotheses which form the basis of the main study, both in terms of corroboration of previous research and in the opening up of new areas of research in the main study. The overall intention is to clearly lay the foundational bases of the main hypotheses.

5.2.INTEGRATION OF THE LITERATURE.

The review chapters have indicated a strong time related element in relation to the design team decision making and participative interaction process. The integration is therefore structured on a longitudinal basis in coordination with the R.I.B.A. plan of work (6). The various factors influencing the decision making and consequent participative processes will be considered according to these stages;

1. Outline proposals.
2. Scheme design.
3. Detailed design.
4. Production information.

(R.I.B.A.(6)).

The earlier inception and briefing stages, together with the later tender action and construction stages are not considered as these fall outside the main design sections. The scheme design and detailed design stages are considered as a single stage since the literature alone does not allow sufficient definition without the development of the findings from the pilot study.

1. Outline proposals.

The Client decides to commission a building. He or she conceptualises an ideal solution and attempts to place these requirements on paper. This may cause some difficulty since the Client is often a layman in construction terms. The Client brief may not fully represent the idealised conception. This lays the foundations for subsequent goal ambiguity and consequent task related conflict and competition. The brief is presented to the Architect upon appointment and the design process begins. The first target is the production of the outline proposals report. The Architect conceptualises a possible solution to the design problems presented in the brief. This concept is purely an Architectural interpretation on the basis of the initial data available in the brief. It represents the trunk of the design tree or the main axis in the

design lattice.

The design team are assembled for the first time. The fact that the professional designers have worked on previous designs has no influence on the participation structure or the subsequent group developmental process. The group has no socio-emotional structure and therefore a basic group process must be established. The Architect is nominally perceived as being the team leader, and the initial group participation structure reflects this. The Architect reflects this group perception and designs with a considerable degree of freedom.

As the outline proposals stage continues, the group begins to develop a perceived meaning. Effectively this perceptual development is initiated at the first meeting. Socio-emotional development continues to evolve as the group members appraise each other and the amount of information available increases.

This group development evolves separately from the initially perceived structure. The presentation of the outline proposals report produces the first appreciable feedback to the design team. This initial feedback provides the basis for initial conflict although the group remains essentially cooperative. The Architect and the Client still work closely together in order to develop the initial stages of the design. They may perceive different design or performance goals or objectives or value judgements but the level of information within the system together with the relatively restricted group process development does not yet highlight any incompatibilities. The design therefore continues to be most strongly influenced by the Architect with the Client acting in a subsidiary role of advisor. This structure is compatible with the initial group process but becomes incompatible with subsequent group

development.

As a result the Architect dominates the decision making process and the interaction and participation procedures. The input from the Quantity Surveyor is limited due to the restricted amount of cost information available to act as the basis of accurate cost reporting. Since the Architect is still heavily influenced by the Client and the brief, the use of experience in the decision making process is limited. The use of experience is also not yet required as defence subject matter against Client attacks.

The Architect exhibits an aesthetics based bias. Due to the lack of conflict and competition, the Architect continues to perceive aesthetics as being a collective group goal, and no role reversal or adjustment has yet taken place. The lack of socio-emotional orientation within the group combined with the Architect as perceived team leader, produces a high task-oriented element in Architect participation, being strongly time related.

2. Scheme design and detailed design stages.

The Architect submits the outline proposals report to the Client for approval. This is the first major item of quantitative feedback made available to the Client and it affects the design process accordingly. The Client realises that the design as conceptualised by the Architect does not match his or her own idealisations. The Client begins to realise that the actual design does not match the idealised design, as the amount of information feedback escalates in proportion to the developing complexity of the design, and in relation to the

growing accuracy of cost reporting from the Quantity Surveyor. The Client begins to suggest possible changes to the design in order to reconcile the presented solution to the idealised version. In effect a process of conflict and competition is initiated via group pressures in order to reconcile the objectives and value judgements of the Architect with those of the Client and those of the group.

The influence of the group on the decision making process of the Architect increases as they force him or her to consider a wider range of design factors and possible solutions. New ideas appear as a result of the design team interaction and these become incorporated into the perceived goal structure of the group. The Architect is forced to rely increasingly on experience as the previously conceptualised design is attacked. The developing socio-emotional group process allows this to happen to a much greater extent than it could have done in the earlier stages. The Architect is no longer directly perceived as team leader, and is role-adjusted by the group into a position of group member and enabler, via a process of conflict and competition.

As the design becomes increasingly complex and the amount of information within the system increases the prominence of the Quantity Surveyor in terms of the effects of cost reporting increases. The Architect recognises this and works more closely with the Quantity Surveyor and a professional coalition forms. This causes a relative alienation of the Client. The influence of the brief decreases further as the Architect is forced to be increasingly creative in order to satisfy the escalating demands of an ever increasing number of interrelated design problems. The level of conflict and competition increases

further as a function of group existence time.

3. Detailed design stage.

Increased accuracy and detail of cost reporting increases the degree of feedback within the system to a design phase maximum. The design reaches maximum complexity as the Architect takes the design up to the submission of the detailed design report. Architect prominence in the design process increases and the prominence of the brief resurges as the Architect has to attend to the fine detail of the design. Close Architect-Client interaction is required although this has now become conflicting and competitive. Group pressures have forced the consideration of a wider range of alternatives and design solutions are now incorporated which do not originate from the Architect. Initial role ambiguity has now been corrected by group pressures and the socio-emotional structure of the group reaches a high level of development via the time related learning process.

The increasing prominence of the Client and Group influence forces the Architect to conform to the newly implanted role of enabler. The Architect-Quantity Surveyor coalition increases in magnitude. The initial perceived goals and value judgements of the Architect have now been corrected and included into the overall group goal. The main reason for late stage coalition becomes that of program and avoidance of late stage redesign work. This is perceived as a group goal by group members and the group norms and regulatory procedures are adjusted accordingly as part of the now highly developed group process.

The amount of information within the system reaches a maximum

and the consequent frequency of Client attacks increases. Architect-Quantity Surveyor coalition defences increase as a direct consequence. Conflict reaches a peak and the Architect increasingly refers to the Client in relation to administrative as opposed to design subject matter. The Architect is forced to increasingly consider the actual construction of the building and the availability of materials as the construction stage approaches.

5.3. INTEGRATION SUMMARY.

This integration produces a number of themes which highlight a number of important implications for design team decision making and consequent interaction. These will now be summarised.

1. The prominence of the Architect in the design team interaction and decision making process varies throughout the course of the design process.

The integration suggests that the prominence of the Architect is lower in the middle stages of the design than in the early and late stages. Initially, the Architect is perceived as being the team leader. The group has no socio-emotional or task oriented structure and these have to be established. As they are forming, the Architect adopts the role of leader and undertakes the bulk of the design work without any significant restraint from other design team members. The Architect works closely with the Client in order to initialise a reasonably compatible design concept, but essentially enjoys considerable design control and freedom with consequent prominence in the decision

making process.

In the middle stages, this independent role starts to be challenged by the other members of the design team. The increasing level of design related information allows the team members to attack specific sections of the Architect's conceptual solution. In addition, the increasing complexity of the design forces the Architect to be creative and this is achieved by the increased use of experience, interpolating potential solutions for the current problem from previous solutions. The prominence of the Architect consequently decreases.

In the later stages, the Architect comes under increasing attack from the Client. The prominence of the Architect increases again in response to this. Late stage Architect prominence differs from early stage prominence in that the interaction is now dominated by conflictive and competitive participation as opposed to supportive and cooperative participation.

2(A). The prominence of the brief in relation to the design decision making process varies throughout the course of the design.

2(B). The prominence of the use of experience in relation to the design decision making process varies throughout the course of the design.

Initially the brief acts as the primary source of information for the Architect in developing a conceptual design. The Architect works closely with the Client and the brief during the early strategic stages. Subsequently, the prominence of the

brief decreases as the conflict phases begin and the Architect is forced to rely more heavily on experience in order to satisfy the rapidly increasing number of design considerations which develop concurrently. In the later stages, the brief resurges to prominence in that the Architect has to satisfy the precise and unique detailed requirements of the Client. Because such requirements are unique to each Client, experience retains a general relevance, but is superceded in prominence by detailed Client information relevant to this particular design.

3. The Architect is consistently the most creative member of the design team.

The Architect has the responsibility of developing a conceptual solution from the initial brief. Throughout the design process he or she has to develop continually changing acceptable solutions in response to changing group goal and role situations. The ultimate responsibility for producing an end solution which works lies with the Architect. The Architect is at his or her most creative during the middle stages of the design, when the goal and role reversals are being implemented and where the design has not developed to a sufficiently rigid state that large scale design changes cannot be implemented. In addition, the earlier and later stages are more constrained in the case of creative application because the prominence and inflexibility of the Client and the brief are more in evidence in these stages. The group influence plays an appreciable part in affecting the overall degree of creativity and alternative potential solutions considered in the design, but the Architect remains the most creative member of the design team.

4(A). In the early stages of the design process, the Architect implements his or her individual goals upon the design. In the later stages goals are increasingly replaced by Client and group goals.

4(B). The Architect increasingly defends against his or her own goal supplementation in the later stages of the design.

In the early stages of the design, the Architect produces a design which reflects or is strongly influenced by his or her own perceptions of what the eventual design should include. As the design process continues, the Client and the group increasingly develop alternative goals which are essentially incompatible with a proportion of the Architect's goals which have already been incorporated into the design. This leads to a process of conflict and competition in which the Architect's implemented goals are replaced to an extent by the discovered goals of the group. This process is a function of initial goal and role ambiguity which has particularly pronounced effects on the building design team, since it is characteristically multidisciplinary and concerned with complex tasks.

In the later stages of the design, the Architect responds to the increased level of conflict and competition within the group and increasingly defends his or her own goal inclusions in the design and disassociates himself or herself from Client impositions upon the design. This is particularly pronounced in the case of cost reduction exercises or cases where the Architect feels that the imposition is fundamentally incompatible with an initially perceived individual goal.

5.The Architect and the Quantity Surveyor increasingly form a professional coalition as the design process continues.

Initially the Architect works closely with the Client.As the design complexity increases this arrangement is no longer satisfactory.The Architect is forced to make use of professional experience which is shared to an extent with the Quantity Surveyor but not with the Client.This, coupled with the increase in conflict and competition between the Client and the Architect causes a relative alienation of the Client and a relative coalition between the Architect and the Quantity Surveyor.This is enhanced in the later stages by the mutual desire of the Architect and the Quantity Surveyor to avoid late stage design changes which would necessarily involve considerable redesign work and consequent disruption to the overall design program.

6.The decision making process of the Architect becomes increasingly influenced by non-design related goals towards the later stages of the design.

As the design process continues, the Client increasingly imposes new design goals upon the Architect.In addition to this, new goals are discovered by the Architect and the group which relate to aspects which are outside the design but which nevertheless influence it directly.The design begins to be influenced by the practical aspects of constructing the building and the availability and feasibility of material options and their supply.

5.4.REPORT ON THE PILOT STUDY.

5.4.1.INTRODUCTION.

The pilot study was designed to apply the main themes developed from the literature integration to an actual building design team in order to assess their generalisability. The pilot is presented as a longitudinal case study with the findings collected at each stage in the design process synthesised to provide an overall view of the processes involved at each stage.

The primary objective of the pilot study was to generate measured and substantiated findings in relation to the main themes which emerged from the literature integration. These were then expanded to form the basis for the operational hypotheses which provided the foundations for the main study. A secondary objective of the pilot study was to collect observational data in order to allow a suitable methodology to be developed, for application on the main and validation studies. This methodological approach of collecting data in order to design a suitable processing methodology corresponds to the grounded theory approach developed by Glaser and Strauss(162).

5.4.2.SUBJECT DETAILS.

The subject for the pilot study was the design of a new Technological Department of a Scottish Academic Institution. The design process lasted approximately eighteen months from inception to tender action (R.I.B.A.(6)). A cost limit of

approximately one and a half million pounds was imposed by the funding body, thought this was subsequently increased to over two million pounds during the course of the design process. The design team consisted of practising Architect, Quantity Surveyor and Consulting Engineers. The team was under the overall responsibility of a Development Officer appointed by the Institution to represent their interests. A Client Representative was provided by the Department with responsibilities for producing an initial brief and representing the Department in the design team. In order to preserve the agreed confidentiality required by the subjects, no further details can be given.

5.4.3.METHODOLOGY.

The pilot study enabled a detailed methodology to be developed. Initially, design team interaction was observed and fully recorded. This led to the initialisation of content analysis as being the most appropriate method for processing and analysing the information arising from the observations. This approach is related to grounded theory in that the methodological and theoretical approaches to the research evolved and developed from initial observation and assessment (Glaser and Strauss(162)).

As the pilot study progressed a system of content analysis was developed which was suitable for analysing the complexities and specialisms of design team interaction. When the methodology had been suitably refined it was applied to the recorded data from the pilot study and subsequently to the data collected in

the main and validation studies.

A full description of the content analysis methodology which was developed in this way is presented in chapter six.

5.4.4.RESULTS.

5.4.4.1.INTRODUCTION.

The pilot study results are combined with the results from the main and validation studies. The results from each section of the data collection process are therefore presented together in chapter seven (qualitative) and appendix five (graphical). So as to avoid duplication of pilot study results, these are not presented graphically in this section.

Each of the results summaries presented in the following section therefore refers to a graphical representation of the corresponding section of the main results appendix. Each of the results listed in the following section contains a reference to the appropriate graphical figure in curled brackets {}. The reference in the curled brackets refers to the appropriate graphical representation in appendix five.

5.4.4.2.RESULTS PRESENTATION.

The pilot study indicated a number of design team interaction and corresponding design decision making process patterns. The results act in substantiation of the literature synthesis themes and are presented in relation to the appropriate hypothesis on a longitudinal basis. Each set of theme related

results is discussed. They are then collectively summarised in relation to the synthesis themes in the following section.

1. The prominence of the design team Architect in the design team interaction and decision making process varies throughout the course of the design.

Results indicated that the Architect was more participative in the group interaction and decision making process during the early and late stages of the design. Specifically, during the MIDDLE STAGES stages of the design process, the Architect;

A. Made fewer total contributions. {fig 4}

B. Placed less emphasis on these decreased contributions.

{fig 6}.

C. Asked more questions. {fig 1}.

D. Expressed more opinions. {fig 3(A)}.

E. Expressed an increased degree of uncertainty. {fig 3(B)}.

F. Made fewer assertive (attacking) contributions. {fig 2(A)}.

G. Made more submissive (defecive) contributions. {fig 2(B)}.

H. Expressed more preferences. {fig 5(c)}.

I. Expressed fewer goals and design constraints.

{figs 5(A) and 5(B)}.

J. Made fewer design (task) related contributions. {fig 7(A)}.

K. Made more administration (group) related contributions.

{fig 7(B)}.

2(A). The prominence of the brief in relation to the design decision making process varies throughout the course of the

design.

2(B).The prominence of the use of experience in relation to the design decision making process varies throughout the course of the design.

Results indicated that the brief played a more prominent role in the development of the design during the early and later stages. During the middle stages, the prominence of the brief decreased and appeared to be superceded by the increased use of experience. Specifically, during the MIDDLE STAGES of the design, the Architect;

- A.Made fewer references to the brief.{fig 8}.
- B.Made more attacks on briefed (Client) goals.{fig 9(A)}.
- C.Expressed more brief-related uncertainty.{fig 10}.
- D.Asked more brief-related questions.{fig 11}.
- E.Expressed a higher design-self association.{fig 12(D)}.
- F.Expressed a lower design-brief association.{fig 12(A)}.
- G.Made more references to other designs.{fig 15}.
- H.Expressed a greater other design-current design dissatisfaction association.{fig 18}.
- I.Made more references to other designs as a defence against Client attacks.{fig 17}.
- J.Made more references to other designs in support of attacks upon design aspects of the current design.{fig 19}.

3.The Architect is consistently the most creative member of the design team.

Results indicated that the largest proportion of all new design concepts originated from the Architect. The results also indicated substantiation for the literature theme on Architect-Quantity Surveyor coalition formation in this context in that the Client tended to increasingly attack new design concept proposals put forward by the Architect, while the Quantity Surveyor increasingly tended to support them. Results indicated that THROUGHOUT THE DESIGN PROCESS;

A. The Architect made the highest frequency of references to new design concepts. {fig 20(A)}.

B. These were most frequently supported by the Quantity Surveyor. {fig 22}.

C. These were most frequently attacked by the Client. {fig 23}.

D. The most frequent subject bases for Client attacks on new design concept proposals were maintainance and initial cost. {fig 24}.

4(A). In the early stages of the design process, the Architect impliments his or her own objectives upon the design. As the design process continues, these goals are increasingly replaced by discovered Client or group goals.

4(B). The Architect increasingly defends against his or her own goal supplementation by discovered goals towards the later stages of the design.

Results indicated that the Architect initially developed the design and included a high level of individual goal inclusion. As the design process continued, the group discovered a range

of new goals and implimented them onto the design via the developing group process. This was increasingly opposed by and defended against by the Architect towards the later stages of the design. Specifically, AS THE DESIGN PROCESS CONTINUED;

- A.The expressed association between aesthetics and design in Architect contributions reduced.{fig 27}.
- B.The expressed association between cost and aesthetics in Architect contributions increased.{fig 28}.
- C.The most frequent attacker of Architect new concept contributions was the Client.{fig 29}.
- D.These attacks were most frequently based upon cost.{fig 30}.
- E.The most frequent Architect defence against these attacks was similarity with previously agreed solutions (reciprocity).{fig 31}.
- F.The frequency and level of emphasis of Architect aesthetics defences increased.{figs 33(A) and 33(B)}.
- G.The frequency of Architect cost-based concessions grew larger. {fig 34}.
- H.The expressed association between aesthetics and expressions of dissatisfaction in Architect contributions increased. contributions increased.{fig 37}.
- I.The frequency of references to cost reduction in Architect contributions fell.{fig 51}.
- J.The expressed association between cost reduction and expressions of dissatisfaction in Architect contributions reduced.{fig 52}.
- K.The expressed association between cost reduction and

maintenance in Architect contributions increased.{fig 53}.

L.The frequency of attack contributions made as responses to cost reduction contributions increased.{fig 55}.

M.The frequency of Architect expressions of dissatisfaction made in response to cost reduction contributions increased. {fig 56}.

5.The Architect and the Quantity Surveyor increasingly form a professional coalition as the design process continues.

The results indicated that the level of cooperation between the Architect and the Quantity Surveyor increased towards the later stages of the design. This occurred at the same time as the general increase in contribution levels of these individuals. This coalition acted to produce a relative alienation of the Client from the design professionals. Specifically, TOWARDS THE LATER STAGES OF THE DESIGN;

A.The frequency of supportive contributions made by the Quantity Surveyor in response to an Architect contribution grew larger.{fig 40}.

B.The frequency of attacks and expressions of dissatisfaction made by the Architect and the Quantity Surveyor made in response to contributions of all types to each other fell.{fig 41(A)}.

C.The frequency of Architect contributions addressed to the Quantity Surveyor increased.{fig 42}.

D.The frequency of Architect contributions addressed to the Client fell.{fig 47(B)}.

- E. The frequency of Architect attack contributions made in response to Client contributions increased. {fig 43}.
- F. The expressed association between Client and Self in Architect contributions reduced. {fig 44}.
- G. The expressed association between Quantity Surveyor and self in Architect contributions increased. {fig 45}.
- H. The frequency of Architect contributions which contained a reference to a previous Quantity Surveyor statement grew larger. {fig 46}.
- I. The frequency of Architect contributions addressed to the Client which related to design increased while the frequency which related to administration increased. {figs 47(A) and 47(B)}.

6. The design decision making process of the Architect becomes increasingly influenced by non-design (discovered) related objectives towards the later stages of the design.

The results indicated that the Architect increasingly considered the actual construction process and the supply and availability of materials and components towards the later stages of the design. Specifically, TOWARDS THE LATER STAGES OF THE DESIGN;

- A. Made more references to construction. {fig 57}.
- B. Made more references to materials availability. {fig 58}.
- C. Expressed a more pronounced association between between construction and references to new design concepts. {fig 59(A)}.

- D. Expressed more construction-based objections in response to new design proposals made by other design team members. {fig 61}.
- E. Expressed a heightened association between new design factors for consideration and construction. {fig 62}.
- F. Made more references to construction in relation to administrative contributions. {fig 63}.

5.4.5. RESULTS SUMMARY.

The pilot study results clearly indicate variations in the interaction and decision making processes of the design team as a function of time. The primary findings from the pilot study may be summarised as follows;

1. The Architect is less prominent in the design team decision making process in the middle stages of the design.
2. The brief influences the design to a greater extent in the early and late stages of the design.
3. The Architect uses experience more in the middle stages of the design.
4. The Architect is consistently the most creative member of the design team.
5. The Architect impliments his or her own designs onto the design in the early stages, but is increasingly forced to concede to the implimentation of group discovered goals towards the later stages.
6. The Architect increasingly resents this process.
7. The Architect and the Quantity Surveyor increasingly form

a professional colaition with a consequent alienation of the Client, towards the later stages.

8.The Architect is increasingly forced to consider non-design related goals towards the later stages of the design.

5.4.6.PILOT STUDY SUMMARY.

The pilot study results clearly indicate a number of important implications for the main study. In order to assemble a coherrent approach to the main and validation studies it is necessary to synthesise the results of the pilot study with the primary themes which emerge from the literature integration.

This overall synthesis is presented in the following section.

5.5.SYNTHESIS OF THE LITERATURE AND PILOT STUDY RESULTS.

The main themes emerging from the literature integration and the main findings from the pilot study are now collectively synthesised in order to highlight a range of primary implications which act as the basis for the main study.It is unrealistic to attempt to study each of the literature synthesis themes of pilot study findings in isolation since there are clearly a range of complex interrelationships acting between all of them.The overriding implication from the literature integration and the findings of the pilot study is that design teams undergo a number of developmental stages, which relate to the reversal and correction of initial goal and role ambiguities.

This collective synthesis is presented as a longitudinal description of the group developmental process with respect to the main themes from the literature integration and the main findings of the pilot study. The evolution of the group process is considered in terms of the early, middle and late stages of the design process.

1. OUTLINE PROPOSALS/SCHEME DESIGN.

The design team is formed for the first time. The group initially has no socio-emotional or task oriented structure. The group therefore exhibits no clear group process and this allows initial perceptions and appraisals to occur. These initial appraisals place the Architect in the role of task oriented and group process team leader. The Architect therefore features prominently in this early stage interaction process. His or her participation is characterised by;

- A. High participation frequency.
- B. Few questions.
- C. Few defences.
- D. High participation emphasis.

The Architect also dominates the early design evolution process, characterised by;

- A. High design-related participation.
- B. High goal implementation.
- C. High brief association.

The Architect is allowed to implement his or her own goals upon the design which is characterised by;

- A.High aesthetics content.
- B.Low cost content.
- C.High aesthetics satisfaction.

This behaviour is in line with the general training of Architects and the characteristically low level of Client awareness. Insufficient group process exists at this stage to allow any correction of these role and goal ambiguities, since the group has not yet been in existence for sufficient time to allow sufficient group norms and regulatory forces to develop.

The design is still at the strategic stage and the relatively non-complex nature of the design and lack of feedback allows the objectives of the group members to appear compatible and balanced. As a result, the Architect is allowed to design with considerable freedom, using the brief as the main conceptual data source. This is characterised by;

- A.High brief prominence.
- B.Low experience prominence.
- C.High brief design association.
- D.High brief-satisfaction association.

The group remains relatively cooperative and non-conflicting since the various individual and group objectives and value judgements remain perceptually compatible.

2. SCHEME DESIGN/DETAILED DESIGN.

As the design process continues, the group process develops through discernable developmental stages. These stages begin to affect the evolution of the design to a greater extent. The group develops norms and regulatory procedures which increasingly act upon the Architect to bring him or her into line with increasingly discovered group and Client goals. More complex design considerations and feedback begin to highlight the basic incompatibilities between earlier Architect-imposed design goals and those now required by the Client. In effect, the various value judgements of the group are progressively shown to be incompatible by the group process and the group enters its next developmental stage.

This next stage is characterised by the appearance of group conflict and competition. This is characterised by;

- A.Reduced aesthetics-design association.
- B.Increased cost-design association.
- C.More aesthetics attacks.
- D.Greater abandonment of aesthetics concepts.
- E.Enhanced Architect defences of aesthetics concepts.
- F.Increased Architect aesthetics-dissatisfaction content.
- G.Heightened cost-reduction dissatisfaction.

This growing conflict is a direct product of goal and role ambiguity correction.It is a product of the Architect being constantly brought into line with the ever changing and

consolidating collective group goal, which evolves in response to the stimulus provided by the growing levels of feedback produced by the design team as the design develops. The group therefore forces the Architect to consider a wider range of design solutions than he or she may otherwise have done. This is characterised by;

- A.Higher frequency of creative participation.
- B.Higher frequency of experience participation.
- C.Increased frequency of experience-aesthetics content.
- D.Greater experience reciprocity.

The perceived "leader" role of the Architect is systematically corrected by the group process away from that of group/design leader to that of enabler. The Architect increasingly resents this imposed role reversal and perceives many of the imposed goals in the design to be unacceptable, either in relation to his or her own original goal perceptions or in relation to the perceived eventual performance of the building. The Architect progressively disassociates himself or herself from such changes. The majority of these changes originate from the Client, and the change-disassociation propagates an Architect-Client disassociation. This in turn leads to an enhanced Architect-Quantity Surveyor coalition. This is characterised by;

- A.More Architect-Quantity Surveyor communication.
- B.Reduced Architect-Quantity Surveyor conflict.
- C.Improved Architect-Quantity Surveyor cooperation.

- D.Reduced Architect-Client communication.
- E.Greater Architect-Client conflict.
- F.Enhanced Client-design isolation.

The coalition itself tends to be self propagating into the next stage of the design process.

3.DETAILED DESIGN/PRODUCTION INFORMATION.

The Architect is now heavily influenced by the design team. The level of design complexity reaches a maximum as does the amount of feedback available to the design team. The Client has now established himself or herself as effective group leader and effectively controls large areas of the interaction process. The discovered group goals are now firmly implanted on the decision making and consequent interaction processes and are maintained and reinforced by the learned group process. The Architect is once again forced to work closely with the Client in order to finalise the unique and precise functional requirements of the building. As a result experience is no longer used to such an extent, and where it is used it is used in a conflicting or competitive context. Increasing specificity and Client refoundation also causes the prominence of the brief to resurge. This is characterised by;

- A.Fewer references to experience.
- B.More experience defences to Client attacks.
- C.Increased experience-dissatisfaction association.
- D.More frequent references to brief.

E. More references to briefed goals and considerations.

F. Increased brief reciprocity as a defence.

Increased goal discovery and consequent imposition onto the design propagate conflict and competition. Architect-Client conflict reaches a maximum. This is characterised by;

A. Decreased Architect-Client communication.

B. Enhanced Client alienation.

C. Increased Architect-Client attacks and defences.

D. Increased Architect-Client communication dissatisfaction.

E. More cost-related conflict.

F. Heightened Architect cost reduction objection.

G. More pronounced Architect cost reduction disassociation.

The multidisciplinary nature of the group propagates this effect with time. Goal discovery also forces the Architect to consider non-design related factors towards the construction stage. This is characterised by;

A. Enhanced construction consideration.

B. Enhanced market availability consideration.

C. Increased frequency of both subjects in response to new design concept contributions made by other design team members.

D. Increased frequency of both subjects acting as the basis for Architect objections to new design concept proposals.

Increased conflict reinforces the Architect-Quantity Surveyor

coalition and enhances the degree of Client isolation from the design process and the design team itself. This is characterised by;

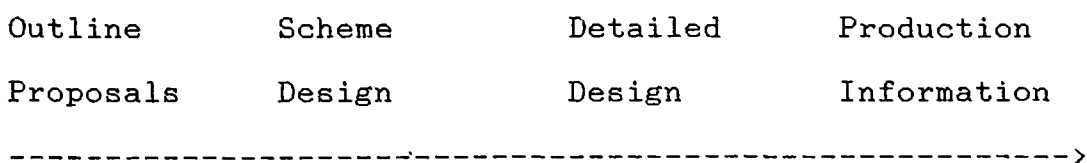
- A. More Architect-Quantity Surveyor communication.
- B. More Architect-Quantity Surveyor cooperation.
- C. Reduced Architect-Quantity Surveyor conflict.
- D. Reduced Architect-Client communication.
- E. Enhanced Architect-Client hostility.

5.6. SECTION SUMMARY.

The overall synthesis of the literature integration and the findings from the pilot study suggest a number of important implications for the main study. The discussion in section 5.5. acts as the basis for the formulation of the main study operational hypotheses. The main themes emerging from the literature and the pilot study are presented diagrammatically in this section as a prelude to the hypothesis formulation. The primary themes are considered in turn and are related to the appropriate diagrammatic representations.

Essentially, the design process can be considered to follow the R.I.B.A. plan of work. The design progression may therefore be represented as;

1. Design stage.



As each recognised stage is reached and developed, the characteristic complexity of the design progresses from the strategic to the tactical;

2.Design complexity.

Simple	Enhanced	Developing	Complex
Strategic	Strategic	Tactical	Tactical
----->			

The increasing complexity of the design renders the brief obsolete after it has been used for the initial establishment of the design. The primary sources of information used in the design process therefore vary in accordance;

3.Primary sources of Architect information.

Client	Experience	Experience	Client
Brief		Feedback	Design Team
		Design Team	Feedback
----->			

(Most prominent at top)

At the same time, the group learns about itself and develops a socio-emotional structure through recognisable stages;

4. Group socio-emotional structure.

Nil	Learning	Learned	Terminal
Testing	Development	Cohesive	Fixed
Cooperative	Cooperative	Conflicting	Competitive

----->

Variations in the group socio-emotional structure produce inevitable changes in the group perceptions and allowed status of the Architect;

5. Group perception of Architect status.

Leader	Advisor	Adaptor	Enabler
Initiator	Optimisor	Consultant	Adaptor
Motivator	Implementor	Member	Servant

----->

(most prominent at top)

This changes the effective distribution of power within the group in relation to inter-member perceptions;

6. Consequent Design Team member imposition prominence.

Architect	Architect	Team	Client
Client	Client	Client	Surveyor
Team	Surveyor	Surveyor	Other
Surveyor	Team	Architect	Architect

----->

(Most prominent at top)

This in turn affects the sources of design goal imposition. The early design freedom and imposition dominance of the Architect becomes replaced with a more group and Client based dominance;

7.Sources of design goal imposition.

Architect	Architect	Team	Client
Client	Client	Client	Team
		Architect	Architect
----->			
(Most prominent at top)			

This results in the a status variation in relation to the percieved importance of a range of design considerations and objectives;

8.Design parameter significance.

Aesthetics	Function	Cost control	Cost reduction
Function	Capital cost	Cost	Cost
Life cost	Aesthetics	Life cost	
----->			
(Most prominent at top)			

This enforced change in objective emphasis produces corresponding socio-emotional variations within the group. The Architect forms a defensive coalition with the Quantity Surveyor while the Client is alienated from the professional

coalition;

9. Client-Architect relationship.

Cooperative	Corrective	Conflicting	Alienating
Harmonious	Defensive	Assertive	Conflicting
Cordial			Competitive
			Agressive

----->

10. Architect-Quantity Surveyor relationship.

Neutral	Cooperative	Supportive	Coalitive
---------	-------------	------------	-----------

----->

These developments influence the creative application of the Architect. The creative input is initially used actively in the design. As the group process takes hold, the creative input of the Architect is increasingly channelled into Client-compatible areas and then actively repressed;

11. Architect creativity effects.

Implemented	Channeled	Retarded	Stifled
Encouraged	Restricted	Supplanted	Overruled
Applied		Manipulated	Supplanted

----->

The group therefore passes through stages of task oriented and socio-motional development. The two aspects of development interrelate with each other as the group passes through each respective stage. The group develops a socio-emotional structure which allows the initially perceived roles and goals to be identified as ambiguous and allows them to be corrected via a process of developing conflict. The role of the Architect is changed from leader to satisficer and the initially perceived goals which are Architect-based are changed to discovered Client-based goals. This process induces corrective resentment and the Architect forms a coalition with the Quantity Surveyor and alienates the Architect.

The Quantity Surveyor provides the cost information which acts as the basis for this metamorphosis, but he or she does not use this information offensively. The Client does. The Quantity Surveyor therefore effectively acts as a conflict catalyst, promoting conflict indirectly. The Architect therefore forms a direct coalition with the person who is indirectly responsible for the origin of the conflict.

The literature integration and pilot study report provided this type of information and acted as the basis for the main hypotheses. The detailed operational and research hypotheses are built up in the following section.

5.7.STATEMENT OF HYPOTHESES.

5.7.1.INTRODUCTION.

The operational hypotheses for the main study are presented in this section. The hypotheses themselves were formulated on the basis of the synthesis of the literature and the main findings from the pilot study, and reflect the overall synthesis presented in section 5.5. They were designed to be analysed using content analysis. This is a well established research methodology and is discussed fully in chapter 6. They are presented as eight main research hypotheses divided up into specific content analysable operational sub hypotheses. Each hypothesis relates to a finding from the pilot study, and a corresponding main emergent theme from the literature synthesis.

5.7.2. STATEMENT OF HYPOTHESES.

1. IN THE DESIGN TEAM INTERACTION PROCESS, THE INFLUENCE OF THE ARCHITECT IS LOWER IN THE MIDDLE STAGES OF THE DESIGN.

- A. The Architect makes more frequent requests for information.
- B. The Architect makes fewer attacks and more defences.
- C. The Architect makes more frequent expressions of opinion and uncertainty.
- D. The proportion of Architect contributions falls.
- E. The proportion of Architect contributions relating to new goals or constraints decreases while the proportion relating to new preferences increases.
- F. The level of emphasis of Architect contributions falls.
- G. The proportion of Architect contributions which relate to

design decreases while the proportion which relate to administration increases.

2. IN THE DESIGN TEAM INTERACTION PROCESS, THE CONTRIBUTIONS OF THE ARCHITECT BECOME LESS BRIEF ORIENTED IN THE MIDDLE STAGES OF THE DESIGN.

A. The frequency of Architect references to the brief falls.

B. The frequency of Architect attacks upon briefed goals or constraints increases.

C. The frequency of Architect expressions of uncertainty in relation to the brief increases.

D. The frequency of Architect requests for information in relation to the brief increases.

E. The significance of association in Architect contributions between;

i. Brief and design reduces.

ii. Client and design reduces.

iii. Architect-produced reports and design increases.

iv. Self and design increases.

3. IN THE DESIGN TEAM INTERACTION PROCESS, THE ARCHITECT IS MOST INFLUENCED BY THE USE OF EXPERIENCE IN THE MIDDLE STAGES OF THE DESIGN.

A. The frequency of Architect references to other designs increases.

B.This effect is more pronounced in relation to certain aspects of the design according to the following scale;

- i.Materials.
- ii.Maintenance.
- iii.Practicality.
- iv.Lifespan.
- v.Aesthetics.

(descending prominence)

C.Architect references to other designs are made more in response to Client attacks upon new design concept proposals put forward by the Artchitect.

D.The significance of association in Architect contributions between references to other designs and expressions of dissatisfaction with the current design grows.

E.Architect references to previous designs are increasingly made with reference to an attack on a previously agreed design goal.

4.THE ARCHITECT IS CONSISTENTLY THE MOST CREATIVE MEMBER OF THE DESIGN TEAM.

A.The Architect produces the highest frequency of references to;

- i. New design concepts.
- ii. Previously undiscussed materials.
- iii. New design courses of action.

B. Architect references to new design concepts are made more in association with certain aspects of the design according to the following scale;

- i. Aesthetics.
- ii. Room layouts.
- iii. Finishes.
- iv. Cladding and elevational materials.
- v. Services.
- vi. Plant room locations.
- vii. External works.

(descending prominence)

C. The most frequent supporter of Architect new design concept suggestions is the Quantity Surveyor.

D. The most frequent attacker of Architect new design concept suggestions is the Client.

E. The most frequent subjects which form the basis of attacks upon Architect new design concept suggestions are maintenance and initial cost.

F. The highest frequency of Architect references to new design concepts occurs in the middle stages of the design.

G. The primary subject used in Architect defences of new design concept suggestions is that of similarity to a briefed or previously agreed design goal.

5. IN THE DESIGN TEAM INTERACTION PROCESS, THE PROMINENCE OF AESTHETICS IN THE DESIGN DECREASES WHILE THE PROMINENCE OF COST INCREASES.

A. The significance of association in Architect contributions between aesthetics and design falls.

B. The significance of association in Architect contributions between cost and design increases.

C. The most frequent attacker of aesthetics based Architect contributions is the Client.

D. The most frequent subject which forms the basis of Client attacks upon Architect aesthetics based contributions is cost.

E. The primary subject used in Architect defences of aesthetics based contributions is similarity to alternatives.

F. The frequency of abandonment of previously agreed aesthetics concepts increases towards the later stages of the design.

G. The frequency and level of emphasis of Architect defences of previously agreed aesthetic concepts grow towards the later stages of the design.

H. The frequency of Architect concessions made in response to cost based arguments increases towards the later stages of the design.

I. The significance of association in Architect contributions between the Client and cost becomes more pronounced towards the later stages of the design.

J. The significance of association in Architect contributions between cost and expressions of dissatisfaction becomes

more pronounced towards the later stages of the design.

K. The significance of association in Architect contributions between aesthetics and expressions of dissatisfaction becomes more pronounced towards the later stages of the design.

L. The frequency of references to aesthetics in Architect contributions remains relatively constant throughout the design process.

M. The frequency of references to cost in Architect contributions increases towards the later stages of the design.

6. IN THE DESIGN TEAM INTERACTION PROCESS, THE ARCHITECT AND THE QUANTITY SURVEYOR INCREASINGLY FORM A COOPERATIVE COALITION.

A. The frequency of Quantity Surveyor supportive responses to Architect proposals or requests for information increases.

B. The frequency of attacks and expressions of dissatisfaction made by the Architect and the Quantity Surveyor in response to all types of participative contributions made by the other reduces.

C. The frequency of Architect contributions addressed to the Quantity Surveyor increases.

D. The frequency of Architect contributions addressed to the Client reduces.

E. The frequency of Architect attacks on Client contributions increases.

F. The significance of association in Architect contributions between Self and Client reduces.

- G. The significance of association in Architect contributions between self and Quantity Surveyor becomes more pronounced..
- H. The frequency of Architect contributions which contain a reference to a previous Quantity Surveyor statement increases.
- I. The frequency of Architect contributions addressed to the Client which relate to design decreases while the frequency of contributions which relate to administration increases.
- J. The frequency of Architect contributions addressed to the Quantity Surveyor which relate to design remains almost constant.

7. THE ARCHITECT INCREASINGLY DISASSOCIATES HIMSELF OR HERSELF FROM COST REDUCTION EXERCISES TOWARDS THE LATER STAGES OF THE DESIGN.

- A. The frequency of Architect references to cost reduction decreases.
- B. The significance of association in Architect contributions between Client and cost reduction becomes more pronounced.
- C. The significance of association in Architect contributions between Quantity Surveyor and cost reduction becomes more pronounced.
- D. The significance of association in Architect contributions between cost reduction and expressions of dissatisfaction becomes more pronounced.
- E. The significance of association in Architect contributions between cost reduction and maintenance becomes

more pronounced.

F. The significance of association in Architect contributions between cost reduction and aesthetics becomes more pronounced.

G. the frequency of Architect attacks made in response to cost reduction proposals from other design team members increases.

H. The frequency of Architect expressions of dissatisfaction made in response to a new cost reduction proposal increases.

8. IN THE DESIGN TEAM INTERACTION PROCESS, THE ARCHITECT BECOMES INCREASINGLY CONCERNED WITH THE ACTUAL CONSTRUCTION OF THE BUILDING AND THE AVAILABILITY OF MATERIALS.

A. The frequency of Architect references to construction increases.

B. The frequency of Architect references to market availability increases.

C. The frequency of Architect contributions addressed to the Client and the Quantity Surveyor which contain a reference to construction or market availability made in support of a new design concept proposal increases.

D. The significance of association in Architect contributions between construction and references to new design concepts becomes more pronounced.

E. The frequency of Architect objections based upon construction made in response to new design course of action proposals made by other design team members increases.

F. The frequency of Architect new design factor for consideration contributions which contain a reference to

construction increases.

G.The frequency of Architect administrative contributions which contain a reference to construction increases.

H.The frequency of Architect administrative contributions which contain a reference to market availability increases.

5.7.3.HYPOTHESIS SUMMARY.

These hypotheses were developed from the preceding sections and formed the basis for the main study.The data source,collection,analysis and processing methodologies which were used to test them will be described in the following chapter.

5.8.CHAPTER SUMMARY.

This chapter has produced a series of hypotheses from a synthesis of the integrated literature and pilot study results. Chapter six develops the methodology which was used in order to test these hypotheses with actual design teams. The hypotheses detailed in this section were developed over a period of time and in conjunction with the evolution of the methodology. This approach philosophy has its origins in grounded theory, as developed by Glaser and Strauss(1962).

CHAPTER 6.METHODOLOGY.

6.1.INTRODUCTION.

The methodology used in this research was essentially developed from existing methodologies with expansions and increased specificity where required. It became clear from the start of the pilot study that design team interaction and decision making analysis necessitated a number of data collection methods and sources (Mackinder and Marvin(8)). This chapter describes and justifies the data sources and processing techniques used initially in the pilot study and subsequently in the main study.

6.2.DATA SOURCES.

6.2.1.SUBJECT DESIGN TEAMS.

Clearly any study of design team interaction must by definition use design teams as the source of data. A full list of the design teams used in this research appears on page xvii. The number of subject teams was maximised in order to optimise the generalisability of the results. In addition, the range of design types and complexities was maximised to promote the validity of comparison between findings. Design duration range was maximised in order to allow for the group lifetime developmental stage effects. The design teams were all structured similarly with compatible target populations.

populations. (Clark(1), Higgin and Jessop(5), Mackinder and Marvin(8), Mackinder(9), Lawson(14),(15),(16), Hoffman and Arsenian(28), Lieberman(29), Hare(30)).

In all cases the structure consisted essentially of an Architect, Quantity Surveyor, Consulting Engineers and a Client Representative. The individual-group effects and multidisciplinary effects were all compatible (R.I.B.A.(6), Yoshida(52), Yoshida et al(53), Bales(54), Ysseldyke et al(55), Collins and Guetzcow(62), Gordon(65)).

These essential compatibilities linked in with the literature integration suggest that the design teams used as subjects all followed the same group process with associated developmental stages and time related dependencies, such as learning processes, leadership perceptions and group evolution. The group participation and interaction patterns could therefore be assumed to be standardised with the consequent transition from cooperative to conflicting and competitive (Higgin and Jessop(5), Shadish(24), Lieberman et al(25), Schutz(31), Shaffer and Galinsky(33), Lewin et al(34), Burke(36), Duncan(40), Gustafson(42),(43), Hancock and Sorrentino(44), Borgatta and Bales(46), Tuckman(47), Baird(48)), Deutsch(49)).

6.2.2.OBSERVATION PERIOD PHILOSOPHY.

The design process takes place over a period of time and the group is influenced by time related factors in terms of the increasing complexity of the task oriented and socio-emotional elements of group development. The observation and data collection duration is therefore of

considerable importance (R.I.B.A.(6), Alexander(10),(11), Bales(35), Hancock and Sorrentino(44), Borgatta and Bales(46), Tuckman(47)).

The methodology literature suggests that group interaction and developmental processes may be analysed in two primary ways;

1. Longitudinally.

Observation of the group from inception to completion on a continuous basis, thereby building up a complete and continuous picture of the group evolution (Derbyshire(2), Higgin and Jessop(5), Mackinder and Marvin(8), Mackinder (9), Alexander(10),(11), Lawson(15),(16), Herbert(17), Shadish(24), Lieberman et al(25), Hare(30), Schutz(31), Shaffer and Galinsky(33), Burke(36), Duncan(40), Borgatta and Bales(46), Tuckman(47), Ysseldyke et al(55)).

2. Cross sectionally

Observation of the group at isolated moments at different stages in the evolution of the group, thereby building up a series of "windows" of the current characteristics of the group at those points.(Clark(1), R.I.B.A.(6), Jepsen(7), Mackinder and Marvin(8), Mackinder(9), Lawson(14), Gelernter(19), Shadish(24), Schutz(31), Egan(32), Willard and Strodbeck(41), Gustafson(42),(43), Baird(48), Deutsch(49), Stendler et al(50), Yoshida(52), Ysseldyke et al(55), Gordon(65)).

Clearly a longitudinal study provides a greater understanding

of the group interaction and decision making process in just the same way a watching a child grow develops a clearer understanding of it's development than observing it once a year. With a longditudinal study, the full sequence of development and evolving interrelationships are recordable (Clark(1)). A longditudinal study however, necessarily involves a considerable time commitment on the part of the researcher. In the interests of validity it is important to observe a large sample size, and with longditudinal studies this becomes unrealistic due to time and resource limitations.

For this reason, it was diecided to carry out a longditudinal pilot and main study in order to build up a detailed understanding of the developmental process, and then to validate this understanding by observing a wide range of other designs on a cross sectional basis.(Mackinder and Marvin(8), Mackinder(9), Shadish(24), Schutz(31), Ysseldyke et al(55)).

The time scale for the longditudinal and cross sectional studies was standardised according to the R.I.B.A. Plan of Work(6), and corresponded to the group developmental stage categorisations used by Higgin and Jessop(5), Shadish(24), and Tuckman(47).

6.3.DATA COLLECTION.

The literature on group interaction and decision making analysis methodologies is dominated by four main methodological approaches;

1(A).Experimental.direct observation.

- 1(B). Naturalistic direct observation.
2. Research interview.
3. Research questionnaire.
4. Documentary evidence.

The approaches which were REJECTED for use in this research are as follows;

1. Experimental direct observation.

Experimental direct observation involves the transfer of the group to a laboratory setting where the interaction can be monitored under stringently controlled conditions. It was rejected for use in this research for the following reasons;

A. The procedure is expensive and impractical in the case of a building design team which consists of practising professional designers and consultants.

B. Researcher reactance is necessarily high. An Architect will behave differently in a sterilised laboratory where he or she is under intense scrutiny compared to the more "normal" behaviour exhibited in the known design team environment (Green and Taber(86), Bouchard(69), Mabry(75), Campbell(89), Cronbach(90)).

2. Research questionnaire.

Research questionnaires involve the presentation of

pre-assembled question lists to the respondent who then answers them as the source of data. It was rejected for use in this research for the same reasons as those put forward by Mackinder(9);

A.Questionnaires are frequently sent to Architectural practices and the Heads of Architectural Departments. They tend to be time consuming to answer and there is consequently no guarantee that they will receive due attention or even be returned.

B.Questionnaires which are designed to produce short answers (and consequently the type most likely to receive attention and be returned) do not give the depth of detail of information required in research of this type.

C.More detailed questionnaires (if attended and answered) are more likely to be rehearsed, with a consequent tendency for the Respondent to state the ideal rather than the actual.

(Mackinder(9:17)).

The approaches which were SELECTED for use in this research are as follows;

1.Naturalistic direct observation.

Naturalistic direct observation involves the researcher observing or recording the proceedings of the group interaction

in its natural environment (Nagao and Hinsz(66), Ysseldyke, Algozzine and Mitchell(55), Donohue, Hawes and Mabee(67), Green and Taber(68), Bouchard(69), Scioli, Dyson and Fleitas(70), Lumsden(71), Segal(72),(73), Castore(74), Mabry(75)). It was selected for use in this research for the following reasons;

A. It has an established history of use and application in research into Architectural and design decision making and has an established methodological basis (Brown(76), Stringer(77), Carrol, Thomas and Malhotra(78), Foz(79), Malhotra, thomas, Carrol and Miller(80), Daru(81), Liu(82), Canter(83)).

B. Standardised and established observation, coding, and processing methodologies are available and have been appraised (Bales(84), Gouran and Baird(85), Bryan, Donohue and Pearl(86), Baker(87), Steinzor(88)).

C. Naturalistic direct observation by definition involves the study of groups in their "natural" interaction environment. It consequently minimises the problem of researcher reactance which necessarily occurs in a fabricated or "artificial" laboratory experimental environment (Green and Taber(68), Bouchard(69), Mabry(75), Campbell(89), Cronbach(90)).

D. The multidisciplinary nature of the building design team relates well to an approach based on naturalistic direct observation in that the combination of a range of individual specialisms are more validly analysed from the point of view

of non-reactive group observation than from the point of view of a combined individual analysis (Yoshida(52), Yoshida et al(53), Ysseldyke et al(55), Brown(76), Carrol, Thomas and Malhotra(78), Gouran and Baird(85), Robinson, Athanasiou and Head(91)).

2. Research Interview.

Interviewing involves the researcher asking the subject questions. The type of question can vary to a considerable extent, together with the way in which it is presented, received and interpreted by the researcher. The use of the research interview occurs throughout the group research literature (Bingham and Moore(92), Katona(93), Asch(94), Cannel and Kahn(95), Hyman et al(96), Richardson et al(97), Fowler(98), Hildum and Brown(99), Sazlow et al(100)). It was selected for use in this research for the following reasons;

A. It has an established history of use and application in Architectural and design decision making and has an established methodological basis (Mackinder and Marvin(8), Mackinder(9), Thomas, Malhotra and Carrol(101), Goodey and Matthew(102), Grainger(103), Wareh and Murta(104), Canter(105), Marans and Spreckelmeyer(106), Stagg(107), Epp, Georgopoulos and Howell(108)).

B. Standardised and established observation, coding and processing methodologies are available and have been

appraised (Murray(109), Snyder(110), Berelson(111), Porter(112), Biehal and Chakravarti(113)).

C. Research interviewing on a one-to-one basis gives the respondent the opportunity of providing a less guarded or more detailed level of information than may otherwise be observed in the design team meeting observation, so long as interview confidentiality is guaranteed (Lieberman, Lakin and Whittaker(25), Napier and Gershenfeld(27), Stroop(59), Campbell(60), Shaw and Wright(114), Payne(115)).

D. Correctly designed and applied research interviews give high reliability due to established procedures for allowing for;

i. Validity: The extent to which the interview questions actually measure what they purport to measure (Kaplan(116), Sellitz, Jahoda Deutsch and Cook(117), Campbell(89), Cronbach(90), Coombs(118)).

ii. Reliability: The extent to which the same questions will produce compatible results on a number of different occasions (Cronbach(90), Coombs(118)).

iii. Sensitivity: The extent of the precisional accuracy to which the applied measures can operate (Campbell(89), Cronbach(90)).

iv. Bias: The extent to which the researcher seeks to

influence the interviewee or implant his or her own interpretations onto the responses (Rice(119), Cahalan, Tamulonis and Verner(120), Ferber and Wales(121), Cannel and Kahn(95), Blankenship(122)).

3.Documentary evidence.

The use of documentary evidence includes the analysis of any supportive records or information, for example the qualitative analysis of meeting minutes (Chapple and Arensberg(39)). It was selected for use in this research as a qualitative support to the other data collection techniques, in order to fill any "gaps" in data not readily discernable from the data gathered elsewhere (Chapple and Arensberg(39)), Lawson(14)).

Data collection was therefore based upon naturalistic direct observation, research interviewing and supportive documentary evidence.

6.4.DATA PROCESSING.

6.4.1.INTRODUCTION.

The literature on group interaction methodologies is dominated by approaches which measure the participation (Stephen and Mishler(37)), actions (Bales(38)) or minutes (Chapple and Arensberg(39)) of the actual interaction process. These methodological approaches all seek to analyse the content of information signals or communications. This approach is

collectively known as content analysis. This section reviews the most popular types of content analysis typologies in current use and justifies the unique typology developed for this research.

6.4.2.CONTENT ANALYSIS.

Content analysis is the detailed investigation of communication content in order to draw inferences about the thought processes of the speaker. The underlying assumption in all the major reviews of content analyses is that the verbal content produced by an individual is representative of the thought processes at work in his or her mind (Berelson(111), Budd(123), Cartwright(124), Kerlinger(125), Osgood, Suci and Tannenbaum(126), Pool(127)). For example, if an Architect is shown to be referring very frequently to cost during an argument about a design decision, a content analyst would deduce that he or she is being heavily influenced by cost in considering the implications of that design decision. The literature suggests that this process of content analysis can be carried out either by a mathematical analysis of the detailed communication content, or by "intuitive" reasoning (Pool(63)) in the mind of the researcher based upon the communication. The content analysis literature reflects this division of approach, representing the two alternatives as quantitative and qualitative content analysis respectively.

6.4.2.1.QUANTITATIVE CONTENT ANALYSIS.

The quantitative content analysis literature contains a multitude of different content analysis methodologies and typologies. Attempts at standardisation have been made, although the relative diversification of typologies has continued (Pool(127)). The literature suggested six primary quantitative content analysis approaches which were compatible with the approaches and objectives of this research;

1. Interaction Process Analysis (Bales(84)).

This system primarily codes the types of communication during interaction, such as a request for information. It does not measure more detailed content (Talland(128), Levine(129)). Numerous researchers have used the system as a basis for extending it to suit their own individual research requirements, usually by adapting it to measure detailed content (Gouran and Baird(85), Landsberger(130), Bryan, Donohue and Pearl(86), Baker(87), Borgatta and Bales(46)).

2. The Bettman-Park typology (Bettman and Park(131)).

This system is similar to Bales(84) I.P.A. and primarily codes the nature of separate items of communication. Again it does not code more specific content detail and has been widely developed and extended by researchers to be useable in specific research areas (Biehal and Chakravarti(113), Bram(132)).

3. Evaluative Assertion Analysis (Osgood et al(133)).

This system was developed initially by Osgood, Saporta and Nunnally(133) and primarily codes the level of emphasis placed on communication content by the speaker. Again it has been used as a basis for purpose designed systems by researchers (Scott(134)).

4. The General Inquirer (Stone et al(135)).

This system uses the sentence as the main unit of analysis and primarily codes the communication content of the sentence down to acceptable detail. It has been adapted for more detailed use by researchers, simply by extending the range of content variables which may be recorded and processed (Stone et al(135), Bales(84), Bram(132)).

5. The Gottschalk-Gleser typology (Gottschalk(136)).

This system codes the nature of the communication and the actual content of the unit of analysis. It therefore represents a combination of I.P.A.(Bales(84)) and Bettman-Park (Bettman and Park(131)) with the general inquirer (Stone et al(135)). It is detailed and flexible, but again the literature indicates that it has been widely extended and adapted to meet individual research interests and requirements (Gottschalk(136)), Gottschalk, Winget and Gleser(137)), Holzman and Forman(138)), Viney and Westbrook(139)).

6. Frequency and Concordance analysis (Pool(63)).

This system analyses content specifically and allows analysis of different units of analysis, either the sentence itself (Bales(84)) or individual words (Gottschalk-Gleser(136)). Analysis can produce a frequency count of word occurrence and also a frequency count of that word in association with other words or in sentence types. The significance of association of words appearing in the same sentence unit may then be calculated. Such associations are based either on a chi-square (Baldwin(141), DeStephen(142)) or standard error of a percentage (Pool(63), (Green(140)) calculation.

The literature suggests that quantitative content analysis typologies work best when designed and adapted to a particular piece of research or investigation. The content analysis system in this research was therefore developed from a combination of the systems listed above following the precedents of Gouran and Baird(85), Landsberger(130), Bryan, Donohue and Pearl (86), Baker(87), Borgatta and Bales(46), Biehal and Chakravarti(113), Bram(132), Scott(134), Stone et al(135), Bales(84), Gottschalk(136), Gottschalk, Winget and Gleser (137), Holzman and Forman(138), and Viney and Westbrook(139)).

The coding summaries for the purpose designed system are shown in appendix (2) together with example coding procedures. Essentially the system used is based upon Bales'(84) I.P.A. extended to include a range of the more specific content

categories included in the General Inquirer (Stone et al(135)), with a facility to carry out full frequency and concordance analysis (Pool(63)). The nearest published systems to the one used in this research are those developed by Gouran and Baird(85), Bryan, Donohue and Pearl(86), Baker(87), Borgatta and Bales(143), Henderson and Jurma(144), Russo and Johnson(145), Goldstein, Strickland, Turnbull and Curry(146), Ysseldyke, Algozzine and Allen(147) and Bochner(148)).

6.4.2.2.QUALITATIVE CONTENT ANALYSIS.

Human speech communication is effectively a system of qualitative content analysis. One hears speech and interprets it's meaning automatically, although such understanding is a product of a considerable learning process. The literature has made some use of qualitative content analysis, generally used as paragraphs of qualitative text presented in support of quantitative results or interpretations (Pool(63), (Green(140), Cooper and Dinerman(149), Sander(150), Schutz(151), Cartwright (124), Guetzcow(152), Mann(153), Garraty(154), Kraucher(155)). Qualitative content analysis has therefore been used in this research in accordance with this precedent.

6.4.3.DATA PROCESSING PROGRAMS.

The literature provides numerous examples of the use of computers to analyse quantitative content analysis data. As with the coding typology literature, the clear tendency with computer processing has been to create unique programs in

order to analyse the aspects of the data which are of particular interest to the researcher (Borgatta and Bales(143), Henderson and Jurma(144), Russo and Johnson(145), Goldstein et al(146), Ysseldyke et al(147), Bochner(148), Mann(153), Kraucher(155), Iker and Harway(156), zimmer and Cowles(157), Bierschenk(158), Hargrove and Martin(159), Johnson et al(160), Cassotta, Feldstein and Jaffe(161)).

The programs used to process the quantitative data in this research were therefore developed specifically to process the type of information required by the hypotheses, in line with the precedents set by earlier researchers.

The programs themselves are presented in full in appendix (3) with example print outs of meeting and interview data files and process results print outs. The programs are written in adapted BASIC and run on a Burroughs B6930 mainframe.

6.5.METHODOLOGY SUMMARY.

The methodology for this research is based on the quantitative and qualitative content analysis of design team interaction and individual interview communication. The data is processed using purpose designed computer programs and patterns of communication content are produced. These are then used to support the hypotheses generated from the literature integration and findings from the pilot study. Inferences relating to the thought processes of the design team members are than made from the hypothesis data support patterns in order to produce a theory of the Architectural decision making process as a function of design team interaction.

This process begins with the presentation of the main results which emerged from the research, in the following chapter.

CHAPTER SEVEN.

RESULTS

7.1.INTRODUCTION.

The results presented in this chapter originated from the subject design teams given in the list of design teams given on page xvii. The results were recorded and processed according to the methodology detailed in chapter six. The presentation of results is based upon the combination of quantitative and qualitative content analysis. The quantitative results are presented in the form of graphical representations of communication variations over time. The qualitative results are presented in the form of extracts from interview responses. The presentation is designed so that the quantitative and qualitative results work together and complement each other.

The overall presentation of results is structured in relation to the hypotheses generated and developed from the literature integration and subsequent synthesis with the results of the pilot study. Each hypothesis is therefore presented with the appropriate results.

7.2.SUBJECT DESIGN TEAMS.

The subject design teams and individual members are quoted and shown graphically according to the identification codes given

on page xvii. The main longitudinal study is therefore designated as design "A". The project Architect for this design is designated as Architect "A" throughout. Keys on the graphs indicate symbolic codes for each design team.

The timescale for each graphical representation is standardised according to the R.I.B.A. plan of work. Each graph shows variations for the main longitudinal study, the pilot longitudinal study and the validating cross sectional studies.

Where qualitative extracts are presented, the question which was presented to the interviewee in order to obtain the quoted response is given before the actual information presented. The design stage in which the response was given is also given. Hence "stage 1" refers to stage one of the full design stages of the plan of work, being outline proposals.

The graphs themselves are contained in the figures section in appendix five. A reference to a figure in the text refers to the corresponding graph in appendix five. The graphs themselves were produced by a computer plotter and have been enhanced manually for presentation in this document.

Quotations in the text are reproduced from actual taped interview responses from the design team members given. The corresponding question which was put to the interviewee in order to produce the response is given in the text.

NOTE: The graphs which accompany the text in this chapter are located in appendix five. A list of the interview questions which were used for the responses quoted appears in appendix (1) page 298.

7.3. PRESENTATION OF RESULTS

HYPOTHESIS 1.

In the design team interaction process the influence of the Architect is greater during the earlier and later stages than during the middle stages.

Results obtained from direct observation of meeting interactions show that the influence of the Architect decreases during the middle stages of the design. Influence is considered in terms of design team interaction as opposed to the design itself. The Architect tends to ask more questions, becomes less assertive during interaction and expresses less certainty and strength of expression.

Preliminary interview results reinforced this observation. The following responses were obtained to the following question:

Q: "At what stage or stages in the design process is the influence of the Architect most pronounced upon the decision-making process of the design team?"

Responses included:

"I suppose I tend to be most influential in the later stages of the design. That's when we get into the detailed design of the building....and the inadequacies of the initial....detailed aspects of the Client's brief start to become apparent. You don't tend to see these problems during scheme design....you're too busy trying to sort out an overall solution to the basic problem....getting the room relationships right and so on."

Architect A, Stage 1.

"Well, if by influence you mean the amount of design...activity which is required of me by the other members of the design team, then it's got to be the later stages....detailed design and production information. I also have to put in a lot of effort in the early stages when we're first agreeing a general approach with the Client."

Architect B, Stage 1.

"Difficult to say....I suppose we tend to get the most responsibility placed upon us in the initial and later stages. Early on we have to sort out the brief and agree upon an approach....basic concepts and shapes and so on. Later on we have the minute detail to contend with....which always leads to problems. Scheme design tends to be the slackest time for us.... it's largely routine design....based upon known requirements and using our experience of previous jobs to go by."

Architect D(A), Stage 1.

"In terms of design team liaison, I suppose scheme design is the least influential time for us. It's largely a matter of getting on with the design by ourselves and then showing the results to the rest of the design team at our design meetings. We then base our subsequent designs on the feedback that eventually we receive....we have to play a much more forceful role in the earlier stages for example....."

Architect I, Stage 1.

Of the 18 Architects interviewed, 12 made comparable responses. The influence of the Architect upon design team interaction does appear to decrease during the middle stages of the design, as based upon direct observation and interview responses.

Figure 1 illustrates variations in the proportion of design team interaction contributions made by Project Architects which took the form of requests for information. Clearly these Architects were asking more questions during scheme design than they were during outline proposals or detailed

design. Figure 2(A) illustrates that the Architects made fewer attacks during the same stage, while Figure 2(B) illustrates that the proportion of Architect defences increased. Figures 3(A) and 3(B) illustrate how the proportion of Architect opinions and expressions of uncertainty respectively increased during scheme design.

These results are indicative of a general decrease in Architect assertiveness during the middle stages of the design. The Architect makes fewer attacks upon design proposals or previously agreed elements, tending rather to defend. In addition, the Architect tends to make more contributions in the form of opinions or uncertainty. Again, these patterns are indicative of a decline in interaction assertiveness.

Interviews with other design team members have supported this observation.

"The Architects tend to be most active....in terms of their interaction with the design team, during the earlier and later stages of the design. During the middle stages....scheme design and so on, they tend to go away and get on with it, giving us details of the design as it develops so that we can keep track of costs."

Quantity Surveyor A, Stage 1.

"We tend to have lots of meetings in the earlier stages....while we sort out an overall strategy if you like. After that, we largely leave the design to the Architect, and simply cost out what they produce."

Quantity Surveyor B, Stage 1.

Figure 4 illustrates how the total number of contributions made by the Architect at meetings tended to decrease during

the middle stages of the design. Figures 5(A), 5(B) and 5(C) illustrate how the content of these contributions varied, showing variations in references to new goals, constraints and preferences respectively. It is clear that during the middle stages of the design, the Architects were referring to new goals and constraints less frequently, and appeared to refer to new preferences more frequently.

Again, these variations are indicative of a decrease in interaction assertiveness. Further results which support this are shown in Figure 6. The average strength of Architect contributions decreased appreciably during the middle stages of the design.

Figures 7(A) and 7(B) provide a more detailed breakdown of Architect contribution types. They show that the Architects observed had a clear tendency to replace design-related contributions with control-related contributions during the middle stages of the design. This trend towards an administrative preoccupation on the part of the Architect was observed to a greater or lesser extent in all the interaction observations.

Other responses to the same basic question of Architect influence upon design team interaction provided qualitative support for these observations.

"The Architect does tend to ask more questions....and be less certain generally during the middle stages.... largely because that's when the first really detailed costs start to come in from the Surveyor. In the outline proposals stage, the Architect produces a design which is costed on a purely indicative basis....he knows if he is in the right general area. During scheme design however, he starts to get detailed costs of some specific aspects of the design, and he has to start asking lots of questions. The whole design becomes less certain again for a while:"

Architect E, Stage 1.

"I would suggest that the influence of the Quantity Surveyor really begins to take off during the detailed design stage. His cost reports begin to seriously affect the Architect's approach for the first time. He starts to say things like; 'Well, we can't afford this' and; 'We can't afford that'. The Architect is forced to comply in order to remain within budget, and the result is growing instability."

Architect K, Stage 1.

"Initially, the Architect sets the pace for the whole project. He takes the Client's brief and really takes command of the whole design for a time. He really suggests all the ideas behind the design in the early stages, largely upon his own initiative. In the stage immediately following that, when the design begins to firm up, the design....process becomes more interactive....more based on a swapping of ideas."

Architect F, Stage 1.

"The Architect tends to adopt a more forceful approach during the detailed design stage I suppose. My opinion on this is that the design has been largely established by then, and there isn't much room for making changes....of a large magnitude, by then. Clients tend to want to make lots of changes at that stage, and the Architect has to be more active in order to avoid time-consuming changes.

As the design progresses, time tends to become increasingly important, and the Architect....well, the whole design team really, have to consider the amount of design time which remains available. The Architect ...as design team

leader, has to take a more active role in terms of control and administration....design management."

Architect D(C), Stage 1.

"The most uncertain time is scheme design....from my point of view. That's the time when I really have to analyse the design as it stands, and have to start asking serious questions as to whether what has been produced up to that point is acceptable or not. It's the time when I have least control over the design team meetings....other members become more prominent if you like....particularly the Surveyor. His cost advice becomes very important to the future development of the project."

Architect J, Stage 1.

Client members of the design teams which contributed suggested similar information.

"The Architect certainly asked more questions during the middle stages....I was quite surprised....I expected him to get on with it more himself."

Client Representative C, Stage 4.

"The Architect seemed to be more assertive in the earlier stages....and is more so at present. He was always suggesting new ideas and making comment when we first started, but that seemed to die out after he gave me the outline proposals report....he became more distant....less helpful, although he did produce a lot of design information....the Q.S. became more prominent if anything....."

Client Representative D(A), Stage 4.

"In the middle stages....the Architect seemed to become less sure....less of a driving force. He seemed to ask me a lot more questions....he was always asking for more information and new details of what we wanted. He also began to mention the program more.... stressing the importance of meeting time deadlines.... he never did that....or did it less often in the earlier stages, although I must admit that he hasn't been doing it as much just recently."

Client Representative D(C), Stage 4.

"Yes....the Architect definitely came in for a lot more....attacks....or challenges to what he had previously decided....or designed, than he has over the past few

weeks. He seemed to go away and get on with it on his own, then he would fetch stuff back and get us to look at it and tear it apart....relatively speaking."

Client Representative L, Stage 4.

"The Architect seemed to play less of a part in the design team meetings a few months ago (during scheme design) than he had done before or as he has done since....I'm not sure why that should be...." (Brackets added)

Client Representative I, Stage 4.

Quantity Surveyors from the various design teams also provided qualitative substantiations for the observation results presented in Figures 1-7:

"During the middle stages of the design, the Architect becomes very much constrained by what he can afford to design. In nearly all design projects, there is only a certain amount of money available....and the Architect cannot go beyond that....I suppose he becomes less of a designer....more of a compromiser... working within limits."

Quantity Surveyor C, Stage 2.

"The Architect....I mean he is prominent throughout the design process....but in terms of design meetingshe says more in the earlier and later stages than in the middle stages....that's really because....well, in the early stages he is producing an initial design for the rest of us to work on. After that we cost it, and he has to adapt the design to suit the cost constraints."

Quantity Surveyor D(A), Stage 3.

"To some extent you could say that the design is....at least partially taken out of the Architect's hands during the scheme design stage, because a lot of changes have to be made on the basis of costs. Scheme design is when hard cost facts first become available to the design team, and the advice of the Q.S. becomes more important. During detailed design, that still applies, but....it must be said that it's too late to start making major changes to the design."

Quantity Surveyor F, Stage 1.

"I mean, during scheme design, the Architect is still fully responsible for the design, but his design freedom becomes

more constrained....he has to work within the cost information that I give him, and....if and when any cost reduction exercises become necessary, he has to take the advice of the Client more....as to what can or cannot be cut. So he becomes less independent....less overriding upon the development of the design.

Now that independence....that power....becomes more prominent again later on in the program, simply because of the increasing complexity of the design."

Quantity Surveyor K, Stage 2.

The majority of design team members held the view that the Architect became less influential upon design team interaction during the middle stages of the design. Clients tended to ascribe this pattern to a growing sense of Architect independence as the design became more established, while Quantity Surveyors tended to ascribe it to growing design constraints produced by increasingly detailed cost information. Architects themselves tended to assign it to increasing involvement by both the Quantity Surveyor and Client Representative.

The underlying implication of these findings is that the Architect becomes more influenced, in terms of his design decision-making, by the other members of the design team during the middle stages of the design. He asks more questions, makes fewer assertive contributions and more submissive ones. He expresses a higher proportion of opinions and statements which are indicative of uncertainty, making fewer contributions of all types, which have lower average strength characteristics. Additionally, his contributions become less design-oriented and more administration/control-oriented.

These findings were put to the various Project Architects towards the end of each design process. The following responses were obtained:

"Well....I find some of these findings very interesting. Making fewer contributions at design team meetings....I....that's maybe not too surprising, since the onus does tend to switch to the Q.S. from that time forwards....his cost reporting becomes of primary importance....I mean I have to design to cost limits. From that point of view, you could say that I was more influenced by the other members of the design team during the middle stages....yes.

As to asking more questions and showing a higher degree of uncertainty....That could tie in with the growing constraints put upon me by the Q.S.....I need to obtain more design-relevant information in order to continue with the design."

Architect A, Stage 4.

"Saying less at design team meetings....yes, that makes sense. Up to that point I was working....really to indicative costs....cost which only gave me a general idea of whether or not the design I was producing was likely to be acceptable in the long run. I was putting forward all the new design ideas....new concepts and goals as you've called them, and everyone else was simply taking them in. The Q.S. used them for producing more detailed costs, and the Client.... well, the Client was simply looking at them to see if they were in line with what he wanted.

Later on we got involved with the detailed design of the thing....the more critical detail. Now at that kind of level....that kind of minute detail, the thing passes over the Client's head to some extent....and the Q.S. is too busy costing to really say a great deal....so it seems reasonable to assume that the Architect would tend to come more 'back into his own' to some extent."

Architect B, Stage 4.

"I would agree with some of those findings....I mean I can relate to some of them. I would agree that I became less active at meetings in the middle stages of the design....say between issuing the outline proposals and scheme design reports. The Surveyor becomes more active then, and I have to listen very carefully to what he

says....especially so....this was especially the case in this design, as you saw."

Architect C, Stage 4.

"More opinions and uncertainty during scheme design.. ..that would have been because that was the period when I needed lots of cost details from the Surveyor.. ..and also, in this particular case, because I needed to closely question the Client as to where we were to go next. The design was constantly changing at that point, as is the case on most....or certainly on many design projects. I suppose I did....well, not lose control, but a lot of the discussion at the meetings we had was taken over by other people."

Architect D(A), Stage 4.

HYPOTHESIS 2.

The contributions of the Architect become less brief-oriented in the middle stages of the design process than in the earlier and later stages.

Findings have indicated that the Architect makes fewer brief-oriented contributions during the middle stages of the design, than in the earlier or later stages. Qualitative results from the design team member interviews have indicated that the Architect is less influenced by the brief when arriving at design decisions, during the middle stages.

Qualitative results were obtained in response to the question:

"As the design develops, does the Architect show a greater or lesser degree of preoccupation with the initial design brief?"

Responses included:

"Obviously, I tend to have to consider the brief very carefully in the early stages, since it forms the whole basis of the design. The brief is really the starting point....the launching pad for the whole project. I am obliged to base my whole approach to the design upon it. As the design progresses, I can start to move away from it to some extent....the design develops beyond the depth of content held in the brief, and I have to work more on an original basis. Then again, in the later part of the design, the brief tends to become more important again....depending upon the complexity of the design, and the depth of information contained within the brief itself.

In this particular case, the brief is very detailed... it specifies almost everything, so I can see that we'll have to come back to it for reference during the detailed design stage."

Architect A, Stage 1.

"The brief is of primary importance during the initial phase of the design....when I'm trying to first put something together....at that point, the brief is uppermost in my mind....definitely. Once I've got a basic approach put together, then I can begin to talk about it with the Client....maybe pointing out where things which are specified or implied in the brief could be improved upon or modified in order to make the design more efficient.

A lot depends on the brief itself....the amount of information which it contains, and how specific it is on certain points. There are always some aspects of the brief that I have to stick rigidly to throughout the evolution of the design....and as such are always at the back of my mind when I'm designing."

Architect B, Stage 1.

"The extent to which the brief influences my thinking....really at any stage in the design process, depends upon it's information content. A very detailed brief will influence me more than a very vague one. Having said that....assuming a theoretical 'average' brief....it would probably be more in my mind at the start of the design process than, say half way through it.

When you are designing a building, you keep finding new things that affect the design....things which make some of the initial briefed requirements difficult or impossible to fulfill....the obvious one being cost. You nearly always find that you can't afford some of the Client's initial

requirements. Factors come into play which reduce the overall impact of the brief upon the design."

Architect C, Stage 1.

"During scheme design I can 'branch out' a bit....start to develop the design upon less restricted lines, and move away from the brief. In the outline proposals stage, my design is much more based upon the requirements and specifications of the Client as set out in the brief. With a lot of design briefs, the information also becomes more constraining again in the later stages of the design....if it contains a lot of specific points on fixtures and fittings for example....as in this case."

Architect K, Stage 1.

Figures 8-12 show qualitative results in support of hypothesis B. Figure 8 illustrates how the total number of references to the brief made by the Architect at design team meetings decreased during the middle stages. The brief was referred to as often during detailed design as during outline proposals, but appreciably less frequently during scheme design.

Figure 9(A) illustrates the increasing proportion of Architect attacks being directed at briefed goals at design team meetings. Despite a falling frequency of references to the brief, the proportion of attacks being directed at briefed goals actually increased, indicating a higher proportion of attack references contained within an overall decreasing frequency reference to the brief. Figure 9(B) illustrates that a similar pattern emerged for observed attacks on briefed design constraints.

Figure 10 shows variations in the proportion of Architect uncertainty statements which contained a reference to the

brief. These results are indicative of a variation in the Architect's perceived 'certainty' in relation to the brief. Figure 11 shows a similar distribution, and illustrates how the number of Architect questions which related to the brief, increased during the middle stages of the design. Again, the results plotted in Figure 11 indicate a decrease in perceived certainty in relation to the brief.

Figure 12 illustrates how the significance of word association concordances between the word design and four variables, varied over the course of the design projects plotted.

Figure 12(A) illustrates how the association between brief and design decreased over the course of the design process. Figure 12(B) shows similar patterns for the association between Client and design.

Figure 12(C) illustrates that over the same design period, there was a growing association between references to reports which had been issued subsequent to the brief, and design. This includes references to such documents as the outline proposals and scheme design reports.

Figure 12(D) illustrates that there was an increasing association between self references by the Architect and design.

The results plotted in Figure 12 are indicative of an increasing Architect disassociation between the brief and design and the Client and design, and of an increasing

association between subsequent documents and design and self (Architect) and design. The brief/design association curves (Figure 12(A)) show a slight upturn in the later stages. This supports the indications of Figure 8, in that there is an upsurge in the Architect's preoccupation with the brief in the later stages of the design.

Interviews with design team members produced qualitative substantiations for these observations.

"The brief starts me on the design....it gives me an initial basis for the design. I start to build up the nucleus of a design around the briefed requirements. After that I begin to develop it along the lines of experience that I've amassed from previous similar designs. It's only during detailed design that I begin to refer back to it in any detail again."

Architect D(A), Stage 1.

"With housing, you tend to get a design brief which sets out a lot of preliminary concepts....such as room sizes and relationships, and also a lot of the detailed things, like the number and....possibly location of outlet sockets and so on. The result is that the brief influences my approach to the design very much in the early stages, but also in the later developments as well."

Architect D(B), Stage 1.

"It depends how detailed the brief is in the first place. If it's a detailed brief, then it sets the style for the whole design. If it gives you details of services locations and that kind of thing, then it influences you later on during detailed design as well. The housing briefs that we get from ***** do just that....you refer to them constantly during the initial stages of the design, then really put them to one side, then look at them again when the design really begins to firm up."

Architect D(C), Stage 1.

"As an Architect....I tend to largely accept the brief as it is presented. I only attack anything in there that is obviously wrong or unacceptable. In the later stages of the design, say into the scheme design stage, I would attack the brief....more openly....more directly. That's

because....by then the design is becoming more complex and involved, and any inadequacies in the brief becomes more apparent and critical."

Architect I, Stage 1.

"If I was going to attack or challenge the contents of the brief, I would say that the most likely time would be somewhere during scheme design."

Architect H, Stage 1.

"If the brief is specific, I tend to use it more in the later part of the design than during scheme design. It is obviously used very heavily in the early stages."

Architect P, Stage 1.

"The brief really influences me least in the central phase of the design."

Architect J, Stage 1.

"In terms of questioning the brief or making changes to it....I would say that the peaks during scheme design or thereabouts....that's the time when the design becomes more separated from the initial pattern laid down by the Client in the brief."

Architect L, Stage 1.

Other design team members made compatible responses when presented with the same question. The overriding impression was that the Architect did not appear to be so influenced by the contents of the brief during the middle stages of the design. Client Representative responses included:

"The Architect certainly seemed to change with regard to his approach to the brief. I mean this was a pretty detailed brief....as the Architect himself said at one point; 'It practically designed the building for him'. He seemed to rely on it pretty heavily at first, then he seemed to move away from it to some extent....he began to point out things in it that he said could not be designed or which were unacceptable for some other reason....and he began to ask more questions about brief-related things."

Client Representative A, Stage 4.

"Well....once the Architect began to firm up the design, he did seem to move away from us to some extent....he seemed to take command of the situation more than he had done previously. As far as the brief went....he was obviously very interested in it at the start....just after we gave him it. After that....over the last few weeks (detailed design) he has begun to take more of an interest in the brief again....he certainly refers to it more at our design team meetings.

He made more challenges to the brief and the things that we had put in there during the scheme design stage."
(Brackets added)

Client Representative B, Stage 4.

"The Architect and the brief....well, he was always asking us to make changes to it after he gave us the scheme....sorry, outline proposals report. Until then he had accepted the brief more or less as it stood. Recently, he's begun to read it as it stands again, and he seems more sure of....really how to interpret it."

Client Representative C, Stage 4.

"Yes....he was more concerned with the brief when the thing first started. He's also started to look at it more closely again just recently."

Client Representative D(B), Stage 4.

"I'd say that the Architect becomes increasingly preoccupied with the reports that he himself produces. In this particular case, in the recent stages of the design (detailed design) he was always going on about that report they produced for us in March. (Outline proposals report). After he'd produced that, he hardly ever mentioned the brief....not at the design meetings anyway.

A couple of months ago he began to tear the brief apart (scheme design) at the meetings....he was always challenging the stuff that we'd put in there. At the time I thought he was doing it so that he could influence the design more to suit himself....but I'm not sure."
(Brackets added)

Client Representative F, Stage 1.

"The brief was fairly detailed, so he's had to look at it closely again just recently, (detailed design) and he hasn't done that for a long time." (Brackets added)

Client Representative G, Stage 4.

"The Architect took an increasingly dominant role in the design, especially during the middle parts of the design. I would say that he has been less and less influenced by us

(The Client) as he has developed the design."
(Brackets added)

Client Representative H, Stage 4.

"Recently, he's (Architect) been basing his design arguments more on the scheme design report than on the brief." (Brackets added)

Client Representative K, Stage 4.

"I must admit that I've been feeling more and more separated from the design as it has developed. I suppose that's inevitable to some extent....I mean he's the expert (Architect) and I'm not....I can only appreciate the full complexities to a certain point." (Brackets added)

Client Representative L, Stage 4.

These interviews were also analysed on the computer. The results of these analyses are shown in Figure 13, and show variations in word association in response to all questions by Client Representatives over the full design periods.

Figure 13(A) shows that the Client Representatives exhibited similar brief/design associations to those evident in the respective project Architect meeting contributions. The late upsurge in brief/design association was again evident.

Figure 13(B) indicates that Client Representative exhibited a decreasing self/design association as the design process continued. Again, these results are compatible with those obtained from Architects as shown in Figure 12(B).

Figure 13(C) shows Client Representative associations for design/subsequent reports. Again, these results are similar to the same analysis of Architect responses. The association between design and reports issued subsequent to

the brief increased throughout the design process.

Figure 13(D) shows association between the Architect and design contained in Client Representative responses. The association curves here appear to be more pronounced than those presented in Figure 12(D) which show the same association plots for the Architect responses. This indicates that the Client perceives a more pronounced association between the Architect and design than does the Architect himself.

Interviews with Quantity Surveyors provided a range of compatible responses.

"Well....there's no doubt that the Architect does tend to come more into his own as the design proceeds. He is the expert, and he's paid to design after all. As to the influence to the brief....obviously that plays the main part early in the design process....when the Architect is trying to work out a basic design to be developed later. In the middle stages....around scheme design, he tries to develop the design along the lines which he established in interpreting the brief in the first place."

Quantity Surveyor A, Stage 3.

"In this particular design....I think it's fair to say that the brief was very prominent in the Architect's mind in the early stages of the design, but it has also played an appreciable part in his recent thinking as well. This brief gave a lot of information which was relevant in the later parts of the design as we started on the fixtures layouts and so on."

Quantity Surveyor B, Stage 4.

"I'd say that over the course of the design, the Architect does become more and more....instrumental... prominent. He produces a series of reports which really supercede the contents of the brief....they become the basis of each subsequent stage of the design, and they are produced largely by the Architect of course. The Client Representative or whoever does become increasingly....alienated from the design.... simply

because he does not have....in most cases, he does not have the necessary knowledge or expertise to fully challenge the increasing complexity and sophistication that inevitably becomes involved in the design."

Quantity Surveyor C, Stage 2.

"What happened here was really the classical project development pattern. The Client became more and more isolated from the design....even bewildered by it's complexity, while the Architect took more and more of it under his wing."

Quantity Surveyor E, Stage 4.

"The Architect was definitely asking more questions about the brief during scheme design."

Quantity Surveyor L, Stage 4.

The majority of design team Quantity Surveyors produced qualitative substantiation for hypothesis B. The influence of the brief was perceived to be of less importance to the Architect's decision-making philosophy during scheme design stage. The relative increase in importance during detailed design was observed in all cases where a complex or particularly involved brief was involved. The effect was less pronounced or not appreciable in those cases where the brief was simple and non-detailed.

Figure 14 provides quantitative support for the interview extracts presented above.

Figure 14(A) shows variations in Quantity Surveyor word associations between brief and design. The same downward trend which was evident for the Client Representative interviews and Architect meeting contribution is evident.

Figure 14(B) shows Quantity Surveyor associations between

Client and design. The decreasing association is again observable.

Figure 14(C) illustrates the increasing association between design and subsequent reports. These curves are almost identical with those provided by Client interview responses as presented in Figure 13(C).

Figure 14(D) illustrates that the Project Quantity Surveyors also exhibited an increasing association between Architect and design, especially during the later stages of the design.

The interpretation of these results is that the Architect experiences a growing sense of independence from the stipulations expressed in the brief as the design process continues. Where the brief is detailed, this independence is curtailed in the later stages of the design. This observation features in the perceptions of the Architect himself, the Quantity Surveyor, and the Client Representative.

These findings were presented to the project Architects near the end of each design process, for comment. Responses included:

"I suppose I did take over the design to a certain extent....at least as far as the Client was concerned. Don't forget that the Engineers made a lot of the running throughout the design, since this building is so complex. The brief was very detailed, but it soon became apparent that we simply could not afford to meet it within the cost limits which were available... so we were forced by circumstances to detach ourselves from it. I would agree

that the brief become more important again later, since it was so specific in terms of services layouts and capacities and so on.

I questioned the brief more during scheme design, but only because I had to....it's contents became.... superceded by events. Goals and constraints which were seen as important when the brief was being written ceased to be so as the design developed."

Architect A, Stage 4.

"The design developed to a stage where it became too complex for the Client to fully appreciate it....even though the Client in this case was relatively well informed. In most designs you find a similar patternthe Client becomes separated from the design to some....to a greater or lesser degree, depending upon experience. When that happens, the brief tends to go out of the window."

Architect B, Stage 4.

"I was asking more questions in relation to the brief during scheme design because it became apparent that some of the items contained within it were no longer compatible with the design as it had developed up to that point. Changes to the brief became necessary, and I could no longer adhere to it as strongly as I had been doing up to that point."

Architect C, Stage 4.

Brief uncertainty....that is a common occurrence on design projects. The brief holds good for a certain time, but then it becomes outdated....some of the things which it contains are no longer workable. That certainly happened with this building. The Client was forced to concede a number of the requirements that were in the original brief. I had to point that out to the Client as soon as it became prudent."

Architect D(A), Stage 4.

"Outline proposals and scheme design reports do act to supercede the brief. The brief starts the design going, but later on it becomes more open to adaptation in order to fulfill the requirements....design requirements of the overall developing design. More acceptable solutions become the obvious choice, rather than the goals or objectives contained in the brief. That happened here....and as a result I had to challenge the brief....on some points."

Architect E, Stage 4.

HYPOTHESIS 3.

Architect interaction is most heavily influenced by past design experience during the middle stages of the design process.

Results obtained from long term observations of design team interaction indicated that the Project Architects became increasingly preoccupied with previous designs from their own experience during the scheme design stage of the process. Results indicated that reference to previous design experience was significantly influencing the decision-making process of the Architect during the scheme design stage. It also became clear that reference to previous designs influenced some aspects of the design more than others.

Interview results reinforced this observation. The following extracts were received in response to the question:

"To what extent is the Architect's design decision-making influenced by his or her experience of previous design projects at each stage in the design."

Responses included:

Past experience plays an important part in the Architect's approach to any single design. The Architect has a basic education in the theory and approach to architectural design, but a lot of what goes into a practical design is based upon past experience. In the initial stage of the design, past experience does not play so great a part, since the brief tends to restrict the approach to the

design.... to an appreciable extent. Once you get into scheme design, it becomes more a case of relying on experience to develop the design towards a more detailed state. Things like materials and associated maintenance problems are good examples....choices between cladding materials or brick types tend to be based upon previous knowledge of maintenance and lifespans and so on."

Architect A, Stage 1.

"Experience comes into it's own during the scheme design phase of the design process. Before that, the Architect is heavily restricted by the brief or whatever document the Client issues in that respect. Once you get into detailed design, the Client's requirements become rather specific....in most cases anyway, and the Architect's opportunity to use his experience become less pronounced....it goes back to Client requirements again."

Architect B, Stage 1.

"Experience always plays a part....really that's what the majority of design....or the design activity is all about. Few aspects of any new design are truly innovative....produced without reference to previous design knowledge.

As to the extent to which the use of experience varies over the course of the design....I suppose....I suppose I try to draw on it most just after some kind of basic design has been agreed with the Client. He tells me more or less what he wants in the brief or whatever, and I produce something around that information. In the next stage....scheme design, I use my experience....to develop the design along the lines which I, as a professional, think are the best lines. That's where experience really becomes a part of the design act."

Architect C, Stage 1.

"Scheme design....that's when I start to apply my design experience to the design in question. It's all too new and specific before that. In the detailed design stage, the Client tends to be very clear in what he wants, and experience....my experience tends to be....perhaps slightly less applicable."

Architect H, Stage 1.

"Design experience applies especially in the case of materials. There are so many materials available on the market now, that you've really got to go by experience....to some extent. Choices of materials... that really begins during scheme design....the scheme design stage....that's when experience is used to any extent....first.

In the later phase of the design....when you get into the real detail, you have....perhaps less choice.... less of a range to choose from. You can still use experience of materials to some extent....but some.... so much of the design has been fixed and finalised by then that the foregoing design itself becomes the primary influencer....the parameter that you have to design to, rather than having a free choice of options for which you have a free choice based upon experience."

Architect L, Stage 1.

"The use of experience really depends on how many buildings of the same type you've done in the past. In this particular case, it's only the second of it's type in the country....maybe in Europe. Having said that, I have to say that my approach to it is being influenced by the simulator at *****....I mean that's all we've got to go on. I suppose....looking back, that I was most....or gave most thought to that other building during the middle stages of the designbefore we got into the real detail....things like specialist floor tiles and so on."

Architect E, Stage 4.

Figure 15 shows variations in references to other previous designs made by Architects over a range of designs. The increase in reference frequency during the middle stages of the design is evident. The results here also indicate that this effect is more pronounced in the case of more simple designs than in the case of more complex designs.

Figure 16 shows a sample distribution of past experience reference contributions for project A. This distribution is typical for the total sample of projects. In the middle stages of the design, the design teams were typically referring increasingly to past experience in relation to materials as opposed to the other design variables shown. Towards the later stages of the design, the team become more concerned with practicality when discussing the design

in relation to past experience.

Interviews provided a range of substantiations for these observations.

"Past experience is very important in the case of the selection of materials. I would generally have to consider a wholly new material very carefully before I would recommend it to the Client or include it in the design....unless it's application was unlikely to provide any doubts about it's suitability. With materials, you've always got to consider the likely durability of the thing....together with the practicalities of using it and it's lifespan....how long it's likely to last. These factors are all things which you gain from past experience of using it before."

Architect A, Stage 2.

"I always try to think back to where I've used materials before when I am considering them in any new design. In this design, we chose these particular facing bricks because we knew that they were good. We used them on phases one and two of the *****, and we knew that they hadn't provided any significant maintenance problems. We knew that the Client liked them....and they look alright, so it seemed to be the obvious course of action to go for them."

Architect B, Stage 3.

"Experience of designing other buildings is an important factor in architectural design. When I consider a material or approach, I think back to where I've seen or used the same thing before. It's always risky....or not really advisable to go for a completely new material or design solution. It's always better choose something which you know has a certain lifespan or maintenance record....that's what I....we tried to do here."

Architect C, Stage 3.

"Experience of recent....or previous designs is a particularly prominent factor in housing design. Houses tend to be similar....similar materials and design....philosophies. You can base one new house design pretty much on the design of previous ones. I know where materials have caused problems or where maintenance weaknesses have been revealed. These are the sorts of things that I was thinking about after the issue of the outline proposals report....a few months ago."

Architect D(A), Stage 3.

"Experience....knowledge of previous design problems or performances in general was important in this design, especially in relation to the selection of materials. The brick....the facing brick that we eventually decided on, for example....that wasn't the cheapest brick that we could have used, but it was one that we knew very well. We had used it on a number of previous designs, and we knew that it performed well and was relatively maintenance-free....that's why we recommended it to the Client. Other brick types might have looked better in that location, but in this case, likely maintenance costs was the prime consideration in the material choice."

Architect D(B), Stage 3.

"Experience played a fairly prominent role in this case....since I had done a number of similar projects in the past. This was really a fairly routine office refurbishment....a variation on a fairly standard theme. The internal layout was decided largely by discussion with the Client, but things like the choice of materials was largely based upon my experience of similar designs in the past."

Architect K, Stage 3.

"Things like the choice of finish materials and their likely maintenance performance were largely dictated by my and my colleague's own design experience of similar applications."

Architect L, Stage 4.

Client Representatives made a range of similar points regarding their own perceptions of the Architect's use of previous experience during the design process;

"The Architect certainly used references to previous designs....that he had done, in order to add weight to some of his arguments. He seemed to do that much more after he had given us the first report. (Outline proposals) He was always going on about that laboratory that they designed for ***** a few years ago. He seemed to do it particularly with regard to internal materials....finishes and services layouts and distributions. He seems to have quietened down about it again just recently."
(Brackets added)

Client Representative A, Stage 4.

"I remember the Architect used his own previous experience to justify his preferred choice of facing brick....on this project. I'm not sure that he mentioned it with any other particular part of the design....it was mainly materials and their likely durability properties. That all came in the scheme design stage of course."

Client Representative B, Stage 4.

"Previous experience....I would suggest that the Architect drew most heavily on that during the scheme design stage. He often referred to other designs theparticularly when he was discussing aspect of materials choice. I remember that the main criteria in his recommended choice of cladding materials was the use of that particular type on a range of advanced factories across Scotland."

Client Representative C, Stage 4.

"The Architect did seem to rely heavily on past design experiences. I'm not sure just at which stage that was most pronounced....it's hard to say for sure. I mean with housing....all new houses are to some extent based on past designs....houses are all based on a central design philosophy....at least ours are.

If I were to be pressed, I would say that the highestextent of past experience influence occurred just after the issue of the outline proposals report.... going back a couple of months (Scheme design). That was when the Architect was first starting to develop the design....more along his own lines....away from the strict requirements of the brief." (Brackets added)

Client Representative D(A), Stage 4.

"....I'd say that the Architect drew most heavily upon previous experience during the scheme design stage."

Client Representative D(C), Stage 4.

"The Architect has designed a number of similar refurbishments in the past....that's why we commissioned him. It's only natural that he should draw on that experience during the design of this building. Things like room areas and relationships were decided by us, but he seemed to use a lot of examples of other designs when arguing in favour of certain materials and finish treatments."

Client Representative K, Stage 4.

The majority of the design team Quantity Surveyors made compatible responses:

"The Architect tended to draw on his past design experience when he was considering the practicalities of selecting one material as opposed to another. The aluminium cladding was a prime example. He was arguing in favour of it because of it's previous successful application on a number of previous buildings that he had designed. Another case was the decision to opt for aluminium as opposed to timber windows....he'd used it in the past and he was quite satisfied with it's performance."

Quantity Surveyor A, Stage 3.

"Past design experience was used by the Architect quite appreciably during this design. It was used often in the arguments....or rather discussions about materials during the scheme design stage....things like a choice of blockwork for the internal partitions. Cost is always a primary consideration, but....even there, the Architect uses past experience in assessing the likely cost of the various alternatives."

Quantity Surveyor B, Stage 4.

"This design was fairly run of the mill, so past experience was an important factor in the Architect's approach....really all through the design, but more so during the selection of materials. It was important in the consideration of materials lifespan and practicality of use and so on."

Quantity Surveyor C, Stage 4.

"I use past experience as well as the Architect. With both of us, it's an important factor in a whole range of design decisions....especially so in housing, where we've both worked on similar designs in the past. The debate on rough-cast versus facing brick was all based on the previous use of both materials....during outline proposals and scheme design. Rough-cast as a material was rejected on the grounds of it's impracticality....it's durability and likely lifespan."

Quantity Surveyor D(B), Stage 4.

"The highest proportion of Architect arguments based on past experiences of materials or whatever, came during the scheme design stage. In most cases, I was already aware of the majority of those arguments.... things like the durability and lifespan of softwood as a material for external door frames and windows."

Quantity Surveyor D(C), Stage 4.

"The Architect based most of his approach upon the ***** Simulator....when the duplication factor requirement allowed him any freedom of design at all."

Quantity Surveyor E, Stage 4.

"The Architect's past experience of design strongly influenced the choice of internal materials on this job."

Quantity Surveyor J, Stage 3.

The qualitative evidence presented above supports the quantitative evidence presented in Figures 15 and 16. The project Architects used their previous design experience most during the scheme design stage of each design process. In addition, the use of past design experience was a major consideration in the selection of materials, and in considerations of maintenance, practicality, lifespan and aesthetics in descending order of prominence.

Further quantitative results on the use of past experience are shown in Figures 17-19.

Figure 17 shows variations in the proportion of Architect references to previous designs which were issued as a defence against a Client Representative attack. The results indicate that an increasing proportion of previous experience reference were used as a defence against Client attacks.

Figure 18 shows variations in the proportion of Architect references to previous designs which were in concordance with expressions of dissatisfaction with the current design. It is clear that the design team Architects were increasingly associating past experience of designs with

dissatisfaction with the current design, as the design processes continued.

Figure 19 illustrates variations in significant concordances between Architect references to previous designs and Architect attacks upon previously agreed design goals. The curves illustrate that the project Architects were increasingly using examples from their own experience to justify or strengthen their attacks upon previously agreed goals. Again, this effect was found to be particularly pronounced in the case of materials goals.

These findings were again presented to the various design team Architects as the designs were nearing completion.

"I would agree that past experience....that I used past experience most during the scheme design stage... when I was starting to develop the design away from the strict requirements of the brief. I would also agree that past experience was used particularly with reference to the selection of materials. I remember that I argued in favour of that facing brick because the ***** used it on all the earlier buildings, and we knew that it had good maintenance properties and was....acceptably priced....at least it cost about an extra £6000 over and above the next alternative.

Using experience as a defence against Client attacksthat's more difficult. I suppose it's a strong defence to quote an actual building which is up and performing well, and that's using the material that you're suggesting for this particular job."

Architect B, Stage 4.

"Past experience more during scheme design stage.... yes, that seems reasonable enough. It also stands to reason that I was using my experience as a defence to attacks by the Client. It's always a powerful argument to be able to point to a real-world example. I did that with the aluminium cladding....and also with the finish on the biotechnology laboratory. I could show them actual cases where the finish had worked perfectly well, although it was not what they had specifically asked for in the brief.

Also it's a useful weapon when I....or when I saw something in the design that I didn't like. I mean it was obvious all along that the cost limits were too low, and I pointed to actual examples in order to support that point of view."

Architect A, Stage 4.

"If....or when I was dissatisfied with a particular aspect of the design, then I probably did use my past experience in order to reinforce my arguments for a change. In addition, I can think of a number of occasions when I used actual examples of buildings in order to defend aspects of the design that I had included....and which the Client objected or voiced an opinion in favour of some alternative or preferred solution.

Architect C, Stage 4.

"Past experience examples are a good defence against Client opposition to a particular aspect of the design. I certainly used it a few times in this design....the arguments about whether to use external rendering or facing brick.... ***** insisted that render was unacceptable, and I responded by quoting a number of examples of housing jobs in this area where that material had been used successfully."

Architect D(A), Stage 4.

"With a housing design, there are always examples of similar designs that you can draw upon....similar designs and similar applications. I quoted a range of housing types that I'd designed or had experience of in the past as this one developed....particularly, as you observed, during the scheme design stage."

Architect D(B), Stage 4.

"Past experience played a part in this design....from my point of view. I remember using examples of practical applications when the Services Engineers were objecting to the location of some of the plant rooms in the scheme design stage."

Architect H, Stage 4.

"I certainly used examples of previous building designs when I came under fire from the Client....it was a good support for the arguments that I was putting forward in favour of particular materials or aspects of design philosophy. I would also agree that I used experience....or actual examples more during the scheme design stage than during any other stage."

Architect I, Stage 4.

"My arguments which were based upon past experience were of considerable application here because we've done a range of refurbishment jobs like this in the past. This was a run-of-the-mill design in that respect. Most of the use of experience....previous designs was made after we had agreed an initial design with *****....during the scheme design stage."

Architect L, Stage 4.

HYPOTHESIS 4.

In relation to creativity, throughout the design process, the Architect suggests more new design concepts than any other individual design team member.

Results indicate that the Architect is the most design-creative member of the design team. There is also evidence that the Architect suggests more new design concepts at some stages in the design process than in others.

The time-related variations in design concept presentation by the Architect also relates to different aspects of the design in different magnitudes.

Qualitative evidence of this hypothesis has been gathered in response to the following question:

Q: "At what stage in the design process did the Architect suggest most new design concepts, and to which aspects of the design did they particularly apply?"

Responses included:

"Creativity....new approaches to design and new design concepts....it's surprising how much of design is simple

repetition of what has been designed before.... just re-hashed to fit the requirements of the current design. The creativity....really what there is of it comes primarily in the scheme design stage, when I begin to get some design freedom. Most of the new design ideas do come from the Architect....as opposed to the Quantity Surveyor or the Client. As to aspects of the design....I would say that the original ideas put forward by Architects relate most prominently to aesthetic treatments....particularly of elevations.... that's where the building get's it's expression of originality....it's visual character."

Architect A, Stage 1.

"New design concepts which come from Architects are generally those which relate to visual appraisals.... the way the building actually looks when it's finished. That also applies to some extent with things like room layouts....the uses and relationships of spaces within the building, and things like finishes. Things like services and services layouts tend to be largely left to the Engineers....the Architect doesn't get much chance to make any kind of original expression there."

Architect B, Stage 1.

"New design concepts are relatively rare....few and far between. The Architect tends....normally to restrict wholly new approaches more to the expression side of the architecture....as opposed to the functional. When you're dealing with the practical aspects of the design, it is often dangerous to stray away from widely used and accepted approaches. With.. ..the aesthetic treatment....of the elevations say, there is much more scope for introducing new ideas."

Architect C, Stage 1.

"Original solutions in housing are a special case.... every design is innovative, but with housing, you tend to follow very much what has gone before. Those you do get tend to be based mainly on the architectural expression of the building....the elevational treatments and things like the layout of rooms inside the dwelling. Those are the sort of things that you decide after the initial presentation of a proposal."

Architect D(A), Stage 1.

"The brief here is quite detailed and specific....it won't allow me to introduce many new ideas into the design. I'll have a certain amount of design freedom with things like the elevational treatment of the buildings and the arrangement of rooms and balance space within them, but not on things like external works....that's pretty much

predetermined on cost grounds. That is the case generally in housing designs."

Architect D(B), Stage 1.

"Design....design innovation is very much limited here because of the cost limits. I mean everything is fairly well decided before I put pen to paper. The only areas where I'll have any design freedom at all will be on things like the colour of the aluminium cladding or of the metal window frames and so on. They won't be decided upon until the next stage."

Architect G, Stage 1.

"With this brief I have a relatively loose rein on the treatment of the elevations and room distribution. Services are more specific and are more or less set from the start."

Architect J, Stage 1.

"I am designing the interior of the bank without any major influence from the brief....internal colours and decorations....no problem. The services layouts are more specific and binding."

Architect L, Stage 1.

Figures 20-25 show the results of content analyses of design team interactions for a number of projects.

Figure 20(A) shows distributions of the proportion of Architect, Quantity Surveyor and Client Representative contributions which contained a reference to a new design concept in design team (A), over the course of the design. Clearly, the Architect was making the highest frequency of references to new design concepts. There is also evidence that this effect peaked for each design team during the scheme design stage.

Figure 20(B) shows similar distribution of references to previously undiscussed materials. Again, in this case, the

Architect was most prominent in raising suggestions for the use of previously undiscussed materials in design team (A). The peaking effect during scheme design was not so pronounced as with new concept discussions as a whole.

Figure 20(C) shows distributions of references to suggested design courses of action. Again, the Architect featured most prominently, although the peaking effect during scheme design was slightly less pronounced.

Figure 21 shows results for distributions of references to new design concepts for seven specific aspects of design. The results indicate that the Architects were prominent in discussing new design concepts in relation to aesthetics, room layouts, finishes, cladding materials, services, plant room locations and external works. The effect was less pronounced in each successive case, although a scheme design peak in the curves is evident in each case.

Figure 22 shows variations in Quantity Surveyor and Client Representative contributions which acted as defences to suggestions of new design concepts made by the respective design team Architects. It is clear that in those design teams shown, the Quantity Surveyor was the main defender of new concept suggestions by the Architect. The curves also indicate a slight increase in this effect towards the later stages of the design process.

Figure 23 shows distributions of attacks upon new concept suggestions made by design team Architects. It is clear

that the primary attacker was the Client Representative in each case. The curves also suggest that this effect became less pronounced during the scheme design stage in each case, although even at the point of lowest Quantity Surveyor/Client attack differentiations, the Client Representative was still responsible for around 70% of attacks.

Figure 24 shows a more detailed breakdown of the primary sources of Client attack subjects. The curves show that the Client Representatives were using attacks based upon maintenance and initial costs when arguing against new concept proposals put forward by the design team Architects. The curves indicate that aspects of maintenance were the primary attack base in the earlier stages of the design, with initial cost becoming more prominent in the later stages. The magnitude of the dominance of these two attack base variables was notable. In most cases, the attack base of other subject variables contributed less than 10% of the total attack base.

Figure 25 shows distributions in new concept contributions for the design team Architects over a wider range of design projects. The peaking effect during the scheme design stage is prominent in each case. One point here is that the scheme design peaking effect appears to be unrelated to the complexity of the design.

Figure 26 shows distributions of defence bases by the design team Architects based upon the new concept being

similar to a briefed or previously agreed design goal. In most cases, this defence against Client attacks constituted the bulk of defence bases. The curves also show evidence of a reduction in this effect in the middle stages of the design and a subsequent increase in the later stages.

These patterns became clear in the early stages of the longitudinal study and pilot study analyses. The project Architects were questioned on them during the later stages of scheme design. Responses included:

"The Architect would be expected to produce the most new design concepts. That's what he's paid to do.... as far as the brief and the cost limits allow him. The number of new ideas that I have been able to introduce into this design has been strictly limited by the specificity of the brief. I mean you saw it... it detailed practically everything. The only area where I really had any design freedom was on the elevational treatments....and even there they specified the brick types. Just recently we were made aware of the fact that we'll have to introduce more sheeting to the elevations in order to save money.

So during the scheme design stage, there is the opportunity to introduce these limited new ideas.... but they are always tempered by requirements for cost efficiency and maintenance considerations. With this kind of brief, design flexibility tends to be restricted to things like aesthetic treatments....and to some extent....room layouts and so on."

Architect A, Stage 3.

"Well....we're into scheme design now....and the only real new design concepts that I've been able to introduce so far have been on the elevations....the external expression of the building. There hasn't really been much flexibility anywhere else. I suggested the metal liners for the laboratory areas as opposed to blockwork....that was one example within the building....I did that because they were cheaper and don't need painting....and so the long term maintenance costs are likely to be beneficial.

In that particular case, the Client attacked it on the grounds that it would get knocked about and was initially rather expensive....although not as expensive as blockwork all-told. The Q.S. defended my argument in favour of it because of it's reduced long term costs. I myself defended it on the grounds that it could do all that blockwork could do....it satisfied the requirements of the brief and outperforms blockwork in the long run."

Architect B, Stage 3.

"These units are basic....cut down to the bone. The only design freedom that I've had so far has been to choose things like the colour of the cladding and similar architectural....as opposed to physically practical considerations. I did....try one or two new ideas, but they were immediately attacked by the Client on the grounds that they were too expensive, or would cost too much in maintenance....ill-grounded grievances, I thought, but the Client has the final say.

I suggested that the new design concepts as far as I am aware....with the exception of one or two on the part of the Quantity Surveyor."

Architect C, Stage 2.

"I find that Clients tend to dislike new design concepts....they tend to be wary of untried things.... quite understandably.... ***** in particular. They tend to attack anything new on maintenance or cost grounds....because they are responsible for maintenance in the future and because they have limited budget limits....which are becoming increasingly squeezed in real terms. The Q.S. has been backing me up on most of the new proposals....but the Client has been rather stubborn....intransigent."

Architect D(A), Stage 3.

"On housing designs, the Client usually wants you to stick to well-trying design solutions....they don't normally like you to stray away from those....not usually. They often argue against new design attitudes....almost as a matter of principle. The only area where I've had any freedom to introduce any of my own initiative....well design adaptation here so far, has been on the elevations....the aesthetic treatment of the building. The Q.S. has been backing me up with some of the elevational arguments, but ***** seem to resent anything wholly new or innovatory."

Architect D(B), Stage 2.

"This design so far has been heavily influenced by the Dundee station. There have been one or two new ideas, but they have applied mainly to the treatment of finishes and elevations. A ***** station is essentially a functional building. The ***** have been reluctant to accept new ideas and new concepts."

Architect F, Stage 2.

"If I put forward any new design concepts....I usually look for support from the Quantity Surveyor. I mean I wouldn't suggest anything new just for the sake of itthe suggestion would have an economic or aesthetic justification....probably more based on aesthetics."

Architect J, Stage 3.

Design team Client Representatives provided a range of qualitative substantiations for the patterns of Architect and design team member behaviours shown in Figures 20-26;

"The Architect has been providing most of the new ideas. Some of them took me a bit by surprisethings like the interceptor for the waste from the biotechnology laboratory....I thought that was a bit unnecessary....extreme for the levels of contamination in the waste. I also thought that the whole building....all the elevations and so on, were unnecessarily complex....that he was trying to make the thing look too nice....after all it's basically a laboratory....nothing more.

Client Representative A, Stage 3.

"New concepts and new ideas....well, the metal liners in the drawing offices was one example there. The Architect suggested those during the scheme design stage on the basis that they looked better than unplastered blockwork, and also that it would be cheaper. I attacked that proposal because I think it will get dented by the students....it will soon get knocked about and will look shabby. The Q.S. backed him up, but I still didn't like it.

There were a range of other examples....mostly during scheme design, most were rejected on cost grounds or because they would cost more to maintain in the future."

Client Representative B, Stage 4.

"The Architect hasn't really had much chance to introduce anything new to this design....mainly because we haven't had much money to spend, and we have had to consider future

maintenance costs so much. The only real new approach has been the colour scheme chosen by the Architect....that is a new one to me.... practical items....no."

Client Representative C, Stage 4.

"The Client brief here was rather specific, and as a result, the Architect's design freedom was restricted. He did introduce some interesting elevational treatments during the scheme design stage, but we had to hit most of them on the head because they were too expensive or because they would have increased the financial burden of maintenance in the future.

With some of them, I did feel that we were arguing against the Architect and the Quantity Surveyor together....they did tend to back each other up, but it all came down to costs....initial and long term in the end. I think the same would generally apply with ***** projects."

Client Representative D(A), Stage 3.

"The brief was assembled in consultation with the Architect, so he had some opportunity to introduce new ideas there. They were mainly aesthetic....the elevations and so on....and....to some extent the arrangement of spaces within the building....some of those are pretty novel. He then went on to introduce some new ideas during the scheme design stage, but some of those were just too expensive....despite what the Q.S. said."

Client Representative I, Stage 4.

"The atrium was a new idea....the Architect thought that one up....to incorporate this internal courtyard. That was a purely aesthetic concept, to brighten up the inside of the building and to provide a central feature. I thought it would be too expensive....but the Q.S. assured me that it could be afforded within the bid."

Client Representative K, Stage 3.

"I've seen most of what the Architect designed before on similar bank refurbishments....pretty commonplace by Glasgow standards. The only new things that he suggested have been aesthetic treatments....many of which had to be scrapped because they were too expensive."

Client Representative L, Stage 3.

Design team Quantity Surveyors provided qualitative substantiations of the patterns illustrated in Figures 20-26:

"The aesthetic treatment of the building was something of a departure....it was more....elaborate than was strictly required by the brief....I think the Architect was being a bit adventurous at first.... especially with some of the ideas for the elevations that he was putting forward in the early stages of scheme design. He certainly put forward the majority of the new concepts that have been included so far.... the brief contained some....but he came up with most."

Quantity Surveyor A, Stage 4.

"Aluminium cladding....as opposed to steel....that was one that I didn't foresee. The Client has some reservations at first, but once we were able to convince them that aluminium wouldn't cost all that much more than steel, and would probably incur lower maintenance costs in the long run. That wouldn't apply everywhere....but certainly in a non-corrosive area like this....no problem. That was finally agreed during scheme design."

Quantity Surveyor B, Stage 3.

"The Architect did come up with one or two new design concepts, but they were mainly decorative....things like these cast iron brackets over the doors and windows on the south elevations and so on. The brief didn't allow him to do much else. The Architect does seem to seek the support of the Quantity Surveyor when suggesting new design ideas....mostly in terms of cost justification....or long term costs in particular, because of ***** responsibility for maintenance in the future."

Quantity Surveyor D(A), Stage 3.

"Some of the brickwork was quite innovatory....more ornate and....experimental than it strictly had to be. Clients objected to it because it was too expensive....at a time when cost reductions became necessary. There was also some objection to some of the room relationships and layouts....I had to back him up on those (The Architect).

The ***** did seem to make more arguments against all aspects of design during the scheme design stage of this particular design....in some ways that is a general pattern in all design."
(Brackets added)

Quantity Surveyor F, Stage 3.

"Maintenance costs were very important in this designthe Architect was influenced by that considerationparticularly in the scheme design stage....when he was

developing it and trying to introduce new ideas. Maintenance and initial costs were the main arguments used by the Client against the Architect's proposals."

Quantity Surveyor H, Stage 3.

"This is a relatively exposed location, so maintenance costs had to be considered at each stage. The Architect did introduce some innovative design elements....the whole layout of the blocks is relatively innovative. The Client....as opposed to myself has been responsible for most of the arguments placed against particular aspects of the design."

Quantity Surveyor J, Stage 3.

The implication of these results is that the Architect is the main initiator of discussion and presentation of new design concepts. This effect is most pronounced during the scheme design stage of the design process. The effect is also specifically pronounced in the case of previously undiscussed materials.

The peaking effect during scheme design is more pronounced on some specific aspects of the design than on others. Aesthetics and room layout new concepts show a prominent peak, with a clearly defined definition between the Architect and other members of the design team. This effect is less pronounced in the case of services, plant room locations and external works.

The Quantity Surveyor provides the majority of defences to new concept suggestions put forward by the Architect. The Client provides most of the attacks upon new concept suggestions. In the case of attacks, there is evidence to suggest that this effect becomes less pronounced as the design process continues. The primary subject bases of

Client attacks are initial cost and long term maintenance costs and implications. The primary subject based used by the Architect in support of new concept suggestions is that of similarity with briefed or previously agreed design goals.

These findings were put to the design team Architects towards the end of each design process. Responses included:

"Suggesting the highest frequency of new design concepts during the scheme design stage....that would be because that was the stage when the design first became....complex and developed away from the brief. I can agree that happened in the case of previously undiscussed materials. Aesthetics seems to be a reasonable candidate for being the most frequent subject of new design concept suggestions. With.... say a material....it's not advisable to opt for a wholly untried solution....simply because you don't know how it's going to perform in the long term. With aesthetics....you can design an elevation say....and carry out all your visual appraisals before the design is put into practice.

The Client was the main attacker of new design concepts and the Q.S. was my main support. I would also agree that most of the attacks on new proposals that I put forward were based upon initial cost or long term cost....maintenance cost considerations."

Architect A, Stage 4.

"I did make most of my new design suggestions during the scheme design stage....definitely. That was when I was starting to stamp my own approach onto the design....and that was reflected by the increasing frequency of my own suggestions for adaptations or refinements of the design. The Client was certainly hesitant to accept wholly new ideas....and the Quantity Surveyor did back me up to some extent.

In this design, a lot of the Client attacks were based on initial cost and long term maintenance costs. The arguments over the metal cladding and the choice of facing brick were good examples of that....the bricks that were eventually chosen being more expensive.

I would also agree that aesthetic treatments dominated my new suggestion contributions....or suggestions.... things like the treatment of the stair tower....that kind of thing."

Architect B, Stage 4.

"I didn't have much opportunity to include any new design concepts here....it was so basic. The few that I did include were generally received with some hostility by the Client....until I could prove that they weren't incurring any cost penalty with the help of the Q.S.

The design has been dominated by the cost limits andto a lesser but still considerable extent by the long term running and maintenance costs of the finished building."

Architect C, Stage 4.

"Most of the new ideas did come during the scheme design stage....or that's where they were actually applied to the design itself. The Client did object to a lot of them....on cost or maintenance grounds.... and the Quantity Surveyor did back me up as far as he was able....and they were....as you say, mainly aesthetic treatments and solutions that I was trying to introduce. My main defences were always that they didn't cost any more than they were worth....and that they were compatible with the design brief, or with what we had agreed after that had been issued."

Architect D(A), Stage 4.

"Most new design concepts were basically visual.... trying to make the thing look better. Most of the Client objections were based upon maintenance or initial cost grievances."

Architect D(B), Stage 4.

"Maintenance and initial cost did seem to form the basis of most Client objections to new proposals put forward by myself....definitely. The new proposals that I put forward were also certainly based upon aesthetic considerations....as opposed to being of a purely practical nature.

The Q.S. didn't make many objections to new design proposals....or not many anyway....they all came from the Client."

Architect F, Stage 4.

"The room layout and the relationships between areas inside the building were quite innovative....really revolutionary as far as I am aware....there were a few objections to

that....during scheme design stage, on cost grounds....wall to floor area and so on....and the area of wall to be maintained in future.

The Surveyor did provide some support....but costs were not as critical as is typical on this job. The design as it stands is fully compatible with the brief and all the subsequent reports that we produced at each stage."

Architect I, Stage 4.

The relationship between the linking blocks is certainly unusual....not strictly economically efficient....I would be the first to admit. The Client objected to that at first, but we were able to convince them that this provides an acceptable solution....after some debate. They were also concerned with maintenance in the middle stages....due to the exposed location of the site....and their responsibility for maintenance costs for the rest of the lifespan of the building."

Architect J, Stage 4.

HYPOTHESIS 5.

During design team interaction, the observed association between aesthetics and design decreases, while the observed association between cost and design increases in Architect contributions, as the design process continues.

Results indicated that the aesthetic aspirations of the Architect become increasingly sacrificed in favour of cost considerations as the design process continues. Preliminary interviews with Architects were made, and the following question put;

Q: "To what extent do the aesthetic aspects of the design become secondary to cost factors, and at what stage in the design process is this most pronounced?"

Responses included:

"Aesthetical considerations are always prominent in the Architect's mind. The Architect has a professional obligation to produce a building which isat the very least, visually acceptable. If I.... as an Architect, am able to produce something over and above that....then all the better. In this design, I am professionally bound to produce the most visually acceptable solution that I possibly can.

Now....that is qualified to a great extent by what I can afford to do. It has become apparent....even at this stage that the cost limits are very tight. I will almost certainly have to curtail....restrict my aesthetic ambitions on this building....because the money which is available, simply will not allow me to do what I would like to do....with it."

Architect A, Stage 1.

"Obviously, I want to make the finished building as visually attractive as is possible. However....visual attractiveness....even basic visual acceptability costs money....and that is going to be the problem with the budget supplied by *****. It may well be that I will be forced to sacrifice the visual appeal of the building in order to maintain the practical applicability of the building....in order to ensure that the thing works as a technological ***** Department."

Architect B, Stage 1.

"***** have to work to a tight budget....restricted cost limits. That restricts the visual appeal....the aspect of the design that I can include. As an Architect....I am obliged to produce the most acceptable design that I can with the resources that are available....but in this case....costs come before visual acceptability."

Architect C, Stage 1.

"With most designs....you find that the Architect produces an elaborate initial design....really the design that he would like to see as a solution to the contents of the brief....or what the Client has said he wants. That is very much the Utopian case....the preferred design. Now, because of cost limits, that is very rarely achievable....it is usually not practically attainable....obtainable. You often find that you have to make cost savings in the later stages of the design, and aesthetics are one of the easiest design factors or considerations to cut out. I fully expect that to happen in this case."

Architect D(A), Stage 1.

"As an Architect, I often have to accept that the eventual design solution will not be as I would ideally like to see it....costs just don't allow it. When the design approaches the contract stage, cost reductions nearly always become necessary....and Clients usually prefer the omission of aesthetic or visual properties rather than practical ones. That's just the way it is."

Architect D(B), Stage 1.

"In the later stages of the design, costs always come before aesthetics."

Architect F, Stage 1.

"Clients usually want the designers to cut back on the visual aspects of the design rather than the practical or utility....functions. I mean that's perfectly acceptable from the Client's point of view, but from the Architectural point of view....it's bad news."

Architect H, Stage 1.

"Generally, the Architect wants a nice looking building that will get into the Architect's Journal and which will win the various design awards. The Client wants value for money and functionality. The design process is essentially a conflict between Client and Architect and arriving at a mutually acceptable solution....that's the truth of the matter."

Architect J. Stage 1.

"Most Client organisations are more interested in use than looks. When the money starts to run short.... they look for reductions in the visual appeal of the building rather than reductions in it's functional capacity or user-acceptability. Money tends to become short in the later stages of the design. In the outline proposals stage....the design is still too remote and distant....not fixed. When you get into scheme design and detailed design the problems come home to roost, and it's usually the aesthetic aspects of the design that suffer."

Architect K, Stage 1.

"In the later stages of most designs....funds become short....and the design team have to reduce costs somehow. With most design teams, that means reducingwhat most Clients would call the 'non-essential'which often means the aesthetic appeal or image that the Architect has tried to implant in the designand nearly always on the grounds of cost limits."

Architect L, Stage 1.

"In all designs there is a basic incompatibility between....well, not incompatibility, but....mild conflict between the visual aspects of the design and it's straightforward practicality. When it comes to saving money....and in most designs it does.... practicality tends to take precedence."

Architect M, Stage 1.

Figures 27-39 show quantitative analysis results of this hypothesis, obtained from observations of design team interactions.

Figure 27 shows results from Architect contributions at design team meetings. The curves indicate a steady decrease in the significance of association between aesthetics and design. The results also indicate that this effect was largely independent of design complexity.

In comparison, Figure 28 shows variations in the significance concordance of association between design and cost. The results indicate that the Architect steadily increased this association throughout the design processes shown. The results also suggest that this effect may have been more pronounced in the cases of the more complex designs.

Figure 29 shows variations in attacks upon all types of aesthetic contributions by the Architect. (Not specifically new aesthetic concept proposals as was the case in hypothesis D). It is clear that the frequency of attacks by all design team members increased during the scheme design stage. Results suggest that the frequency of attacks decreased slightly in the detailed design stage,

although these later design stage levels remained higher than was the case during the outline proposals stage.

Figure 30 shows variations in all attacks upon Architect contributions relating to aesthetics, which were based upon cost. In all the design processes shown, this attack subject base made up the majority of all attack bases upon aesthetics. The results also indicate that there was no peaking effect at any stage in the design process.

Figure 31 shows variations in Architect defence bases using cost comparisons with workable alternatives, in response to attacks upon aesthetics based contributions. It is clear from the results shown that the design team Architects increasingly used such cost comparisons as defenses against attacks upon aesthetics. In the case of Architect A, such defences constituted over 75% of all defence bases during the detailed design stage.

Figure 32 shows variations in the number of aesthetic design concepts abandoned at meetings. The curves indicate that higher frequencies of aesthetic concept abandonment occurred in the later stages of the design processes shown.

Figure 33 shows variations in Architect defences of all types of previously agreed aesthetic concepts. From Figure 33(A) it is clear that the frequency of all types of defences increased throughout the design processes shown. Figure 33(B) indicates that the strength of Architect

defences of previously agreed aesthetic design concepts also increased throughout the design process. In the case of defence strength, the curves suggest that there was an observable increase in defence strength in some cases, during the scheme design stage.

Figure 34 shows variations in the frequency of Architect concessions to cost arguments put forward by all other members of the design team. The curves indicate that the Architects shown were increasingly conceding to cost arguments towards the later stages of the design. A number of the curves, particularly those which represent the more complex designs, exhibited the steepest increases during the scheme design stage.

Figure 35 shows variations in the significance of association between Client and cost references. The curves indicate that the Architects were increasingly associating cost with the Client as the design processes continued. In addition, increases in this association were most pronounced during scheme design stage in many cases.

Figure 36 shows variations in the significance of association between cost and dissatisfaction. These results indicate that the design team Architects became increasingly dissatisfied with costs as the design processes continued. Again, the effect appears to have been most pronounced in the cases of the more complex designs.

Figure 37 illustrates similar variations in the significance of association between aesthetics and dissatisfaction. Clearly, the Architects were becoming increasingly dissatisfied with the aesthetic aspects of the design as it evolved. In a number of cases, the most pronounced increases again occurred during the scheme design stage, and appeared to be more pronounced in the cases of the more complex designs.

Figure 38 shows the total proportion of Architect references to aesthetics throughout the design processes. Apart from higher frequencies in the early stages of the design, total references to aesthetics clearly remained almost constant.

Figure 39 illustrates that total Architect references to cost increased as the designs evolved. Again, this trend was again more pronounced in the cases of the more complex design.

Interviews with Architects during the detailed design stage provided qualitative substantiations of these observations.

"We are now well into detailed design....and I have to give up a lot of my original aesthetic....ideas or aspirations for the building. The initial design that we produced was good....it was visually acceptable at any rate....we thought so. However....it becomes clear that the design as it stood was completely unacceptable in terms of cost. As a result, we had to produce this alternative design....it's just a 'big tin shed' now....no visual expression....or hardly anypurely functional and cut back to the bare minimum.

I'm not happy with that....and I argued against it on many occasions, but the costs are the overriding factor....and I am obliged to design a solution that is economically acceptable. Cost comes before aesthetics."

Architect A, Stage 3.

"There have been some pretty heated arguments on aesthetic treatments up to now....no doubt about it. The design as it stands still has a reasonable appearance, although it is not up to the standard that I would ideally like. Aesthetics....do give way to costs in the long run....cost increasingly....has increasingly influenced my approach to the design since I started on it....definitely. Most of the direct attacks upon my visual ideas came in the scheme design stage....a couple of months ago....mostly from the Client....some from the Q.S.

"A lot of ideas had to be changed or abandoned.... because of costs.....I was forced to increasingly give way because of that....cost. My defences were largely based upon my ideas being not much more expensive.... or no more expensive than equally acceptable alternatives. I mean the better quality bricks only cost an extra few thousand pounds....peanuts compared to the overall contract value. Cost considerations have been a problem....a source of conflict....but that's normal....it happens on most designs."

Architect B, Stage 3.

"With this design....cost has been discussed more just recently than it was at first. Whenever I mentioned some kind of aesthetic subject....they (Client) repeatedly stressed the importance of cost savings and economy measures....even though I could show that what I had suggested was not costing much more than any other acceptable alternative....at least as far as I and the Quantity Surveyor could see." (Brackets added)

Architect D(A), Stage 1.

"The first design was nice....I liked it....it had a lot of expression and combined well with the surrounding area. The elevations were imposing....it looked like a ***** Station. Now because of cost problems, we had to change it....take off a lot of what the Client called 'unnecessary expense'. Their whole argument was based on cost....cost factors have dominated the last few design team meetings. I keep stressing the importance of the building's visual effect....but they clearly aren't impressed. I have become....dissatisfied with it....I will never feel proud of having being the Project Architect with this building....".

Architect F, Stage 3.

"I'm not entirely happy with the aesthetics content of this design....it honestly looks cheap and nasty.... but it's all I could do within the cost limits. I was forced to give in to a number of cost-based argumentsagainst visual aspects of the design."

Architect G, Stage 3.

"I had to reduce the size.... the volume of the atrium in order to get more usable area into the building....the atrium now doesn't work as well as it did....it's a bit claustrophobic....cramped now. That was simply a cost requirement. I argued in favour of retaining it....but it was not possible within the cost requirements of the brief....or rather to meet the cost requirements of being able to make a bid that has any chance of being accepted."

Architect K, Stage 2.

"In most designs you get arguments between the Client and the Architect about aesthetic approaches....the Client nearly always insists that the Architect....the design team save money in the later stages of the design."

Architect L, Stage 3.

Qualitative results suggest that Architects are increasingly influenced by cost as the design process continues and resent or object to reductions in the aesthetic quality of the design which become necessary as a result.

Other members of the design teams provided qualitative substantiation of this observation. Responses from Client Representatives included;

"Aesthetics....the way the thing actually looks is important....I mean as a Department....we don't want our new building to just look like a big shed or anything....but practicality must come first. If we can afford to put more into a laboratory at the expense of reducing the area of facing brick on the northern elevation....then that's what we must do. The original elevations were too complex....too much designed to look good. The ***** managed to argue the Architect down on that....the latest design is much simpler and much more

straightforward. I mean it was all down to cost....all our arguments against the Architect's aesthetic approaches have been based on cost. He's had to drop more and more decorative aspects of the design."

Client Representative A, Stage 4.

"Some aspects of the design were obviously only included for their visual effect. Some we argued against because they were too expensive for what they did. Others we....we were convinced that they did not cost any more than the workable alternatives. One example was the curved retaining wall on the northern elevation. That looks nice, and the Q.S. was able to convince us that it wouldn't cost any more than a more angular alternative.

The Architect has had to give way more and more just recently....more than he did at first. The whole design team has been much more geared up to cost discussions recently....although the Architect keeps plugging the aesthetic aspects steadily."

Client Representative B, Stage 4.

"There hasn't been much scope for aesthetic extravagance on this design....any that were proposed were more or less immediately rejected on the basis of cost....one example was the cowboy front....that was to hide the roof slope....we kept it in as long as we could, but we had to throw it out in the end because we couldn't afford it."

Client Representative C, Stage 4.

"We had to force the Architect to omit some of his visual use of materials because of cost....we simply couldn't afford them. He didn't like it....Architects never do....they want to stamp their own ego....or personality on a design....but on a tight budget.... we just can't afford to do that."

Client Representative D(C), Stage 3.

"In my experience....Architects always seem to over-design in the early stages of the process....they produce an extravagant scheme that they know has no chance of going through. We then argue them down and take out all the non-essential items that we can't afford....usually most of them.

The extravagances usually get the 'chop' from scheme design stage onwards....as has happened here. The design team becomes increasingly preoccupied with costs as the design process continues....it's really inevitable."

Client Representative G, Stage 3.

"Non-essentials always end up being cut out on cost grounds....on the vast majority of design projects.... it's happened here as well. The Client always objects on cost grounds but the Architect always keeps trying."

Client Representative L, Stage 3.

Extracts from Quantity Surveyors responses also provide qualitative support for the observations;

"The Architect has been forced to omit more and more of his original preferred aesthetic treatments over the past few months....in response to cost arguments from the *****....that happens on most designs. I have been able to provide him with cost evidence to back up some of his arguments. In some cases he was able to defend the design....or aspects of the design by proving that what he had proposed was both visually attractive and as cheap as most workable alternatives.

The Architect has tended to defend the few remaining aesthetic design elements more and more....strenuously as more and more have been dropped. Again....that's fairly typical. There's no doubt that the design team has become....obsessed with costs....aesthetics have had to 'go out of the window'."

Quantity Surveyor A, Stage 4.

"Where the Architect....with my help, has been able to prove that what he had proposed was as cheap as any acceptable alternative, then he has been able to hold onto them. Where the cost arguments have been too strong....he had had to omit them. The design has become dominated by costs....the design team meetings are all about cost now. The Architect keeps plugging away at his aesthetic ideas....but it's all down to costs now....really."

Quantity Surveyor B, Stage 3.

"With this design....costs have taken precedence over aesthetics. That has been the case all the way through....but all the more so just recently."

Quantity Surveyor C, Stage 4.

"Most of the aesthetic expression in these house designs has had to go in the face of cost objections from *****. Those which remain have really only done so because they are as cheap as any other alternativeand because the Architect and myself have been able to prove that. At

design team meetings now, the talk is all of costs....saving more money."

Quantity Surveyor D(A), Stage 3.

"The Architect has had to take out most of the aesthetic attraction that he included in the initial design. As you know....we had to practically redesign the whole thing when we were informed of the final cost limits. I know that he's (Architect) not happy with the appearance of the building, but in the face of overwhelming cost arguments....he had to give wayalthough I must say that he keeps trying to inject an aesthetic element whenever he gets the chance. It's all down to costs now."
(Brackets added)

Quantity Surveyor G, Stage 4.

"It hasn't been so bad here....there's lots of money to spend....relatively speaking. The aesthetic items which have been taken out have all been omitted on cost grounds....Client arguments based on cost."

Quantity Surveyor I, Stage 3.

These results indicate that cost considerations increasingly influence the Architect's approach as the design process continues. Aesthetic considerations remain at a constant level in the Architect's perceptions and design team contributions, while the aesthetic content of the design actually decreases. This decrease is primarily caused by Client attacks upon 'non-essential' aesthetics based upon cost.

The Architects's association between aesthetics and design decreases while the corresponding association between cost and design increases. This suggests that although the Architect continues to stress the importance of aesthetics and increasingly defends this aspect of the design, he or she actually disassociates it from the design increasingly

in the later stages and increasingly considers the design in terms of cost.

The primary Architect defence against such attacks is that of cost comparisons with alternatives. The Architect is increasingly forced to abandon previously agreed aesthetic concepts in the later stages, while increasingly associating the Client with cost and expressing dissatisfaction with the consequent effect upon the design.

These findings were put to the design team Architects towards the end of the detailed design stages of each process. The following interview extracts were obtained;

"Looking back over the course of this design....a lot of the original aesthetic expression was lost.... especially during the scheme design stage. My approach to the design was increasingly influenced by cost considerations....I would agree, largely at the expense of aesthetics. The attacks came from the *****...and were mostly based upon cost problems. More and more of the aesthetic content of the design has been dropped as the design has evolveddespite my efforts to keep them in....some of them quite strenuously.

Despite Client opposition....I did try to maintain my stand on the importance of the building's appearancedespite the opposition....or transition of priorities."

Architect A, Stage 4.

"I would agree that I have been forced to consider cost more and more as the design has evolved.... largely....or heavily at the expense of aesthetic expression. The building now is....not ugly....but projects an image of functionality....it's not very lively. I did argue the importance of appearance all through the design process....and I did base a lot of my arguments for specific aspects of the design upon cost comparisons of available alternatives....with support....cost support from the Quantity Surveyor.

Decorative....or expressive items have been knocked out successively. More were indeed taken out during the scheme design stage....that's when the Client assaults really began."

Architect B, Stage 4.

"Yes....a lot of the extras that I'd put in did go out in the scheme design stage....definitely. That's when the ***** started to tell us that the design was running out too expensive for us to have any hope of arriving at a viable ground rent. We had to drop a lot of small extras after that. Most of the anti-aesthetics arguments were based on cost....cost problems....my primary argument in some cases was that of the cost of viable alternatives.

The design team discussions have really revolved around costs for the last month or month and a half" (detailed design). (Brackets added)

Architect C, Stage 4.

"A lot of the small extras came out in scheme designdespite my....entreaties to the contrary. It all became dominated by costs....that was all that ***** could think about....quite understandably....I must admit.

I had to stress the importance of appearance.... especially in houses where people have to live....but costs came first."

Architect D(B), Stage 4.

"Cost was influencing my design approach more than any aesthetic considerations....really by the early part of scheme design. ***** had made it clear that costs were of primary importance....more so than any considerations of visual or aesthetic qualities.

Arguments against aesthetic content have really revolved around costs."

Architect D(C), Stage 4.

"Costs became the prime factor in the design....really as soon as we got the new cost limits....during the scheme design stage. From that moment on, the design team had to become almost....obsessive about costs.... and aesthetic expression became less of a priority.... or even of a design consideration."

Architect F, Stage 4.

"Costs were really the primary factor....nearly all the way through the design process. Any decoration or visual effects had to take very much a second place. That became clear....certainly by the scheme design stage."

Architect G, Stage 4.

"I've had to cut out some of the things which....I thought made a nice touch to the design....things which would have improved the visual aspects of the building. They mostly....well, a lot of them went in the scheme design stage....and the rest have gone since. All through, I have stressed the importance of the building's appearance....though arguments based upon hard-and-fast cost limits are difficult to counter."

Architect K, Stage 4.

"Designs usually start off....really as an expression of the Architect's design capabilities....the preferred solution. In most cases, cost factors start to take over from aesthetic factors by the middle stages of the design. The Client only has so much money to spend, and they....as the employer, have the last word....no matter how much the Architect dislikes what is happening to the design....and how much he feels his design freedom is being curtailed."

Architect L, Stage 4.

HYPOTHESIS 6.

The frequency of supportive statements made between the Quantity Surveyor and Architect increases as the design process continues. i.e There is evidence of Architect/Quantity Surveyor coalition formation.

Preliminary results and subsequent detailed analyses indicated that design team Architects and Quantity Surveyors increasingly formed a supportive coalition as the design process continued.

Preliminary interviews were conducted, in which the following question was posed;

Q: "To what extent do the Architect and the Quantity Surveyor support each other at each stage in the design?"

Responses included;

"Architects do generally look to the design team Q.S. for support in their arguments....or propositions to the Client. They are both professionals....in their own fields....whereas the Client Representative usually is not....at least as far as design....design of buildings goes. The design professionals usually stick together....especially when things get rough.... when drastic cuts to the design become necessary on cost grounds or something like that. The reason is....well, it could be that as the design develops, any large scale changes to the design involve a lot of abortive work....redesign for the Architect and recosting for the Quantity Surveyor. If any such changes occur in the later stages of the design.... time is often short, and it is in the interest of both parties to avoid any....not unnecessary work....but any duplication or repetition of the design....if at all possible."

Architect A, Stage 1.

"You usually find a certain comradeship between the Architect and the Quantity Surveyor....maybe because they have seen it all before....and they both know the design 'game' inside-out. The Client is not usually an expert in building design....and they often put forward proposals which are unrealistic....simply not translatable into a realistic design solution. That's when the design professionals have to support each other. It happens in most designs....often towards the later stages of the process....when cost savings and reductions in overall specification become necessary."

Architect B, Stage 1.

"The Architect does look for support from the Q.S. in the face of Client criticism of the design. Clients don't usually realise the full implications of a design....and they tend to make impractical suggestions. In such a situation, it is understandable that one specialist in design should seek the advice of another."

Architect C, Stage 1.

"Architect and Q.S. would support each other in the situation where the Client is trying to impose an illogical or unacceptable course of action upon the design team. That often happens in the later stage of the design. The Client begins to find that he's short of money, and he looks for cost reductions....on such a scale as to leave

the design unacceptable to a design expert. The Architect and the Q.S. often argue in the early part of the design....while the Architect is still trying to work out a generally acceptable solution, but that....professional conflict usually dies out towards the detailed design stage. It reaches a stage where it is in their own mutual self-interest to minimise the number of changes that have to be made to the design....simply in terms of the amount of work that is involved in making such changes at such a late stage in the design."

Architect D(A), Stage 1.

"The Architect and the Q.S. support each other in the later stages of the design. That's when it becomes of the utmost importance that the design does not have to be changed to any appreciable extent. If the design has to undergo any significant changes at that stage, the time connotations....the effects upon the time limit allowed for the design process become a major problem."

Architect E, Stage 2.

"In many design cases....the Client does tend to become....isolated from the professional designers.... simply because his knowledge of building design is not sufficient to allow him to understand the full complexities of the evolving design. The Architect and the Surveyor have a wealth of design experience... and so they support each other's proposals and suggestions....even when the Client may not agree with them."

Architect F, Stage 1.

"The Architect and the Q.S. usually support each other more in the later stages of the design....when it's too late to start making large-scale changes."

Architect I, Stage 1.

Figures 40-48 provide quantitative substantiation of hypothesis F. These results were again obtained by direct observation of design team meetings, and show evidence of coalition formation between design team Architects and Quantity Surveyors.

Figure 40 shows variation in the proportion of total Quantity Surveyor contributions which took the form of

supportive comments made in response to a request for information from the Architect. This proportion clearly increased throughout the design processes shown.

Figure 41 shows variations in Architect and Quantity Surveyor attacks and expressions of dissatisfaction in relation to each other.

Figure 41(A) illustrates that the proportion of Architect attacks on all kinds of Quantity Surveyor contributions decreased as the design process continued.

The similarity in the curves for the various design types here is noticeable.

Figure 41(B) shows variations in Architect expressions of dissatisfaction in response to a Quantity Surveyor statement. These curves are not as closely related as the corresponding attack statement curves, nor do they decrease in magnitude so steeply. There is also evidence that this decrease in dissatisfaction contributions is more pronounced in those designs which are subjected to greater proportional cost reduction exercises or requirements.

Figure 41(C) shows variations in the proportion of Quantity Surveyor attacks on Architect contributions of all types. Again, the proportion of attacks decreased throughout the design process.

Figure 41(D) shows variations in the proportion of Quantity Surveyor contributions in the form of an expression of

dissatisfaction in response to all types of Architect contributions. Again, dissatisfaction contributions decreased as the design process continued.

These results suggest a decreasing conflict between the Architect and the Quantity Surveyor towards the later stages of the design. Each makes fewer attacks and dissatisfaction expressions in response to contributions from the other.

Figure 42 shows variations in the total proportion of Architect address contributions, addressed to the Quantity Surveyor. The curves indicate that the design team Architects shown made an increasing proportion of addresses to the Quantity Surveyor as the design processes continued.

Figure 43 illustrates variations in Architect contributions which constituted an attack on the Client. In all cases, there was a slight increase throughout the design process. Again, there is evidence that this effect was more pronounced in the cases of designs which were subject to large cost reduction requirements.

Figure 44 shows that the significance of association between the Architect and the Client decreased throughout the design process in Architect contributions. This indicates a growing sense of Architect-Client separation or disassociation towards the later stages of the design.

Figure 45 shows Architect-Quantity Surveyor association for design team Architects. The indication here is that the Architects were increasingly associating themselves with the Quantity Surveyor at the same time as they were disassociating themselves from the Client.

Another implication of Figures 44 and 45 is that the magnitude progressive of Architect-Client disassociation and Architect-Q.S. association were more pronounced in the cases of the more complex designs.

Figure 46 shows variations in Architect contributions which contained a quotation or a reference to a previous quotation by the Quantity Surveyor. Again, the Architects were increasingly using such quotations as the designs progressed.

Figure 47 shows how the subject content of addresses to the Client varied. From Figures 47(A) and 47(B), it is clear that the Architects were increasingly basing their statements to the Client upon administrative content, while the frequency of design-based references decreased. Again, these results indicate an increasing tendency by the Architect to verbally disassociate the Client from the later stages of the design process.

Figure 48 illustrates that the frequency of design-based address contributions addressed to the Quantity Surveyor by the Architect remained relatively constant. Clearly, the Architects were maintaining their design-based references

to Quantity Surveyors but not to Clients. The balance was made up by an increase in design-based references to other members of the design team.

Interviews with Architects during the design process provided qualitative substantiation of these observation results. Extracts of responses made in the later stages of the design, to the question listed at the start of this proof included;

"I have been looking increasingly to the Quantity Surveyor for advice in recent weeks....the detailed design stage. He has been supporting me more than he used to....I mean he did pick out a few design weaknesses....weaknesses in terms of cost efficiency in the early part of the design....but recently he has been more supportive. I mean....at this stage we can't really start messing around and making changes to the design....changes that would necessitate major changes to the drawings. I have been stressing the importance of the program more and more just recentlybecause it's important....we have to get these drawings out on time.

The Client has been more out of things....less involved in the design as it has developed into a more and more complex form. It has really passed beyond the ***** in many ways....in some ways."

Architect A, Stage 3.

"The Quantity Surveyor and myself have based our approach largely on....'constructive criticism', if you like. If he saw an aspect of the design which was not a reasonably cost efficient solution, he would point it out....and we would argue it out. It has really progressed beyond that now....into the next stage. We are now refining the 'product' of that process. In most designs, you do get this....an increasing....not co-operation, but mutual assistance developing between the Architect and the Quantity Surveyor in the later stages....simply because they have to."

Architect B, Stage 3.

"We have been backing each other up more in the detailed design stage....it has to be said. ***** often want changes to be made in the later stages which would disrupt the drawing schedule. This design involved the Client to a

significant extent....but they have 'drifted away' from it....they have been leaving it more and more to the Professionals."

Architect D(A), Stage 3.

"Working out the finer points of the design is a job for the Architect, supported by advice from the Q.S. The Client's role diminishes to a certain extent. That is what has happened here.... ***** are now concentrating on the early stages of other projects."

Architect D(B), Stage 3.

"I have tried to defend some of the design featuresincreasingly using the cost information provided by the Q.S. We have been working together more during detailed design. The major reductions in the cost limits have upset our design schedule....and I have been stressing the significance of that to the Client increasingly in the recent past."

Architect F, Stage 3.

"When the costs are as tight as they are here, contact and mutual support between the Architect and Quantity Surveyor are all important. That support has become more important in this particular case because of the increasing problems we've had in staying within budget.

That's not to say that we've been pushing the Client out, but they haven't been so involved recently as they were before."

Architect H, Stage 3.

"The Clients.... ***** have been separated from the design to a limited extent....it's down to me and the Q.S. now....detailed design."

Architect L, Stage 3.

These extracts support the results shown in Figures 40-48. Throughout the various design projects, the Architects during interview referred increasingly to a developing coalition between themselves and the Quantity Surveyor, and a growing 'alienation' of the Client from the rest of the design team. The most common explanations for these effects were that the design becomes too complex for the

Client's appreciation, and that late changes to the design would cause an unacceptable administrative reorganisation process, especially in terms of the additional workload which would be involved in making alterations to drawings.

Interview responses from Client Representatives reinforced these observations. Responses included;

"The Architect and Q.S. do seem to be working more together than they used to....no doubt about it. They are giving the impression that the ***** is only included in the design process....almost as a formality or courtesy. When we say something about the design, they listen and take notes....but they don't seem to value our opinions as much now as they used to. They very rarely contradict each other nowand contradict us much more. They seem to talk to each other more than they used to....at meetings. I mean they are still doing a good job, but I get the impression that they want to avoid changes at this stage....changes that would slow down the presentation of drawings later on."

Client Representative A, Stage 4.

"The Architect and the Q.S. have formed something of a coalition....which includes the Engineers as well to some extent....more so than in the early stages of the design. They look at each other and sometimes grin when we make a comment. It's quite clear that they don't want to make changes to the drawings now.... which is perfectly understandable from their point of view.

They have definitely started to support each other's arguments more over the last month or so....and that comes out at the meeting....and the number of meetings that we get to attend has also decreased."

Client Representative B, Stage 4.

"The Architect and Q.S. always worked closely together on this design. They have been holding more private discussions on their own behalf just recently....they come to meetings and come out with points that were never implied at the previous meeting....I would say.

They support each other more at the meetings....and talk to each other more as well."

Client Representative D(A), Stage 4.

"They (Architect and Q.S.) have isolated themselves with the design to a point, but that is normal....or in my experience it's normal on a relatively simple house design like this. We get them going in the early part of the design, then just leave them to get on with it....until or unless we see something that we don't like. It's understandable that they stick together in order to avoid having to make laborious changes late in the design."
(Brackets added)

Client Representative D(C), Stage 3.

"The design has now largely been delegated to the Architect and the other specialists....we produced a detailed brief and they know by now what we want....we are largely leaving them alone now to develop the detailed design on their own. We just go to the occasional meeting and see how it's progressing."

Client Representative I, Stage 4.

"Now we are into detailed design....it has become very specialised and detailed....and the designers are working largely on their own initiatives. They are exchanging information amongst themselves....and really just keeping us informed of progress. I think that's typical for most designs."

Client Representative L, Stage 3.

A range of qualitative substantiations was also provided by Quantity Surveyors in interviews. Responses to the same question included:

"The Architect has been looking to me for support in his arguments....or discussions in design team meetings....more than he used to, really because he has had to. This design has been changed and developed to such an extent now that we can't start to make any more significant changes at such a late stageI mean I have to admit that. Three separate, fully worked-up designs have now been presented to the *****, and we can really do no more. It has become a matter of defending the merits of each individual design. There has been an element of the design team 'rallying around' so that we can at least get somewhere.

So the Architect and myself have been forced to become more mutually supportive recently....simply because of the basic

incompatibilities between the design requirements and the cost limits which apply."

Quantity Surveyor A, Stage 4.

"We have always worked as members of a team....that's part of the job, but lately we have become more of.... more of a co-ordinated group. We see now what the design requirements are, and we are working them up towards the issue of drawings. The role of the Client has become largely....political....administrative. We just keep them informed of progress really. I think Clients often become to some extent detached from the design in the later stages....it's left much more to the specialists."

Quantity Surveyor B, Stage 3.

"The Architect and myself have increasingly dominated the design meetings....in terms of the number of comments made....sheer talking time. It is also noticeable that the Architect has been stressing program more and more to the Client as we have progressed.

Our (Architect and Q.S.) whole strategy and approach at meetings has changed....which is quite routine. In the later stages, the Client often still wants changes and alterations....which are very difficult to accommodate without disrupting the drawing issue schedule....and the designers often have to resist that....simply because of workload. That's probably why the Architect has brought up the program more and more recently." (Brackets added)

Quantity Surveyor D(A), Stage 3.

"The Architect and myself do tend to work more closely together in the later stages of the design....that probably shows at the meetings....we have to back each other up to a greater extent than in....say, the outline proposals stage. The design is much more restricted by then....less scope for changes and alterations to the design in order to incorporate new design aspects."

Quantity Surveyor D(C), Stage 3.

"We have been lending each other....more assistance in the face of Client objections to the design....that's because time is short, and is becoming increasingly so."

Quantity Surveyor F, Stage 3.

"The Client has become less involved in the design process....they are really leaving it up to us now. That's the usual situation."

Quantity Surveyor H, Stage 3.

"They (The Client) have withdrawn to some extent over the past couple of months. Me and the Architect have been left very much to our own devices. At meetingswe seem to have been doing most of the talking and raising of points and issues." (Brackets added)

Quantity Surveyor J, Stage 3.

These results indicate evidence of a growing coalition between the Architect and Quantity Surveyor in the design teams studied. The Quantity Surveyors increasingly offered supportive comments in response to requests for information from the Architect. Both made fewer attacks and expressions of dissatisfaction in response to contributions made by the other in the later stages of the design.

The Architects increasingly addressed the Quantity Surveyors as the design processes continued, and made more attacks upon the Client. In addition, the Architects increasingly disassociated the Client from self, while they increasingly associated the Quantity Surveyor with self, and made a higher frequency of references to previous Quantity Surveyor quotations in the later stages of the design.

The frequency of Architect statements which were based upon administrative content and addressed to the Client increased, while design content addresses decreased.

These findings were presented to the design team Architects at the end of the detailed design stage of each design process. Results again provided substantiations of the coalition observation. Responses included;

"I would agree that the Q.S. made a higher proportion of supportive comments on my behalf in the later stages of the design....that was because we had to get the thing off the ground in one form or another. We contradicted each other less and were generally more 'amicable'. I would also agree that I addressed more of my comments to him at the design team meetings over the later stages of the design....and considered the thing....perhaps more in terms of what he was telling me, than in terms of what the Client was saying.

I can accept that I also quoted more of the Surveyor's previous remarks in the later stages. When the Client was complaining about something, I sometimes responded by saying something like: 'Well, we told you so.'"

Architect A, Stage 4.

"I was certainly relying on the Quantity Surveyor more in the later stages of the design....we were having to work hard on the drawings, and it was in both our interests to minimise disruption. I can see that I was talking to him more frequently at design team meetings....yes.

The Clients did become separated from the day to day aspects of the design....and I was stressing the importance of time and other administrative aspects in the later stages....because I had to."

Architect B, Stage 4.

"I would agree with most of those results....we were certainly more in agreement during the later stages. I certainly addressed more comments to the Quantity Surveyor during the later phases of meetings than I did in the earlier ones....and we had less disagreements of opinion.

I probably was attacking the Client when they were trying to make changes to the design....we didn't have time for that....really. I almost certainly associated myself with the Q.S. more than with the Client in the later stages....more so than during the outline proposals stage for example."

Architect D(B), Stage 3.

"Myself and the Surveyor did do most of the talking at the later meetings....the Client hasn't been saying much....just criticising various aspects of the design. It also seems acceptable that I was referring to previous comments more by the Surveyor....in the later stages....when problems that we had previously pointed out to the Client produced their results."

Architect H, Stage 3.

"I would have associated the Q.S. with the design andwith myself more than the Client in the later stages. We have been working closely together to develop the detailed aspects of the design and keep it within budget."

Architect I, Stage 4.

"There has been a developing working relationship between the design specialists....largely at the expense of the levels of Client involvement....those results reflect that."

Architect L, Stage 3.

HYPOTHESIS 7.

As the design process continues, the Architect increasingly disassociates himself/herself from cost reduction exercises.

Results have indicated that the design team Architects who were interviewed increasingly disassociated themselves from cost reduction exercises, and as measured by contribution content analyses from direct observation of design team meetings.

Preliminary analysis of the pilot study indicated that the Architect showed increasing levels of dissatisfaction and response attack when cost reduction suggestions were made by other design team members. Factors such as maintenance cost penalties and aesthetic considerations were observed to be prominent points raised by Architects in such situations.

Early interviews with the cross-sectional design team Architects provided qualitative substantiation of this observation. The following question was posed;

Q: "When cost reduction exercises are discussed or proposed, does the response of the Architect vary according to the stage of the design in which this occurs?"

Responses from Architects during the outline proposals stage included;

"Well....generally, proposals for cost reduction actions are more favourably received by Architects during the early stages of the design. Later on, it's a lot more difficult to make changes to the design, as it affects the issue of drawings. Also....when you are designing something, you don't mind making changes to it while it's still in it's infancy, but you tend to resent changes when you've worked on it and tried to produce a workable and....acceptable solution.... maybe it's an ego thing, I'm not sure.

The problem is that most changes....to the design tendor often start to appear in the later stages of scheme design....that's when the Client starts to realise that the job is going over-cost....and most jobs do. The first thing they think about is reducing the visual appeal of the building....elevational treatments and so on. In many ways, it then becomes the....professional duty of the Architect to defend those aspects of the design if he can."

Architect A, Stage 1.

"The problems usually start during scheme design.... and often continue through to production information. The Client realises that the building is going to cost too much, and he starts to look for ways of saving money. The classical approach is to chop out all the items....or some of the items which the Client considers to be non-essential....what he sees as "Architectural whimsey'. Now that can be harmful in two ways....firstly, the elevations are usually designed to have good maintenance properties....and if we have to start changing the design and opting for inferior materials, that can lead to long term maintenance cost penalties. Secondly, the appearance of the building can be irreparably damaged. Last minute changes to the design often show up on the final building.

So the Architect tends to object to later cost reduction proposals more than early ones."

Architect B, Stage 1.

"Architects never like cost reduction exercises.... and they like them even less in the later stages of the design....because of the disruption they cause towhat is usually, a carefully planned design process. It would be understandable if....say an Architect objected to a proposal to remove plaster or something like that in the detailed design stage, when the result would be a requirement to change all the door and window details on the drawings."

Architect C, Stage 1.

"An Architect would tend to receive a cost-reduction proposal less favourably in the later stages of the design....when it would necessitate changes to the drawings....and maybe major re-costing work."

Architect D(A), Stage 1.

"It really depends upon the cost reduction subject.... and to what extent it would make re-design necessary. A lot of cost reductions force the Architect to make changes to the design which leave the eventual building looking worse than it should....or increase long term running or maintenance costs....the idea of the false economy."

Architect D(C), Stage 1.

"Architects usually feel obliged to resist proposals which would make the building less of a complete structure than they originally intended. In the case of most designs, cost reduction requirements become more extreme towards the end of the scheme design stage....that's when Architect opposition might be expected to be greatest."

Architect F, Stage 1.

"In my experience....I would attack a proposal to reduce costs which would leave the building below the standard which I considered to be acceptable. The cuts which most often do that appear later in the design, and are indicative of....a mild desperation in the Client or design team, to get the cost of the building down to an acceptable final cost."

Architect J, Stage 1.

Figures 49-52 show results from content analysis of design team interactions, in substantiation of hypothesis G.

Figure 49 shows variations in the proportion of Architect contributions which contained a reference to cost

reductions. While overall design team interaction became increasingly preoccupied with cost reductions, it is clear from these results that the Architects were making fewer contributions which referred to cost reductions. This effect was more pronounced in the later stages of the design.

Figure 50 shows variations in the significance of association between Client and cost reductions, in Architect contributions. The results indicate that the Architects were increasingly associating the Client with cost reductions. Again, the curves indicate that this effect was most pronounced in the later stages of the design. In addition, the effect also appeared to be more pronounced in the cases of more complex designs.

Figure 51 shows the corresponding Architect association curves between Quantity Surveyor and cost reductions. It is clear that the Architects were increasingly associating the Quantity Surveyor with cost reductions. These curves are less pronounced than the corresponding Client association curves, indicating a more steady increase throughout the design process.

Figure 52 illustrates variations in the significance of association between between cost reductions and an expression of dissatisfaction in Architect contributions. The curves indicate a growing association in Architect contributions based upon cost reductions and expressed dissatisfaction. Again, this effect was more pronounced in

the cases of the more complex designs.

Figure 53 shows variations in the significance of association between cost reductions and maintenance. The association between these two variables increased throughout the design process, and was more pronounced in the cases of the more complex designs. Maintenance and associated long term cost consequences was a popular factor mentioned by Architects in relation to the potential long term cost consequences of making immediate cost reductions to the specification.

Figure 54 shows variations in the significance of association between cost reduction and aesthetics. Again, this association increased in magnitude throughout the design processes, with no apparent increase in the later stages.

Figure 55 shows variations in the proportion of Architect attacks upon cost reduction based contributions by other design team members. The frequency of such attacks clearly increased throughout the design process. The curves suggest that steep increases in such attacks occurred in the majority of cases, but earlier in the more complex designs and later in the less complex designs.

Figure 56 illustrates the proportion of Architect contributions which constituted an expression of dissatisfaction in response to new proposals of cost reduction courses of action. Again, the increases occurred

throughout the design processes, and the steepest increases occurred earlier in the cases of the more complex designs.

These results indicate that the Architects were referring less to cost reductions at meetings while increasingly associating them with the Client and the Quantity Surveyor. The main objections were future maintenance and aesthetics penalties. Attacks and expressions of dissatisfaction in response to cost reduction proposals increased throughout the design process, with the greatest frequency increases occurring earlier in the design process with more complex designs.

Interviews with design team Architects towards the end of the detailed design stage provided qualitative substantiation of these observations. Responses included;

"No-one likes to see the specification of the building being reduced....Architects design buildings as an acceptable solution to the requirements which are set out in the brief. The design is a projection of the Architect's perceptions of what is a workable and acceptable solution to those requirements. Once you start to make cost reductions, the design ceases to be that....it becomes less than what the Architect has intended.

So Architects try to avoid cost reduction exercises wherever possible....and for as long as possible. Clients often increase their long term maintenance commitments in order to reduce capital costs....and it is often difficult to convince them of the basic folly there."

Architect A, Stage 3.

"Architects do resent changes forced upon them by the Client....especially when they just pick on something at random and say; 'right, we can do without that for a start'. That does happen quite often....and it can cause havoc to a carefully constructed design....and can spoil the whole design concept of the building.

Cost reduction requirements usually originate with the Client, but the detailed requirements... what actually goes....comes from the Quantity Surveyor. They are a fact of design life....but that doesn't make me like implementing them any more."

Architect B, Stage 3.

"In this design....the Q.S. has provided monthly.... or periodical reports, which he has been giving to the Client. The Client has then been saying how much he wants to be saved, and the Q.S. and me have then been drawing up the points that we feel can actually be omitted....he usually goes for the ones which save big blocks of money....I go for the ones which least reduce the overall expression or functionality of the building."

Architect D(A), Stage 3.

"Some of the cost reductions here have left the building looking less than ideal....definitely. They mostly came from the Client....although some came from the Q.S....in the first instance. I saw it as my duty to object to some of them."

Architect F, Stage 3.

"There have been some reductions in specification here that will increase the running costs of the buildingand it's expected lifespan in the long run will suffer. They have been forced upon us. The Client insisted that I omit items in order to save money, so I had to do that....not that I like doing it....and I objected to a number of such proposals....especially some of the later ones."

Architect J, Stage 3.

"I have had some quite heated exchanges just recently about reductions in specification. It happens on many designs, and it hasn't been as bad here as it often is. I feel that the Client has sacrificed a number of long term advantages and benefits, simply in order to save a few thousand pounds now."

Architect L, Stage 3.

The underlying implication of these results is that the design team Architects were dissatisfied with cost reduction requirements and resented putting them into action, particularly during the later stages of the design. From hypothesis F, it is clear that the Architects were

increasingly working in co-ordination with their Quantity Surveyors in the later stages, but findings in support of hypothesis G indicate an underlying resentment or defence perception against that section of the Quantity Surveyor's role which requires him to present potential cost reduction proposals to the Client.

Responses from Client Representatives have reinforced these observations. Responses included;

"A lot of cuts became necessary....simply because we didn't have enough money to pay for the design as it stood. The Architect has been avoiding the issue to some extent....recentlythe Q.S. has been offering most of the suggestions as to how we can reduce the cost of the design....the Architect has been putting those suggestions into practice.

It's clear that he's not happy about making some of these reductions in specification and making omissions. He feels that the building has been reduced to little more than a shed....a tin shed. I mean that's an understandable attitude, and I do sympathise with it, but it all comes down to costs."

Client Representative A, Stage 3.

"This building seems to be still a reasonably acceptable solution. We did have to make cuts....and the Architect didn't like it very much....and argued for the retention of some of them. I suppose the ***** pushed most of the cost reductions...he (Architect) fought against some of them....especially in the later stages of the design."
(Brackets added)

Client Representative B, Stage 4.

"We had to drop some things....and the Architect did argue for the retention of some of them....things like reducing the specification of the floor finish in the main workshop areas....money had to be saved, and the Q.S. calculated that we could save £X,000 by changing that to concrete with a surface hardener instead of grano. He argued that it wouldn't make any wearing difference, but the Architect argued that it would.... based on maintenance costs."

Client Representative C, Stage 3.

"Generally, the Architect did receive suggestions for cost reductions....unfavourably....especially those in the later stages of the design. He made it clear that he didn't want to lose some of the things that we had to cut out....but it was essential....had to be done. The Surveyor calculated which things would be the best to omit."

Client Representative D(A), Stage 3.

"The Architect didn't like the scale of the cost savings that had to be made....I mean they were pretty significant....something like a quarter of the budget that he had been working to previously....so, in effect he had to start again....or at least change his approach. He reckons that the revised design will cost more to run and maintain in the long run....but we have to save money now."

Client Representative F, Stage 3.

"He (Architect) certainly argued against some of themones that he said would lead to the building having inferior aesthetic or performance properties."
(Brackets added)

Client Representative J, Stage 3.

"Reductions became necessary....reducing the amount of open space within the building....non-lettable space. That had to be reduced....and the Architect didn't like it....he said that it would make the building more claustrophobic....and so it does."

Client Representative K, Stage 3.

Quantity Surveyors provided compatible responses during interview. Responses to the same question included;

"Architect usually object to cost reductions....as a matter of principle. They see it as an attack on what they have taken a lot of care over....and given a lot of thought to. In this case, the cost reductions were so severe, that the whole design had to change....all the expression that the Architect had included in the initial design had to go....and obviously he didn't like that very much....and he argued against it. I suppose that was something of a professional obligation....in some ways."

Quantity Surveyor A, Stage 4.

"There was a certain resentment....I suppose....when the design had to be cheapened....and costs reduced. I

produced lists of potential savings, and the Architect and the ***** considered them. I'm not sure that they had the same priorities there....not at all."

Quantity Surveyor B, Stage 3.

"I know the Architect complained about some of the omissions that we proposed to the Client *****the quality of the external cladding was one particular case that springs to mind. The Architect said that this one we've got now wouldn't last as longbut it was a lot cheaper....so the Client went for it."

Quantity Surveyor C, Stage 3.

"The Architect did object to some of the cost saving requirements, but he was forced to accept them....he didn't have any alternative. That happens on a lot of design projects....Architects being forced to alter their designs in order to compensate for over-expense. They often complain about the present and future consequences for the building."

Quantity Surveyor D(B), Stage 3.

"What happened here was fairly representative....the Client said that the design was too expensive, and asked us to reduce the cost. I then costed out a series of alternatives and presented them to the design team for appraisal. The Architect objected to most of them, but via a process of discussion, a number of them were adopted. That process became more laborious in the later stages of the design."

Quantity Surveyor F, Stage 3.

"There was a sudden increase in the Architect's resistance to cost reduction suggestions in the scheme design stage of the original design....maybe fired by a sense of desperation at the way the design was being cut back. He made some good arguments in favour of keeping a number of things, but most of them had to go anyway."

Quantity Surveyor G, Stage 4.

The extracts above provide further substantiation of the hypothesis. In all the design teams observed, the Architects referred to cost reductions less and less throughout the design process, while the importance and consequences upon the design of such cost reductions was

increasing. This indicates a disassociation which was out of context with the behaviour of the rest of the design team. Both the Client and the Quantity Surveyor were increasingly associated with cost reductions, and in the case of the former, especially so in the later stages of the design.

Architects increasingly expressed dissatisfaction, both in concordance with cost reductions and new proposals of cost reduction courses of action, together with increasing attacks. Cost reductions were also increasingly associated with maintenance and aesthetic factors.

These findings were put to the design team Architects near the end of each design process. Responses included;

"I did have to cut out a lot of things in this designthings which I would have preferred to have seen left in....quite honestly. We are now left with a design that is actually....absolutely basic. It has no frills or extravagances whatsoever. It doesn't look very nice....hardly ant brickwork....nearly all aluminium cladding. Generally, the more brickwork you have, the lower the future maintenance costs you can expect to incur.

The cost reductions were forced upon us by the Clientalbeit indirectly....since the amount of money that they had to spend on it was never going to be enough. I didn't enjoy doing that....the first design worked very well....much better than what we have nowlike it or not."

Architect A, Stage 4.

"I would agree that I did play down the cost reduction side of the design in the later stages....it's not that I was trying to 'duck-out' or avoid my responsibilities....it's just that I thought the design had suffered enough, and I didn't want to see it go down any more....and I wanted to avoid making changes at the detailed design stage of things, as far as possible.

I was dissatisfied....and I did attack a number of the new money saving ideas put forward by the Universitythis argument about the plaster on the office walls....whether unplastered blockwork is really any cheaper than plastered finish....I think the Client misunderstood that."

Architect B, Stage 4.

"Maybe I did contribute less in the cost reduction discussions during the most recent stages of the design. That makes sense for the reasons that I've already explained, (minimisation of drawing disruption) and because I didn't want the design to suffer any more. The Clients did suggest a lot of cost reduction courses of action....not all of which made complete sense....that's why I attacked some of them and argued in favour of others. I still think that the future maintenance costs of these houses will be higher in future because of some of the measures we've taken now to reduce capital costs."
(Brackets added)

Architect D(B), Stage 4.

"I know that I resisted new cost cutting ideas late in the design process....because they often lead to long term problems in exchange for an initial or short term gain."

Architect D(C), Stage 4.

"I would agree that I associated the Client with cost reduction exercises and stipulations....they were the ones that told us that we had to save money. I did argue against some of the reductions on the grounds that they affected the appearance of the building or would give longer term cost penalties. I would also agree that my objections became more pronounced in the later stages of the design process."

Architect F, Stage 3.

"I wasn't saying much in the cost cut discussions towards the end of the detailed design....because it was largely a matter of waiting for the Q.S. to work out how much we had to save....and then deciding on what we could do without. I did object to some of the Client's cost saving suggestions, because they were impractical....simply not workable."

Architect H, Stage 4.

"I can see that I associated the Client with cost reductions....because the Client was providing the money in the first place. I certainly wasn't happy about some of them....and I made that clear....especially where I thought

the effects on the design outweighed the immediate financial gains."

Architect J, Stage 4.

Yes....I wasn't saying much in the later discussions about potential cost savings....except to defend aspects of the design that I considered to be particularly important, in the face of attacks by the Client....in order to reduce the capital cost of the building."

Architect K, Stage 3.

HYPOTHESIS 8.

As the design process continues, the practical aspects of the approaching construction stage increasingly influence the decision considerations of the Architect.

Results on the pilot study indicated that the Architect was increasingly considering the approaching construction stage when making design recommendations and considering design solution options. One prominent consideration was found to be that of the market availability of the various design solution options. There were a number of examples where the Architect or the other members of the design team opted in favour of one material or product, simply because the delivery dates or general availability were likely to most assist in the future construction phase.

Preliminary interviews provided clarification of this observation. The following question was used;

Q: "To what extent is the design approach adopted by the Architect influenced by considerations of the physical

construction process which will eventually be needed, in each stage of the design process?"

Responses included;

Well....Architects are always supposed to design with the eventual construction of the building in mind.... that is a very important consideration to be borne in mind in each stage of the design. It would be possible to produce a design which looks nice and which theoretically works very well....but which simply cannot be built.

I think construction considerations play more of a part in the later stages of the design. At the start, the actual building part seems a long way ahead....and it is simply a design as opposed to a building. As the construction commencement approaches, any illogicalities or practical incompatibilities in the design begin to come to light.

Design teams do seem to become more construction- oriented in the detailed design stage....simply out of necessity. That includes things as everyday as the ordering of materials by the Contractor. The Architect might like a particular rustic brick or something, but if they aren't going to be available for a year or so, then there's no point in specifying them."

Architect A, Stage 1.

"The design team has to increasingly consider the practical construction aspects of the design towards the later stages. The Architect has to consider how all the details actually slot together....in absolutely minute detail. It's all right to design some new kind of cladding solution....or to specify a new cladding material, but in the detailed design stage, he (Architect) has to show exactly how it is going to fit onto the frame....and all the jointing details and so on....and the Q.S. has to make all the appropriate costings and information.

So construction does become more of a consideration in the later stages of the design....the design team discuss construction aspects more....it's noticeable."
(Brackets added)

Architect B, Stage 1.

"When you get down to detailed design, and the prospect of the construction stage begins to affect your design approach....you do start to consider things like delivery dates and the actual physical construction of the things that are being designed. You begin to think....'well, this

will be being built in two months time. If I specify this type of insulation, will it be available on time....what if it's not?'....and that kind of thing.

"You also begin to see problems with the design.... parts that won't fit together properly and bits of detailing that have been missed out, and which have to be designed in a hurry. The construction aspect does become more of a topic for discussion."

Architect C, Stage 1.

"The physical aspects of actually building the thing become more of a talking point during detailed design and production information. As an Architect, I do tend to consider construction more in the later stages of the design....Architects always do....they have to."

Architect D(B), Stage 1.

"At the moment, the construction stage is still a long way ahead....it's only a matter of designing an outline at the moment. The design team....myself included, will consider construction more in due course....in a few months time....it will increasingly become a factor in the design process."

Architect D(C), Stage 1.

"Things like brickwork and blockwork, which are based upon materials which are generally commercially available....things like delivery dates and market availability are no problem. The problem comes with the more obscure aspects of the design....fancy window frames and so on. We will also have to consider how each part of the building is actually going to be built....physically. Bad detailing....or detailing which is designed without full consideration of the construction process can cause lengthened contract periods and higher costs."

Architect F, Stage 1.

"This design is a mixture of new sections and existing building....so we have to consider how each part will be built at each stage of the design....perhaps more so than in the case of a project which is being built entirely from scratch. When we get towards detailed design, we'll have to consider that a lot more....the actual building of what we are designing."

Architect H, Stage 1.

"Design teams do consider the practicalities of the design as the construction stage approaches....I think that's inevitable. It does come to dominate certain aspects of

the design team discussions in the later stages of some designs."

Architect J, Stage 1.

"In this case, the design is in two parts, which will have to be built as two separate....contracts really. That means that our whole approach to the design has to be based on the phasing of the construction phases in order to get each finished on time. The nearer we get to the construction phase, the more that becomes important."

Architect L, Stage 1.

Figures 57-61 show quantitative results from direct observation of design team interaction, in support of hypothesis H.

Figure 57 shows the proportion of Architect contributions which contained a reference to construction. Clearly, all the Architects shown were referring to construction more in the later stages of the design. In addition, the highest proportion of construction references were made in the cases of the simpler designs.

Figure 58 shows similar curves for the proportion of Architect contributions which contained a reference to market availability. Again, the proportion became greater in the later stages of the design. Again, the effect was more pronounced in the cases of the simpler designs.

Figure 59 shows Client Representative and Quantity Surveyor responses to an Architect contribution which suggested a new design concept, where the responses contained a reference to construction or market availability.

Figure 59(A) shows variations in Client Representative

responses which contained a reference to construction, while Figure 59(B) shows variations in the same response content by the Quantity Surveyor. Clearly, in both cases, the frequency of construction responses increased in the later stages of the design, although the curves were steeper and of greater magnitude in the case of the Quantity Surveyor, than in the case of the Client Representative.

Figures 59(C) and 59(D) show curves for Client Representative and Quantity Surveyor responses respectively which contained a reference to market availability. Again, these were responses to an Architect suggestion of a new design concept solution.

Figure 60 shows variations in the significance of association between a new design concept and construction in Architect contributions. Clearly, this association increased throughout the design process. The curves also indicate that this pattern increased more steeply in the later stages of the design.

Figure 61 shows variations in Architect objections to proposed design courses of action by Client Representative and Quantity Surveyors, where the objection was based upon cost factors. Figures 61(A) and 61(B) show the appropriate curves for the Client Representative and Quantity Surveyor respectively. Both sets of curves increase appreciably in the later stages of the design, indicating an increasing

use of construction-based objections by the Architect in the later stages of the designs.

Figure 62 shows variations in the proportion of Architect contributions which constituted a new design factor for consideration and which contained a reference to construction. The curves indicate that these proportions increased steadily throughout the design process.

Figure 63 shows variations in the proportion of Architect administrative contributions which contained a reference to construction. The curves show that an increasing proportion of administrative contributions contained a reference to construction. Qualitative analyses revealed that many of these contributions related to aspects of the construction program.

Figure 64 shows variations in the proportion of Architect administrative contributions which contained a reference to market availability. Again, these curves indicate that an increasing proportion of administrative contributions made by the Architect contained a reference to market availability.

These quantitative results indicate a growing preoccupation with the construction stage towards the later stages of the design phase. Further qualitative substantiations were received from Architects during interviews conducted later in the design process. Responses to the same question included;

"The design team has been discussing aspects of construction more recently....that has been a growing aspect of our....deliberations. The Q.S. has been pointing out that some of the things that were designed were not the best....or not the most favourable design in terms of how they eventually had to built. We have made some changes for that type of reason.

I have also had to object to some ideas put forward by both the Client and the Q.S. simply because they were not practically applicable, when the actual construction was considered."

Architect A, Stage 3.

"The 'buildability' of the design is something that we have been considering more since we got into detailed design....I mean we have had to. It's a thing that is often not considered fully enough in design. We have been looking at aspects of the design in terms of how it will eventually be built, much more recently."

Architect B, Stage 3.

"Construction aspects....they do come into mind as the construction stage approaches. The design team here has been discussing those aspects of the design much more over the past few meetings. It applies particularly with things like fixing and 'detailed detailing'....the fine details."

Architect C, Stage 3.

"The influence of the construction stage on my design approach has basically taken two forms. Firstly I have had to carefully consider the exact detailing of things on drawings....so that the Contractor will have all the information that he will need to actually built it. Secondly, I have had to consider the availability of materials. That can have more of an influence than you might think. Those two factors apply more in the later stages of the design....they should apply in the early stages of the design as well....but Architects usually....'put them off' until later."

Architect D(C), Stage 3.

"Construction....and all that that entails plays a larger part in influencing my thinking on the design in the later stages....it has done in this design."

Architect F, Stage 3.

"With this design....a number of the approaches are quite new....and some of the materials used are not... they aren't used widely in the construction industrythings like bumper rails and disabled sanitary ware. I have had to be careful to check that what I have been designing will be available when the Contractor comes to order it."

Architect J, Stage 3.

Responses from Client Representatives to the same question gave further substantiation. Responses included;

"The Architect has been referring to constructional aspects more in recent months. (Detailed design stage) He never mentioned it at one time. He has been particularly concerned about detailed aspects of the design. I know he's conferring with the Engineers and the Surveyor on some of them." (Brackets added)

Client Representative A, Stage 3.

"Some aspects of this design were....they weren't designed with the actual construction of the building in mind. I think that the Architect is now starting to realise that....it shows in the correspondence. Certainly, he's talking about the Contractor and things like 'site start' and Architect's instructions more than he used to. There was a big administrative argument about the value of A.I.s that he could issue without the prior authorisation of the *****....I think it was decided to limit them to £500."

Client Representative B, Stage 3.

"With housing....the majority of the design is based on past designs. A lot of the stuff in here is based on what we've had designed for us before....so we have a pretty good idea that it's practical and relatively easily built....hopefully. The Architect and the Q.S. have been talking more in terms of the construction aspects of the design recently....they always do.... things like the issuing of A.I.s and site meetings and things."

Client Representative D(B), Stage 3.

"The Architect has been referring to the Contractor and the construction phase more recently....at meetings. We've been agreeing on points of the design that will be needed for that stage."

Client Representative D(C), Stage 3.

"The construction phase has been cropping up more often at meetings recently....both in terms of the design and in terms of the administrative aspects of actually conducting the contract....getting it built."

Client Representative F, Stage 3.

"I'd say that the Architect is becomingly increasingly concerned with the forthcoming construction of what he has designed. It features more in what he says at meetings....just how it's influencing the design itself....I'm not sure."

Client Representative H, Stage 3.

"The construction phase becomes more of a consideration in the detailed design stage....because it's getting so close by then. The Architect has to start considering the Contractor more by then."

Client Representative K, Stage 2.

The results given above indicate that the design team Architects were becoming increasingly concerned with the construction phase of the design as this phase approached. Interviews with design team Quantity Surveyors provided further substantiation of this observation. Responses included;

"The design team do have to consider the award of the contract more as the design gets nearer....things like how they are going to liaise with the Contractor and arrange meetings and so on....the administrative handling of the building process becomes more of a factor to be considered. The building process is a complex administrative process, and the Architect and other members of the design team have to get a system worked out before they start....things like designing for easy construction....or possible construction in some cases."

Quantity Surveyor A, Stage 3.

"The control aspect of the building process becomes more of a point for clarification during production information....how to relate to the Contractor....the Architect has to propose the sequence of site meetings and the necessary checks to be carried out.... appointment of

a Clerk of Works and all that....It all has to be agreed with the Client before the contract is awarded."

Quantity Surveyor B, Stage 3.

"The design team have to discuss the construction aspects of the design more in the detailed design stage....things like the materials that are to be used on the building....that applies especially on housing specialities like this, things like 'wet' bathrooms and special wall finishes. They aren't used much and have to be ordered well in advance....from a limited number of suppliers. Things like that have to be duly considered."

Quantity Surveyor D(B), Stage 2.

"Construction considerations have been considered more in the recent part of the design....the design team have been looking at the control of the construction phase....site meetings and communication with the Contractor. That happens in all design processes."

Quantity Surveyor G, Stage 3.

"The Architect has made more comments....and more objections to new proposals on the grounds of construction-related bases. I remember there was an argument recently about which way to place the beams over the rooms in the cabin blocks....the rooms are about the same dimension....just slightly rectangular. We could have put the beams in to span either way. After some discussion, it was decided to put them in parallel to the external wall, since that would be easier to build....easier for an 'iron fairy' to drive up outside and just lift then in.

There were a number of examples like that....where the design was directly influenced by considerations of how it was eventually going to be converted into a structure."

Quantity Surveyor J, Stage 3.

"Thinking about building the final product has entered into the approach taken by the design team more....as compared to the general design information that we were producing in outline proposals and scheme design. The double ceiling in the main concourse was one example. We showed it in general detail in the earlier stages, but over the past few weeks we've been trying to design it in detail, and the idea of fixing one ceiling through another....with all the lighting and a multitude of services in between has been quite difficult....to produce a workable solution."

Quantity Surveyor L, Stage 3.

These interview extracts act in substantiation of the meetings observation results presented in Figures 57-64. The overall implication from the results given in that the practical aspects of converting the design became more of an influence in the later stages of the design process. An increasing proportion of Architect and other design team member contributions contained a reference to construction. In addition, an increasing number of objections to new proposals were based upon construction as the design process continued. Results also suggest that this effect is no more pronounced in complex designs than in more simple ones.

The concordance analysis results indicate that the design team Architects were increasingly associating design with construction and market availability. The administrative aspects of the construction phase featured prominently. Late design team meetings contained an increasing proportion of administrative contributions which were based upon construction, such as agreeing the sequence of site meetings with the Contractor and concerns about the issue of working drawings to program. The effect in relation to administrative contributions was particularly apparent during the production information stage, with significant increases being apparent.

The results obtained in substantiation of hypothesis H were presented to the design team Architects at the end of each design process. The results obtained from their responses

provided further support. Responses included;

"I would agree that I made more references to 'construction' during the latter part of the design.... Architects usually do. As the time approaches, the design team as a whole have to consider the next stage....that of converting what is a design....on paper, into an actual building. The practicalities of what are involved become apparent. New design proposals become influenced by the proximity of the award of the contract. In production information, the Architect may see a better solution to one aspect of the design, but he starts to think; 'Well, should I change it....if I do, how will it affect the drawings that I've already produced....can I include the changes necessary in time to still give the Contractor the drawings that he will need on time?'"

Architect A, Stage 4.

"The construction aspect did become more of a problemor consideration in the detailed design stage. Both the Client and the Surveyor rejected....or argued against a number of new proposals on the grounds that they might have upset the work that had been done already....that has to be considered."

Architect B, Stage 4.

"The later stages of the design always bring up new problems and considerations based upon the construction stage which have to be contended with. The whole basis of the design team meetings switches from being design-based to being contract-based."

Architect C, Stage 4.

"The contract stage always start to influence the design stages as they near their conclusions. The whole of the design is geared-up towards the eventual work on site, but the prospect of including the Contractor into the process does bring about changes in the approach of the design team. These houses don't really raise the problem of 'building practicality', but on larger or more complex designs, that could become an element of some scale."

Architect D(C), Stage 3.

"I did make some objections based on the difficulties that a given proposal would cause in the subsequent construction stage....a lot of them were based on administrative considerations....as opposed to the actual design....things

like communications with the contractor and quality control."

Architect F, Stage 3.

"We did consider construction all through the designI had to design with construction in mind....it's always easy to miss things out or not provide all the information needed for the thing to be assembled. The administrative side of the construction stage is always a thing to consider as well. I have to have all the information to hand. If I forget something, and have to start designing it when the Contractor asks for it, then we get into claims for extensions of time and so on."

Architect H, Stage 3.

"Those results do make sense....I would say that they represent what actually happened....at least as far as the later stages of the design are concerned."

Architect J, Stage 4.

7.4.CHAPTER SUMMARY.

This chapter has presented the primary results emerging from this research. The results represent variations in communications for a wide range of design teams over a standardised period of time. These variations have been related to the research and operational hypotheses which were generated from the literature integration and subsequent synthesis with the initial pilot study results.

These results, acting in substantiation of the hypotheses are used, in conjunction with a literature reappraisal, to develop the general theory of Architectural decision making, in the following chapter.

CHAPTER EIGHT.

LITERATURE REAPPRAISAL AND THEORY DEVELOPMENT.

8.1.INTRODUCTION.

This chapter reappraises the synthesised literature in relation to the findings from the main study. This reappraisal forms the basis of the development of the general theory of Architectural decision making in relation to the group influence. The reappraisal takes the form of a restatement of the main study findings in relation to the literature which first suggested them during the formation of the hypotheses. The reappraised findings are then used to develop the general theory in the following section.

8.2.MAIN STUDY RESULTS AND LITERATURE REAPPRAISAL.

The main study and literature/pilot study synthesis suggests that the decision making process of the Architect develops as an increasing function of the evolving group process. The results from the main study link synthesise with all the main themes suggested from the literature synthesis. The main study findings were;

[1].The prominence of the Architect in the design team interaction process and is less pronounced in the middle stages

of the design process.

[2].The prominence of the brief in the design team interaction process is less pronounced in the middle stages of the design process.

[3].The prominence of the use of experience in the Architectural decision making process is more pronounced in the middle stages of the design process.

[4].The Architect is consistently the most creative member of the design team.

[5].The prominence of aesthetics decreases while the prominence of cost increases towards the later stages of the design process.

[6].The Architect and the Quantity Surveyor increasingly form a professional coalition towards the later stages of the design.

[7].The Architect increasingly disassociates himself or herself from cost reduction exercises towards the later stages of the design process.

[8].The Architect increasingly considers construction and market availability towards the later stages of the design process.

The findings in relation to hypothesis[1] are compatible with

Yoshida's(52) theory on goal ambiguity and Bales'(54) theory on role ambiguity in multidisciplinary teams. The Architect is initially perceived as team leader due to the undeveloped nature of the group process. In line with the observations of Yoshida et al(53), the Architect therefore plays a prominent part in the interaction process. In addition, the Architect is allowed considerable design freedom and interaction flexibility. The Architect is therefore allowed to implant a high degree of his or her own design objectives into the design. This corresponds to the findings in relation to hypothesis[5] with regard to the high prominence of aesthetics based considerations in the early stages of the design (Derbyshire(2), Lawson(14),(15), Gelernter(19), Shadish(24), Napier and Gershenfeld(27), Schutz(31), Shaffer and Galinsky(33), Bales(35), Tuckman(47), Stendler et al(50)).

As the design process continues, the design becomes increasingly complex and the amount of information within the system expands. The group is also increasingly discovering new goals, due to the multidisciplinary interaction process, and to the detailed information available to the system. The Architect is therefore increasingly subjected to expanding design requirements, the majority of which are produced and imposed by other design team members. As a result, the brief ceases to be of practical use in terms of the amount of design information it can provide. Discovered goals become group goals and may supplant the original goals listed in the brief. This ties in with the findings relating to hypothesis[2] with regard to the high initial prominence of the brief, followed by a middle stage decline in prominence. The Architect is

therefore forced to look elsewhere for design information and he or she can only do so by making increased use of practical experience. This links in with the findings in relation to hypothesis[3] in relation to the increased use of experience in the middle stages of the design process (Clark(1), Higgin and Jessop(5), R.I.B.A.(6), Jepson(7), Alexander(10),(11), Herbert(17), Miller et al(18), Gelernter(19), Darke(20), Yoshida(52), Yoshida et al(53)).

As the design process extends into the end of scheme design and the start of detailed design the level of information available within the system escalates (R.I.B.A.(6), Alexander(10),(11), Herbert(17), Miller et al(18)). The escalation in system information has a number of effects;

- 1.It propagates the group discovery of goals. The developing group process has by now established group regulatory procedures which allow other design team members to challenge the design authority of the Architect. As the Client receives more and more cost and design information, additional implications appear. New goals are discovered, and are increasingly imposed onto the design at the expense of previously included Architectural goals. This is compatible with the findings in relation to hypothesis [5] with regard to the increasing imposition of cost factors in the design process at the expense of aesthetics factors (Shadish(24), Cartwright and Zander(26), Yoshida(52), Yoshida et al(53), Ysseldyke et al(55), Ysseldyke et al(56), Stroop(59), Campbell(60), Collins and Guetzcow(62)).

2.It propagates the formation of intra-group conflict. Discovered goal imposition together with information expansion causes inevitable intra group conflict. The Architect increasingly resents the group process imposing role and goal corrective forces. This is compatible with the findings in relation to hypothesis[5] with regard to the Architect progressively alienating the Client, and with the findings in relation to hypothesis[7] with regard to the Architect progressively disassociating himself or herself from the imposition of the discovered goal of cost reduction towards the later stages of the design (Higgin and Jessop(5), Mackinder(9), Yeomans(21), Mann(22), Shadish(24), Cartwright and Zander(26), Gustafson(42),(43), Yoshida(52), Bales(53), Stroop(59), Campbell(60), Collins and Guetzcow(62)).

3.The increase in intra-group conflict favours the formation of sub-coalitions between sub-groups of overall group members. This is compatible with the findings in relation to hypothesis[6] with regard to the progressive formation of a cooperative coalition between the Architect and the Quantity Surveyor towards the later stages of the design (Baird(48), Deutsch(49), Stendler et al(50)).

4.The information expansion relates to both task oriented and socio-emotional development. As a result, group social awareness expands via the learning process. Socio-motional group influence on the individual therefore increases as a function of design complexity. Architect objectives are increasingly replaced by discovered group objectives and the

Architect's initial role and goal ambiguities are increasingly corrected as he or she is converted to the role of enabler. This links to the findings in relation to hypothesis[1] with regard to the continued low prominence of the Architect in the interaction process and hypotheses[6] and [7] with regard to the continued imposition of group goals as opposed to initial Architect goals and consequent increasing Architect dissassociation respectively (Derbyshire(2), Alexander(10),(11), Rittel(12), Johnson(13), Lawson(14), Lieberman et al(25), Bales(35), Tuckman(47), Yoshida(52), Dion et al(57), Duncan(58), Campbell(60)).

5.It stimulates the creativity of the Architect. Increasing design complexity and consequent feedback together with the expansion of group discovered goals and subsequent imposition increasingly restricts the design freedom of the Architect. In addition role correction systematically implements an enabler role upon the group perception of Architect status. These variations occur by the developing group process tending towards conflict and competition. The group also implants a creative influence upon the Architect in terms of creative stimulation as a function of the respective group process. As a result the Architect has to consider an increasingly complex range of design factors and parameters in the formulation of potential design solutions. These factors force the Architect to be more creative in terms of considering a greater degree of innovative design information in the formulation of solutions. This corresponds to the findings in relation to hypothesis[3] with regard to the Architect using increased experience in

order to provide the bases of creative responses. It also corresponds to the findings in relation to hypothesis[4] with regard to the characteristic creativity of the Architect and the increase in creative applications in the middle stages of the design (Higgin and Jessop(5), Mackinder(9), Rittel(12), Johnson(13), Lawson(14), Herbert(17), Miller et al(18), Darke(20), Yeomans(21), Mann(22), Lieberman et al(25), Shaffer and Galinsky(33), Lewin et al(34), Tuckman(47), Baird(48), Deutsch(49), Bales(54), Ysseldyke et al(55), Stroop(59)).

Towards the later stages of the design, the level of information within the system approaches a design maximum. As a result information-group effects also reach a peak;

1.The degree of design constraint acting upon the Architect maximises. the Architect is increasingly forced to seek design information from the Client in relation to specific requirements. This has the effect of reducing the application of experience. Each Client has different individual requirements and experience becomes inapplicable at the detailed tactical level. The Architect therefore is forced to seek more information directly from the Client, although in a progressively competitive atmosphere. This corresponds to the findings in relation to hypothesis[1] with regard to late stage resurgence in Architect prominence, and with the findings in relation to hypothesis[2] with regard to the late stage resurgence in brief prominence in relation to design information (Clark(1), Higgin and Jessop(5), R.I.B.A.(6), Jepson(7), Mackinder and Marvin(8), Mackinder(9),

Alexander(10),(11), Lawson(15),(16), Herbert(17), Miller et al(18), Darke(20), Yeomans(21), Rittel and Kunz(23)).

In addition, increased specificity in relation to detailed design and consequent resurgence of Client and brief prominence reduces the applicability of creativity and experience in relation to design development. This corresponds to the findings in relation to hypotheses[3] and [4] with regard to late stage creativity and experience decline respectively.

2.The degree of conflict within the system reaches a peak. Information maximisation towards the later design stages causes a subsequent conflict maximisation. Goal implementation and role readjustment of the Architect by the group process developed regulatory procedures causes increased resentment. Increased Architect-Client conflict propagates Architect-Quantity Surveyor cooperation. This relates to the findings in relation to hypothesis[6] with regard to the late stage optimisation of the Architect-Quantity Surveyor coalition (Mackinder and Marvin(8), Alexander(10),(11), Yoemans(21), Mann(22), Shadish(24), Cartwright and Zander(26), Baird(48), Schutz(49), Yoshida(52), Bales(54)).

Increased Architect-Client communication in the later stages is necessary in order to reconcile individual requirements, but this is done in an environment of escalating hostility due to information availability. This links in with the findings in relation to hypothesis[1] with regard to the late stage increase in Architect participation prominence, and with the findings in relation to hypothesis[6] with regard to the late stage continuing alienation of the Client by the Architect, and

the increasing levels of communication conflict between them (Higgin and Jessop(5), R.I.B.A.(6), Mackinder and Marvin(8), Gustafson(42),(43), Stendler et al(50), Yoshida(52)).

3.The degree of goal discovery and imposition reaches a peak. Increased information and the increasing group process results in the maximisation of goal discovery and implementation. The imposition of group discovered goals increasingly results in the abandonment of Architect goals. The Architect is forced to accept this via a process of enhanced conflict although defending with heightened influence and reciprocity. The Architect is forced to consider new goals such as cost reduction, construction and market availability as opposed to original aesthetics objectives. These trends tie in with the findings in relation to hypotheses[5], [6], [7] and [8] with regard to greatest level of the substitution of aesthetics by cost goals, heightened Architect-Client conflict, heightened disassociation from imposed cost goals, and maximum consideration of construction stage factors towards the later stages of the design respectively (Mackinder(9), Lawson(14), Gelernter(19), Shadish(24), Gustafson(42),(43), Oskamp(51), Yoshida(52), Stroop(59), Campbell(60), Collins and Guetzcow(62)).

8.3.MAIN STUDY RESULTS AND LITERATURE REAPPRAISAL SUMMARY.

The results from the main study relate well to the main themes emerging from the literature integration. This combination of the

research findings and literature themes is now used in the development of the theory of Architectural decision making in relation to influencing factors from other members of the design team. The theory is developed in the next section and is physically represented at the end of the chapter.

8.4.HYPOTHESES RESTATEMENT AND APPRAISAL.

8.4.1.HYPOTHESES RESTATEMENT.

The research hypotheses which form the basis of this research are;

1.IN THE DESIGN TEAM INTERACTION PROCESS, THE INFLUENCE OF THE ARCHITECT IS LOWER IN THE MIDDLE STAGES OF THE DESIGN.

2.IN THE DESIGN TEAM INTERACTION PROCESS, THE CONTRIBUTIONS OF THE ARCHITECT BECOME LESS BRIEF ORIENTED IN THE MIDDLE STAGES OF THE DESIGN.

3.IN THE DESIGN TEAM INTERACTION PROCESS, THE ARCHITECT IS MOST INFLUENCED BY THE USE OF EXPERIENCE IN THE MIDDLE STAGES OF THE DESIGN.

4.THE ARCHITECT IS CONSISTENTLY THE MOST CREATIVE MEMBER OF THE DESIGN TEAM.

5.IN THE DESIGN TEAM INTERACTION PROCESS, THE PROMINENCE OF AESTHETICS DECLINES WHILE THE PROMINENCE OF COST INCREASES.

6. IN THE DESIGN TEAM INTERACTION PROCESS, THE ARCHITECT AND THE QUANTITY SURVEYOR INCREASINGLY FORM A COOPERATIVE COALITION.

7. THE ARCHITECT INCREASINGLY DISSOCIATES HIMSELF OR HERSELF FROM COST REDUCTION EXERCISES TOWARDS THE LATER STAGES OF THE DESIGN.

8. IN THE DESIGN TEAM INTERACTION PROCESS, THE ARCHITECT BECOMES INCREASINGLY CONCERNED WITH THE ACTUAL CONSTRUCTION OF THE BUILDING AND THE AVAILABILITY OF MATERIALS.

8.4.2. HYPOTHESES APPRAISAL.

All the hypotheses are unreservedly accepted. They are confirmed by the main themes emerging from the literature integration and pilot study results synthesis, and by the main and validation study findings. It is not possible to assign confidence limits to the degree of acceptability in this case, but the extent of supportive evidence is considerable. Proof of the numerous research sub-hypotheses by a combination of qualitative and quantitative content analysis acts as acceptable substantiation of the centralised main research hypotheses.

Acceptance of the research hypotheses allows the further development of the general theory of Architectural decision making in relation to design team interaction. This theory development takes place in the following section.

8.5.THEORY DEVELOPMENT.

The design process may be viewed as the collective synthesis of a range of ideas into a central solution. The Architect provides some of these ideas but not all of them. He or she provides a roughly constant frequency of ideas throughout the design process but in the early stages, a high proportion are actually transferred into the design, while in the later stages only a small proportion are incorporated. As this process is continuing, the design itself is becoming increasingly complex and the number of ideas which are incorporated into it in total is expanding. An increasing proportion of implemented ideas are therefore coming from elsewhere in the design team.

This process of design initiative passing from the individual to the group is brought about by the group development process. Design initiative passes from the Architect to the group as the group process systematically develops via the communication and participation processes of the group. The readjustment of the status quo has to overcome socio emotional inertia and therefore takes place via a process of conflict and competition evolution. The previously cooperative interaction of the group becomes increasingly characterised by argumentation in the form of attacks and defences. The primary initiator in this respect is the increased level of cost feedback which results in an adjustment of Client goals, and subsequent implementation into the design process. In effect, the Architect forms the coalition with the Quantity Surveyor at the same time that the Quantity Surveyor is becoming one of the primary influences on

the design. Architect discovered goals are increasingly rejected by the group on cost grounds which originate from Quantity Surveyor participation, but which are increasingly put forward by the Client in an "offensive" form. The Quantity Surveyor can therefore be considered to be restricting the creativity of the Architect by reporting upon costs, the discovered objective of the Client which increasingly becomes prominent.

The Architect-Quantity Surveyor coalition is therefore somewhat double sided. They increasingly cooperate in participation in the face of increasing Client conflict, but the Quantity Surveyor is increasingly responsible (albeit indirectly) for providing discovered objective attack "ammunition" to the Client for use against Architectural creativity. As a result, the Quantity Surveyor may be considered as being primarily responsible (again in a passive form) for the evolution of conflict within the group, since the predominance of cost information in the design feedback system increases as the design process progresses, and the Quantity Surveyor is responsible for providing it. In effect, the Quantity Surveyor is therefore responsible for much of the group process of role and goal readjustment which occurs within the group developmental process.

The few late stage discovered goals which do originate from the Architect, such as the physical construction of the building and the market availability of materials are also affected by Quantity Surveyor input. These discovered goals are first discussed in an atmosphere of cost-based concern and conflict. Any form of construction or any material is

theoretically plausible if money is no object, but in the design team, cost becomes of increasingly paramount importance, and these examples of discovered goals are clearly influenced by cost considerations.

Much of the characteristic group development process towards a cost-based preoccupation can therefore be ascribed to the Quantity Surveyor. He or she is responsible for all of the behaviours shown by the hypotheses proofs, and may be duly regarded as the emergent prime influencer of the design team decision making process.

As the complexity of the design increase, the Architect is subjected to this group process. The range of design factors and requirements for design achievement expands considerably. The Architect is therefore forced to use previous experience as a source of information and potential design solutions. The Client and the brief provide sufficient information in the early stages, but the complexity of the design increasingly develops ahead of Client design contribution "usefulness". The use of experience therefore increases in the Architectural decision making process, especially in relation to creativity, although this use is increasingly restricted by the increasing prominence of the discovered objective of cost being injected into the decision making process by the Quantity Surveyor and being used participatively by the Client. The Quantity Surveyor can therefore be regarded as the primary influence on the variable use of experience in the design process. Increasing cost feedback acts to reduce the use of experience and produces a consequent enforced readjustment, in which the Architect has to work more closely with the Client in order to develop the

fine detail of the design within an established atmosphere of cost preoccupation.

This late stage Architect-Client realignment is however the product of an enforced rather than optional situational influence. Unlike the early stage close association between the Architect and the Client, the later stage association is characterised by conflict and hostility. Late stage design development is therefore characterised by the implementation of Client as opposed to Architect goals into the design evolution. This tends to reinforce the communicational alienation of the Client in Architect participation, and the role readjustment of the Architect away from that of leader towards that of enabler or midwife.

It is important to note that these characteristics apply regardless of;

- 1.Contract type.
- 2.Design complexity.
- 3.Method of procurement.
- 4.Client body characteristics.

The general patterns observed in the pilot, main and validation studies apply to a range of different contract type characteristics. This suggests that the same variations occur in design teams working on any building design complexity, to any form of contract, and including any type of Client body. For example, the same increasing cost preoccupation was evident in the results of a design team working on simple housing for a Housing Association Client as

was evident for a complex engineering design for an Academic Institution Client.

This apparent irrelevance of contract form, complexity, method of procurement and Client clearly has considerable implications. It is evidence of the generalisability of the results and reinforces their applicability to all building design team types.

8.6.THEORY DEVELOPMENT SUMMARY.

The general theory development represents the synthesis of the main study findings and the primary themes which emerge in relation to the relevant literature. The development shows that a number of variables influence the Architectural decision making process and that these variables are not constant in either expression or influence throughout the design process. The Architectural decision making process cannot be regarded as an isolated activity. It must be viewed as the resultant summation of a wide range of influencing factors which are brought to bear upon the design evolution through the design team interaction and communication process.

The errective and relative influence of these variables is considered collectively in the general theory which is stated in the next section.

8.7. A GENERAL THEORY OF THE ARCHITECTURAL DECISION MAKING
PROCESS AS A FUNCTION OF DESIGN TEAM INFLUENCE.

8.7.1. INTRODUCTION.

The theory is intended to encapsulate the synthesised findings of the main study and the literature. It is presented as a general theory consisting of a series of sub-theories. Each sub-theory constitutes a component part of the main theory. The theory itself relates to the Architectural decision making process as the function of the group process.

8.7.2.THEORY STATEMENT.

The theory can be stated as follows;

The extent to which Architect objectives are included in the design varies as an inverse function of the time for which the design team has been in existence.

The extent to which discovered group objectives are included in the design varies as a positive function of the time for which the group has been in existence.

The extent to which infra-group design information becomes included in the design process varies as a positive mid-stage maximising function of the time for which the group has been in existence.

The degree of conflict and competition which characterises these developments varies as a positive function of the time for which the group has been in existence.

These characteristics apply regardless of design team supplementary characteristics, such as design complexity, form of contract, method of procurement and Client type.

The theory is considered in terms of group process sub-theory

primary components and subsidiary symptomatic secondary components.

1. Group process sub-theory primary components.

The underlying factors in the validity of the theory are the group process developments which relate to the relative implementation of Architect goals.

A. Group socio-emotional process.

The group learns that the Architect is not in fact the team leader and that challenge is acceptable. This process increases with time so that Architect objectives are increasingly challenged in the light of new information and new objective discovery, and the variation in leadership perceptions allow Client discovered objectives to override Architect initial objectives. Architect goal implementation onto the design therefore decreases.

B. Group task-oriented processes.

The group learns that the Architect does not necessarily have the last say on design related discussions, as the Client becomes increasingly cost-assertive. Client discovered goals are increasingly accepted as group perceptual goals and outweigh Architect initial objectives. Architect goal imposition onto the design therefore decreases.

C.Design development process.

The design becomes increasingly complex with time, and the design freedom of the Architect becomes increasingly restricted as the range of design parameters expands. The increasingly specific requirements of the Client towards the later stages act to further restrict design freedom and consequent Architect objective inclusion.

2.Subsidiary symptomatic secondary components.

The developmental processes aspects of the theory can be considered in terms of the following sub-theory symptoms;

A.Role ambiguity detection and subsequent correction, via a process of role discovery and implementation.

The initial perceived Architect role of team leader is undermined by the group developmental process and is corrected over a period of time towards an enabler role. The Client develops the role of aggressor against Architect defences of the initial role scenario. This fundamental challenge and role realignment stimulates the formation of the Architect-Quantity Surveyor coalition towards the later stages of the design process. The reduction of the Architect role of primary initiator results in the decrease of Architect goal imposition onto the design.

B.Goal ambiguity detection and subsequent correction, via a process of goal discovery and implementation.

The initial Architect goals included in the outline proposals are detected as being inappropriate and incompatible with the group goals which are discovered as a function of information availability and design team interaction. New goals are imposed upon the design by the Client increasingly towards the later stage of the design. In particular, increased cost reporting produces the discovered goal of cost minimisation with consequent pressurisation of Architect aesthetic goals. Cost based goals are increasingly imposed on the design.

C.Conflict evolution from initial cooperation.

The developing group process with characteristic role and goal ambiguity corrections necessarily tends towards competition and conflict. The process is essentially one of group objective and process discovery and subsequent enforcement upon the individual. This process occurs in any group, but is particularly pronounced in the multidisciplinary building design team. It is a product of intra-group information availability and consequent developmental influences.

Architect-Quantity surveyor coalition formation is symptomatic of this process. Increasing intra-group conflict between the Client and the Architect produces cooperation between the professional Designers. This development is a function of status defence and redesign avoidance.

D.Decay and subsequent re-application of Client information.

The Client and the brief initially steer the design development. As the design becomes increasingly complex, these sources of information become inapplicable due to the relative design inexperience of the Client. The Architect therefore increasingly uses experience as a source of information and becomes increasingly creative. As the design approaches completion, the Architect is again forced to seek detailed information directly from the Client with regard to individual specific requirements, and the brief again becomes prominent. This information exchange however develops from an initial cooperative phase to a subsequent assertive-conflicting phase.

8.7.3.THEORY SUMMARY.

This general theory of the Architectural and design team decision making process applies to all design teams and design complexities considered within the range of this research. The validation process has shown it to be applicable in design considerations from simple housing to nuclear reactor facility installations.

All design teams will undergo the characteristic progression from being Architect-dominated to becoming group dominated. This will be characterised by rising intra-group conflict and competition. At the same time, the restraints and requirements of the developing design will compel the Architect to seek design information increasingly from outside the system, until increased design specificity causes a return to Client-based

information sources.

The theory clearly has considerable implications for the Industry, and especially from the point of view of Architects and Client bodies. The conflict process does produce a better or more mutually acceptable design, but it also causes considerable non-productive interaction and abortive design work. It should be possible to achieve the same accuracy and acceptability of resultant design without the requirement for the conflict progression and inevitable disruptive effects by group process engineering. The primary requirement here is simply to overcome the initial role and goal ambiguities which invariably form in the building design team at the outset. These conclusions are expanded and developed in the next section.

These characteristics apply regardless of design team characteristics. The same observations apply to private and Local Authority Clients and for design teams working to J.C.T.80 or G.C.Works.1., or other alternative permutations. This implies that these patterns are a function of group process as opposed to administrative, organisational or extraneous factors. The logical extension of this theory is that any attempts to improve the current situation requires analysis of the group theory and subsequent engineering of the group process, as opposed to concentrating on the design or form of contract.

This clearly has implications for the standard view of design team operation. The following section considers the theory in terms of compatibility, with and implications for, the R.I.B.A. Plan of Work.

8.7.4.IMPLICATIONS FOR THE R.I.B.A. PLAN OF WORK.

The R.I.B.A, plan of work was referred to and listed in chapter one. The theory is clearly incompatible with the listed plan in a number of areas. The main shortcomings in the plan of work which this research has identified are;

1. Inception and Feasilbility problem areas.

A.Initial appraisal.

B.Establishment of form in which project is to proceed.

C.Financial feasibility.

D.User requirements study.

E.Design and cost planning.

The initial appraisal is not carried out in line with true or eventual Client requirements. The Client is manipulated by the Architect into agreeing an initial form which is more compatible with Architect objectives than Client objectives. The initial financial feasibility of the project is incorrectly grounded and remains incompatible with Client capacity. User requirements are incorrectly weighted and this distorts the subsequent design and cost planning. Much of the development which occurs in subsequent stages emanates from this initial inaccuracy.

2.Outline Proposals problem areas.

A.General approach to construction.

B.Brief development.

C.Cost analysis.

Construction is hardly considered at this stage and its effect upon the development of the design is minimal. The brief is heavily used in design development but it is not developed to any extent. Information is obtained more from outside the system than by brief development. Cost analysis remains incompatible with true Client capacity and objectives.

3.Scheme Design problem areas.

A.Brief completion.

B.Construction methods decisions.

C.Cost approvals.

The brief becomes less important at this stage. Experience becomes the dominant information source for the Architect. Construction is still not considered to any appreciable extent. Cost approvals become more difficult to obtain as the level and accuracy of cost reporting increases.

4.Detailed Design problem areas.

A.Final decision on cost.

B.Final decision on construction.

C.Final development of the brief.

D.Complete cost checking.

E.Final design of all aspects.

Cost becomes the main conflict area at this stage. Costs are anything but settled. Construction is considered more but the final decisions are not made until later. The brief is used to an increasing extent but is not finalised as a document. Much design information still originates outside the system and non-briefed objectives increase. Cost checking increases in accuracy but does not maximise. Group-imposed design changes still enforce changes to the design.

The results clearly suggest that although the R.I.B.A. plan of work is almost universal in application, design teams in practice do not adhere to it's stage definitions.

8.8.THEORY APPLICATION.

The theory has been proven to apply across a range of design teams and design types. It applies in relation to the socio-emotional and task oriented aspects of group development. It has also been shown that the theory essentially relates to the design team group theory and process as opposed to the characteristics of individual designs or design team members.

In terms of application, it is therefore apparent that the application of the theory must be grounded in the engineering of the design team group process. To be of any use, the theory must be related to the characteristic evolution of the group process over time. It is also apparent from the literature integration, that the most critical time in relation to influencing the evolution of the group process

must be at the outset, when the group assembles for the first time or soon after.

It is therefore apparent that the application of the theory to the industry should take the following approach;

1.Restriction of initial Architect goal ambiguity.

Control of the high initial level of Architect goal inclusion, characterised by a high initial aesthetics preoccupation. As the group develops and new goals are discovered, these initial goals are increasingly revealed as being ambiguous and are subsequently rejected, necessitating re-design work and corresponding conflict.

2.Restriction of initial group role ambiguity.

Control of the characteristic initial perception of the Architect as the team leader working closely with the Client. Increasing group development and information availability systematically enforce a group-centered control system with the Quantity Surveyor acting as information supplier.

3.Restriction of design development evolution.

Control of the rate of development of the design in relation to the amount of information available within the system and the rate and efficiency with which it can be processed. Information will necessarily be required from outside the system although the importance of intra-system information

increases towards the detailed development of the design. The implication is that Client and external information require close synthesis and control.

4. Restriction of intra-group conflict.

Conflict is inevitable as a corrective procedure. It is important in relation to group development and actual role and goal perception and realisation. Control is required in order that the degree of unproductive conflicting participation does not become predominant in relation to the overall constructive design interaction process.

The application of the theory centers around the restriction and control of initial role and goal ambiguity, restriction of the rate of evolution of the design and related information availability and consequent restriction of conflict. The literature and the main study findings all indicate that the emergence of conflict is largely a result of the group corrective and information seeking developmental processes. Control of the developmental process therefore implies control of the consequent conflict propagation characteristics.

The group process itself is clearly a function of information availability and application. Too little information at the group formation stage leads to the initial role and goal ambiguities and the requirement for subsequent correction. Too much information in relation to design requirements in the subsequent stages forces the search for extra-system information, and attempts to implement the findings in the face

of increasing internally generated information, particularly with regard to costs. These two factors are essentially the basis for subsequent conflict. This produces a more balanced design but wastes a high proportion of interaction communication and consequent physical design time.

The theoretical solution appears to be that of rearranging the information flow within the design team. A high level of initial relevant and founded information is required at the time of the formation of the group, followed by a more controlled release of design information in phase with the levels of socio-emotional information which develops within the group as a function of time. This requirement is more pronounced in relation to certain information types. The results indicate that cost information is primary in this respect, and consequently so is the responsibility of the Quantity Surveyor. Cost reporting can stifle creative innovation and the use and application of valuable experience simply by making cost information available to the Client. It can also propagate destructive conflict which tends to remain within the design process throughout.

The required high initial information level should clearly be designed to engineer the group and design development. It should therefore clearly state as many role and goal definitions as possible at the outset. It should prevent the formation of early ambiguous perceptions. The role of the Architect and the level of individual objectives and goals which he or she can impose upon the early design should be clearly defined. The Client should attempt to produce a level of initial design information which allows the combination of

internal and external information sources in the development of the subsequent design, consequently avoiding the worst consequences of allowing the discovered cost goal to become overriding in terms of design parameters.

This theory application is not simply acting so as to substantiate the well documented arguments for Project Management or Architect involvement at inception. It is suggesting that the information system within design teams needs to be controlled as a group resource and used and applied in the best interests of the design. Early Architect involvement would not make any difference to the observed situation if the level of information, particularly cost information, at the outset remains unchanged and if the subsequent development and utilisation of information remains unmoderated and free to circulate as it becomes available.

It is suggested that some type of information moderation system (I.M.S.) is required in order that the information available at the outset has been properly considered and assembled with regard to current research. The I.M.S. should subsequently be applied in close coordination with the brief and corresponding cost information in order to ensure that the level of design developmental process matches that of the group developmental process, with consequent control of the conflict evolution process. It should then be applied in order to ensure the reasoned use of experience and design implication feedback in relation to the wider aspects of the design such as eventual maintainance and costs in use.

8.8.1.THEORY APPLICATIONS SUMMARY.

The theory relates to the developmental processes within the group as a function of intra-system information. The application of the theory in the Industry depends upon the control and moderation of information available to the system in relation to the development of the design and the group process. The final conclusions and subsequent developments towards suggestion for further research are presented in the following chapter.

CHAPTER NINE.

CONCLUSIONS AND SUGGESTIONS FOR FURTHER RESEARCH.

9.1.INTRODUCTION.

This concluding chapter states the final conclusions of this research together with primary applications for the industry in relation to the implementation of the theory. This takes the form of a simple restatement of the theory together with the suggested applicational approaches developed in chapter eight. This leads on to the concluding section in which the theory application is used as a basis for developing ideas and suggestions for further research based upon the application and testing of the ideas which have been developed in the preceding chapters.

9.2.CONCLUSIONS.

The primary findings of the research indicate that the design team decision making and interaction process is characterised by;

1. A high initial degree of Architect goal implementation onto the design, being superceded by an increasing degree of group discovered goal imposition onto the design.

2. A low initial level of infra-group conflict, being superceded by increasing levels of conflict and competition in

the later stages.

3. A high initial and terminal application of infra-group information in relation to design creativity, separated by a high application of external information application in relation to maximised creativity.

These characteristics are a result of a combination of task oriented and socio-emotional group development characteristics. The primary influencing factors are;

1. Initial role ambiguity, and subsequent group detection and correction.

2. Initial goal ambiguity, and subsequent group detection and correction.

3. The characteristically high level of group influence upon the individual in multidisciplinary and high task complexity groups.

4. The increasingly complex levels of information available to the system together with evolving and increasingly refined communication and interaction group processes.

5. The initial tendency for the design evolution to develop more quickly than corresponding group process in both task oriented and socio-emotional respects, enabling initially perceived goals and roles to persist and causing information to

be obtained from without the system.

The control of these effects requires an information moderation system which restricts and engineers the levels of information within the system. In order to be applicable, the characteristics of such a system should be;

1. Production of optimised design requirements information at the inception stage.

2. Production of unambiguous group process requirements information at the inception stage.

3. Promotion of group process development information.

4. Retardation of design process information, particularly cost information, so as to equate with the rate of development of group process development information availability.

9.3.LIMITATIONS.

The findings of this research have been shown to be independent of a range of design team subsidiary characteristics. The results apply to all the design teams studied, regardless of the nature of the Client body, method of procurement, form of contract and design complexity. The conclusions may therefore be regarded as applicable to design teams in general throughout the construction industry.

The research was limited to the specific characteristics of

design team interaction in relation to the Architect, Quantity Surveyor and Client Representative. The interaction communication of the Specialist Engineering Consultants were not individually coded. Engineering Consultants were coded collectively as opposed to individually. The research conclusions do not therefore allow specific analysis of the influence of individual Engineering Consultants upon the decision making oprocess of the Architect.

9.4.SUGGESTIONS FOR FURTHER RESEARCH.

The theory indicated the general requirements of an information moderation system. These included a high level of design information as early in the design process as possible, and subsequent control of the rates of development of task and group process information, particularly with regard to cost reporting. Valuable research could be conducted in these areas in relation to how these requirements could actually be implemented and tested.

A high level of design requirement information at the inception stage may seem impossible with regard to the characteristic design ignorance of Client bodies. However, research findings such as those presented in chapter eight indicate specific areas where subsequent conflict and changes are likely to occur. With Consultant advice, there is no reason why a Client should not be made fully aware of the likely cost of the building at the outset and impose a cost limit on elevational treatments specifically, which then becomes fixed. An Architect with two million pounds to spend will initiate a

design differently to a second Architect who has two million pounds to spend, of which only fifty thousand pounds can be spent on the elevations. Research is therefore required into methods of providing early accurate cost estimates in relation to specific aspects of the design, and corresponding methods of communicating these, and their consequences, to a layman Client.

The moderation of the group development process in relation to the design development process is more difficult. Research is required into methods of controlling the rate of development of the group process. The obvious way of achieving this would be to educate design teams in relation to actual group positions as opposed to perceived ones. The shift towards project management in recent years has been symptomatic of the realisation of a problem, but clearly it has not gone far enough. Consultants need to be convinced of the importance of group development and the potential consequences of role ambiguity and consequent destructive conflict correction. Research could indicate suitable ways of doing this. This would effectively reshape the current concept of the design team as lead by the Architect on behalf of the Client and supported by cost reporting from the Quantity Surveyor towards a new concept of aimless and largely abortive initial design work because the Architect does not appreciate what the Client really wants, and by the time he or she does it is too late to avoid problems.

Research is also required into methods of improving the Architect-Client relationship. The implementation of the theory would assist in this but the observations and results indicate a perceptible lack of understanding between these

individuals. The difference in specialism is a formidable obstacle, but it could be overcome with correct Architect training. Architectural education is renowned for its lack of concentration upon managerial skills. Research could indicate training methods in relation to the communication process between Architect and Client in order that a higher level of mutual appreciation and understanding could be developed from the outset.

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APPENDIX ONE.

EXAMPLE INTERVIEW QUESTIONS.

INTERVIEW QUESTIONS

Interview questions in this research were designed to be open ended so as to invite an unlimited and unrestricted response. They were designed so as to be examined using content analysis, and therefore no two analysis variables were included in any question. This was considered to be important, since a reference to two analysis variables in a question could amount to prompting of the respondent.

The questions were based upon observations of design team interaction, and not all the questions were universally applicable. For example, a question on facing brick choice would only be applicable on those designs where facing brick was actually used, or where facing brick was a considerable option.

If observations revealed that a design team appeared to be exhibiting a certain association between facing brick choice and cost, then a facing brick choice question would be put forward. The question would refer to facing brick, but not to cost.

For example, the phrasing;

"What factors influencing your choice of facing brick?"

would have been used as opposed to a more prompting phrasing such as;

"To what extent did cost influence your choice of facing brick?"

Several questions included references to both analysis variables and stages of the design process. In such cases, the questions contained no references to specific design stages.

For example, the phrasing;

"At what stage did the Architect ask most questions?"

would have been used as opposed to a more prompting phrasing such as;

"Did the Architect ask more questions during the scheme design stage?"

Where specific or implied references to design stages were made in questions, the phrasing was designed so as to give no prompting as to the second analysis variable.

For example, the phrasing;

"In the later stages of the design, did the Architect ask more or less brief-related questions?"

would have been used as opposed to a more prompting phrasing such as;

"In the later stages of the design, did the Architect ask less brief-related questions?"

Certain questions referred to more than one aspect of Architect behaviour or interaction characteristics. Where such questions were used, they were designed so as not to contain any two analysis variables in any sub-section of the question.

For example, the phrasing;

"At what stage in the design process did the Architect ask most questions, and to which aspect or aspects of the design did they most apply?"

would have been used as opposed to a more prompting phrasing such as;

"Did the Architect ask more questions during the scheme design stage, and did they apply particularly to cost?"

Where two analysis variables had to be included in a question, the phrasing was designed so as not to influence or bias the response. For example, in the examination of the variations in aesthetic versus cost considerations in the design process, it became necessary to present questions which contained references to both these analysis variables. Where this occurred, the question was designed so as not to imply any expected response or connection between the two analysis variables.

For example, the phrasing;

"To what extent do the aesthetic aspects of the design become secondary to cost factors, and at what stage in the design process is this most pronounced?"

would have been used as opposed to a more prompting phrasing such as;

"Does cost become more important than aesthetics during the detailed design stage?"

References to individuals, as opposed to specific aspects of the design, were treated in exactly the same way. Design team members were regarded as standard analysis variables. Where an interaction relationship between two design team members was being examined, the same precautions against bias and prompting were taken.

For example, the phrasing;

"To what extent do the Architect and the Quantity Surveyor support each other throughout the design process?"

would have been used as opposed to a more prompting phrasing such as;

"Do the Architect and the Quantity Surveyor become increasingly mutually supportive in the later stages of the design?"

References to factors which were not an inherent part of the design process but which nevertheless influenced the design process were treated as standard analysis variables. An example is the actual construction of the building. This phase does not occur until most of the design work has been completed, but it does influence the design process. References to construction in questions were phrased in accordance with the precautions taken with all other analysis variable references.

For example, the phrasing;

"To what extent is the design approach adopted by the Architect influenced by the physical construction process which will be needed, in each stage of the design process?"

would have been used as opposed to a more prompting phrasing such as;

"Is the Architect's approach to design more influenced by the forthcoming construction stage in the production information stage of the design process?"

All interview questions were designed with reference to the works reviewed in Section 6.2. of this thesis.

INTERVIEW QUESTIONS.

The following questions were used at two stages in the design process in order to obtain the qualitative extracts presented in chapter seven.

1. At what stage or stages in the design process is the influence of the Architect most pronounced upon the decision making process of the design team.
2. As the design develops, does the Architect show a greater or lesser preoccupation with the initial design brief?
3. To what extent is the Architect's design decision making influenced by his or her experience of previous design projects at each stage of the design.
4. At what stage in the design process did the Architect suggest most new design concepts, and to which aspects of the building did they particularly apply?
5. To what extent do the aesthetic aspects of the design become secondary to cost factors, and at what stage in the design process is this most pronounced?
6. To what extent do the Architect and the Quantity Surveyor support each other at each stage of the design process?
7. When cost reduction exercises are discussed or proposed, does the response of the Architect vary according to the stage of the design in which this occurs?
8. To what extent is the design approach adopted by the Architect influenced by considerations of the physical construction process which will eventually be needed, in each stage of the design process?

APPENDIX TWO.

CATEGORY CODING SUMMARIES.

The coding categories used in this research were largely based upon typologies used by previous researchers, as reviewed in Sections 6.5.1. and 6.5.2. The coding systems can be considered in the following groups.

1. Meeting analysis codes.
2. Interview analysis codes.
3. Universal design variables.
4. Architect supplement.
5. Quantity Surveyor supplement.
6. Specific design variables.

These coding categories are detailed in the same sequence in this appendix. Section one details the codes used in the analysis of meetings data. Section two details the corresponding interview codes. Section three details the universal design variable codes together with the supplementary architectural and surveying codes with additional specific project codes.

The contribution origin codes (meetings category 1) given in section one also act as universal design variable codes in the case of references to design team members. The universal design variable codes apply to both meetings and interview data. The supplementary codes were developed in order to analyse the more specialised verbal content of Architect and Quantity Surveyor contributions and interview responses. The specific design

variable codes were developed for use with project A (longitudinal study) and project B (pilot study), and were used with some of the more complex pilot studies.

The majority of the codes are self explanatory. For example, if a question was given during a meeting, it would be assigned a category 3 (contribution) coding of 19. If a design goal was referred to, it would be assigned a category 5 (subject type) coding of 2. A design goal would be differentiated from a design constraint by the degree of flexibility available to it. For example, the Client may have specified a type of brick as being either desired (goal) or compulsory (constraint). The same applies for administrative elements. For example, a programmed completion date could be either desired (goal) or compulsory (constraint).

Category 2 (sentence form) of the interview codes may need some explanation. These codes are taken directly from the references given in Chapter 6. They have been used in this research as follows;

1. Fact form certain.

A statement presented as true.

e.g. "The roof is costing exactly £40,000."

2. Fact form uncertain.

A statement presented as possibly true.

e.g. "The cost of the roof has been estimated at £40,000."

3. Fact form evaluative certain.
A judgement as an assertion.
e.g. "We cannot complete the roof by March."

4. Fact form evaluative uncertain.
A judgement as a possibly true assertion.
e.g. "We might be able to complete the roof by July."

5. Comment form self.
A personal opinion.
e.g. "I don't think we can complete the roof by June."

6. Comment form attributed specified.
An indirect quotation with a specified source.
e.g. "The Architect told me that it was not practical."

7. Comment form attributed unspecified.
An indirect quotation with an unspecified source.
e.g. "Somebody said that it was not practical."

8. Comment form quoted specified.
A direct quotation with a specified source.
e.g. "The Architect said; 'It's not a practical proposition'."

9. Comment form quoted unspecified.

A direct quotation with an unspecified source.

e.g. "Somebody said; 'It's not a practical proposition."

10. Unclassifiable

Any sentence not included in the above categories.

e.g. "What time is it?"

The category interpretations given are quoted in Berelson (Chapter 6, reference 117). The examples are taken from responses given to interview questions in this research.

SECTION 1. MEETINGS DATA CODES

CATEGORY 1. CONTRIBUTION ORIGIN.	
CODE.	INDIVIDUAL.
A	Project Architects.
AA	Project Architect.
AB	Assistant Project Architect.
AC	Additional Architect.
B	Client Representatives.
BA	Primary Client Representative.
BB	Secondary Client Representative.
BC	Additional Client Representative.
C	
CA	
CB	Extra Client Representative codes.
CC	
D	Project Managers.
DA	Primary Project Manager.
DB	Secondary Project Manager.
DC	Additional Project Manager.
E	*****
F	*****
G	*****
H	Meeting Chairman.
I	*****
J	Design Team.
K	*****
L	*****
M	*****
N	Eventual Users.
O	Others.
P	*****
Q	Quantity Surveyor.
R	*****

CATEGORY 2. INFORMATION FLOW.	
CODE.	INFORMATION FLOW.
1	Giving Information.
2	Asking for Information.

CATEGORY 3. CONTRIBUTION TYPE.	
CODE.	TYPE.
1	Unclassified.
2	Decision.
3	Attack.
4	Defence.
5	Opinion.
6	Suggest/Propose.
7	Restate.
8	Deferrment.
9	Correction.
10	Summation.
11	Uncertainty.
12	Give Example.
13	Undertake.
14	Submit for Discussion.
15	Refer to previous event/document.
16	Forecast.
17	Abandon.
18	Concede.
19	Quotation.
20	Confirm.
21	Observation.
22	Assumption.

CATEGORY 4. CONTRIBUTION STRENGTH.	
CODE.	TYPE.
A	Strongly Worded.
B	Normal Emphasis.
C	Weakly Worded.

CATEGORY 5. SUBJECT TYPE. (A: DESIGN)	
CODE.	TYPE.
1	Unclassified.
2	Design Goal.
3	Design Constraint.
4	Design Preference.
5	Design Factor for Consideration.
6	Design Course of Action.
7	Design Concept.
8	Design Omission.

CATEGORY 5. SUBJECT TYPE. (B: CONTROL)	
CODE.	TYPE.
9	Administrative Goal.
10	Administrative Constraint.
11	Administrative Preference.
12	Administrative Factor for Consideration.
13	Administrative Course of Action.
14	Administrative Concept.
15	Administrative Omission.

CATEGORY 6. SUBJECT ORIGIN.	
CODE.	TYPE.
D	Briefed.
E	Discovered.
F	New.

CATEGORY 7. CONTRIBUTION DESIGN VARIABLES.	
See this appendix. Section 3.	

SECTION 2. INTERVIEWS DATA CODES

	<p>CATEGORY 1.CONTEXT.</p> <p>Same codes as Contribution Design Variables.See this appendix.Section 3.</p>
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	<p>CATEGORY 2.SENTANCE FORM.</p>
CODE.	TYPE.
1	Fact Form Certain.
2.	Fact Form Uncertain.
3	Fact Form Evaluative Certain.
4	Fact Form Evaluative Uncertain.
5	Comment Form Self.
6	Comment Form Attributed Specified.
7 .	Comment Form Attributed Unspecified.
8	Comment Form Quoted Specified.
9	Comment Form Quoted Unspecified.
10	Other.

	<p>CATEGORY 3.SENTANCE STRENGTH.</p>
CODE.	TYPE.
A	Strongly Worded.
B	Normal Emphasis.
C	Weakly Worded.
	<p>CATEGORY 4.SENTANCE DESIGN VARIABLES.</p> <p>Same codes as Contribution Design Variables.See this appendix.Section 3.</p>

	<p>CATEGORY 5.SENTANCE SATISFACTION.</p>
CODE.	TYPE.
X	Disclaimer.
Y	Satisfaction.
Z	Dissatisfaction.

CODE.	CATEGORY 6. SENTANCE TENSE.
V	TYPE.
W	PAST TENSE.
	FUTURE TENSE.

SECTION 3. UNIVERSAL, SUPPLEMENTARY AND SPECIFIC CODES

CATEGORY 7. (MEETINGS CATEGORIES)
 CATEGORY 4. (INTERVIEW CATEGORIES)
 UNIVERSAL DESIGN VARIABLES.

CODE.	TYPE.
1	Accomodation.
3	Location.
4	Cost.
5	Aesthetics.
6	Access.
7	Noise.
9	Layout.
10	Program.
11	Finishes. (General).
12	Finishes. (Floor).
13	Finishes. (Wall).
14	Finishes. (Ceiling).
16	Computer Equipment.
17	Control.
18	Dimensions.
19	Vibration.
20	Worktops and Shelving.
21	Obstruction.
22	Mechanical Ventillation.
23	Natural Ventillation.
24	Air Conditioning.
25	Fumes.
26	Artificial Lighting.
27	Natural Lighting.
28	Services. (General).
29	Function.
30	Materials. (General).
31	Electrical/Sockets.
32	Non-Program Dates.
33	Disturbance.
34	Area.
35	Thermal Parameters/Temperature.
36	Comfort.
37	Doors/Windows.
38	Sponsorship.
39	Partitionioning.
40	Research.
41	Ceiling Height.
42	Political.
43	Vidio/Audio-Visual.
44	Links.
45	Sink/Wash Hand Basin.
46	Level.
47	Drainage.
48	Shape.
49	View.
50	Quality/Workmanship.

(Continued....)

51	Notice Board.
52	User Numbers.
53	Fire/Security Alarms.
54	Floor Numbers.
55	Secondary User Numbers.
56	Special Equipment.(General).
57	Roof.
58	Bearing Capacity.
59	Microfilm.
60	Cleaning.
61	Deliveries.
62	Visuals.
63	Machinery.(Specific Description).
64	Machinery.(Specific Dimensions).
65	Machinery.(General).
66	Safety.
67	Air Changes.
68	Structural Beams and Columns.
69	Teaching Aids.
70	Heating Panels/Radiators.
71	Lockers.
73	Maintainance.
74	Bays.
75.	Shower.
76	Benches.
77	Storage.
78	Toilet Facilities.
79	Blackout.
80	Flexibility
81	First Aid.
82	Dust.
83	Wheatherproofing.
84	Durability.
85	Ducting.
86	Chemicals.
87	Wiring/Cabling.
88	Teaching.
89	Frequency of Use.
90	Meetings.
91	Duplication.
92	Testing.
93	Corridors.
95	Furniture.
97	Methods of Work.
98	Decision.
99	Specifications.
100	Foundations.(Normal).
101	Strategy.
102	Tactics.
105	Rooms.(General).

(Continued....)

106	Waste.
107	Fixtures and Fittings.
109	Innovative Building Systems.
110	Communication.
111	Feedback.
112	Argument.
113.	Manufacturer/Supplier Names.
115	Learning.
116	Workload/Commitment.
119	Mistake/Misunderstanding.
120	Time Saving.
121	Non-Financial Constraints.
122	Risk.
123	Condensation.
124	Role.
127	Sample.
128	Assumption.
129	Service Towers.
130	Bias.
131	Forecasting.
132	Construction Industry.
134	Double Glazing.
135	Blinds/Curtains.
136	Verification.
137	Records.
138	Modelling.
139	Meeting Relationships.
140	Policy Reversal.
141	*****
150	Brief.
152	Legal/Statute.
153	Development Report.
154	Design Reports/Documents.
155	Policy Documents.

CATEGORY 7.(MEETINGS CATEGORIES)
 CATEGORY 4.(INTERVIEW CATEGORIES)
 UNIVERSAL DESIGN VARIABLES.
 ARCHITECTURAL SUPPLEMENT.

CODE.	TYPE.
201	Design.
202	Feature.
203	Design Modification.
204	Colour.
205	Compatibility.
206	Design Grammar.
207	Design Relief.
208	Design Evolution.
209	Convenience.
210	Components.
211	Weathering/Exposure.
213	Modularity.
214	Frame.
216	Status.
217	Grid.
218	Specialisation.
219	Fashion.
220	Order.
221	Expression.
222	Spur and Spine.
223	Expansion.
224	Character.
225	Elevation.
228	Interest.
229	Unity.
230	Luxury.
231	Inter-zone Interaction.
232	Environment.
233	Adaptation.
234	Connections.
235	Client Processes.
236	Regularity.
237	Contrast.
238	Design Failiures.
239	Centrality.
240	Universality.
241	Coherence.
242	Relationships between buildings.
243	Lifespan.
244	Responsibility.
245	Joint Tasks.
246	Impact.
247	Landscape.
248	Style.
249	References to other designs.(General).
250	References to other designs.(Similar).

(Continued....)

251	References to *****
252	Buildings. (General).
253	Sophistication.
254	Autonomy.
255	Identity.
256	Restoration.
257	Construction.
258	Structure.
259	Compromise.
260	Futurism.
261	Past.
262	Distance.
263	Complexity.
264	Concept.
265	Cladding.
266	Roof Coverings.
267	Obscelecence.
268	Brickwork/Blockwork.
269	Concrete.
270	Sheet Metal.
271	Volume.
272	Practicality.
273	Staining/Discolouration.
274	New Applications.
275	Atmosphere.
276	Success.
277	Efficiency.
278	Conformity.
279	Outdatedness.
280	Compact.
281	Congestion.
282	Proximity.
283	Texture.
284	Distraction.
285	Logic.
286	Symbolism.

CODE.	TYPE.
	CATEGORY 7. (MEETINGS CATEGORIES)
	CATEGORY 4. (INTERVIEW CATEGORIES)
	UNIVERSAL DESIGN VARIABLES.
	QUANTITY SURVEYING SUPPLEMENT.
401	Cost Reductions.
402	Tender.
403	Claims.
405	Bill of Quantities.
407	Site Conditions.
408	Contingencies.
409	Current Financial Situation.
410	Cost Penalties.
411	Preliminaries/Overheads.
412	Builder's Work in Connection.
413	Regional Variations.
414	Cost Indices.
416	Insurance.
417	Form of Contract.
418	Project Defination Form.
419	Final Account.
420	Work Package.
421	Abnormals/Extra Overs.
422	Fluctuations.
423	Special Allowances for Services.
424	Estimate.
425	Value Added Tax.
426	Interrim Valuations.
427	Take-Off.
428	Increased Specifications.
429	Undercosting.
430	Nomination of Sub-Contractors.
431	Extension of Time.
432	Relaxations.
433	Financial Incentives.
434	Investement Interest.
435	Labour Costs.
436	Cost absorption.
437	Safety Margins.
438	Specification.
439	Negotiations.
440	Diversity Factor.
441	Rate Loading.
442	Damages.
443	Freeze Point.
444	Warranty.
500	*****
501	*****
502	*****
503	*****
504	*****

CODE.	TYPE.
	CATEGORY 7.(MEETING CATEGORIES)
	CATEGORY 4.(INTERVIEW CATEGORIES)
	SPECIFIC DESIGN VARIABLES.
	PROJECT A.
602	Unique Plant Descriptions.
603	Specific Instrument Descriptions.
605	Hazards.(General).
606	Hazards.(Specific).
606	Hazards.(Potential).
609	Specific Gas Services.
610	Specific Special Services.
611	Special Electrical Services.
612	Special Structural Design.
613	Special Foundation Design.
614	Special Drainage.
615	Special Safety Provisions.
616	Chemical Properties.
617	Containment.
618	Pipe Runs.
621	Contiguity.
623	Hygiene.
625	Fire Standards.
626	Machinery Weight/Bearing.
627	Light Tools.
628	Pressurization.
629	Pressure Venting/Exhaust.
630	Electrical Loadings.
631	Instrument Packing.
632	Plasma.
633	Powders.
634	Fuel Gas.
635	Special Surface Treatments.
637	Equipment Transfer Lines.
639	Special Connections.
640	Sealable Openings.
641	Glands/Anti-leakage.
642	Peak Loadings.
643	Hardstanding.
644	Clock.
645	Gas Bottle Caging.
648	Shared Areas.
649	Alterations to *****
650	Experimentation.
651	Unique Processes.
652	*****
653	*****
654	*****
659	Flameproofing.
660	Unique Storage.
661	Cells.
662	Blowout Panelling.
663	Mezzonene.
674	Special Waste Disposal.

CATEGORY 7 (MEETING CATEGORIES).
 CATEGORY 4. (INTERVIEW CATEGORIES)
 SPECIFIC DESIGN VARIABLES.
 PROJECT A.

CODE.	TYPE.
1*	***** Accomodation.
1A*	***** Offices.
1B*	***** Offices.
1C*	Research Offices.
1D*	*****
1E*	Secretarial Offices.
1F*	***** Common Room.
1G*	Conference Room.
1H*	Computer Room.
1I*	Administrative Stores.
2*	Design Room.
3*	***** Rooms.
4*	Laboratories.
4A*	***** Lab.
4B*	***** Lab.
4C*	***** Lab.
4D*	***** Lab.
4E*	***** Lab.
4F*	***** Lab.
4G*	***** Lab.
4H*	***** Lab.
4I*	***** Lab.
4J*	***** Lab.
4K*	***** Lab.
4L*	***** Lab.
4M*	***** Lab.
5*	Workshops.
6*	Task Related Spaces.
6A*	B.01.
6B*	G.17.
6C*	G.18.
6D*	G.23.
6E	G.24.
6F*	G.39.
6G*	B.19.
6H*	l.22.
7*	*****
8*	External Works.
9*	Others.
10*	Staircases.
11*	Lifts.
12*	Entrances.
13*	Yard.
14*	Parking.
15*	Boilerhouse.
16*	Plant Rooms.

CATEGORY 7. (MEETING CATEGORIES)
 CATEGORY 4. (INTERVIEW CATEGORIES)
 SPECIFIC DESIGN VARIABLES.
 PROJECT B. (PILOT STUDY)

CODE.	TYPE.
1*	***** Offices.
1A*	***** Offices.
1B*	***** Offices.
1C*	***** Offices.
1D*	***** Research Offices.
1E*	Secretarial Offices.
1F*	***** Common Room.
1G*	Conference Room.
1H*	Computer Room.
1I*	Administrative Stores.
2*	Drawing Offices.
2A*	Drawing Offices.(Type A).
2B*	Drawing Offices.(Type B).
2C*	Drawing Office Stores.
2D*	Drawing Office.(Type C).
2E*	Drawing Office Store.(Type C).
2F*	Data Processing Room.
2G*	Information Unit.
2H*	Photocopier Room.
2I*	Darkroom.
2J*	Dyline Printing Room.
3*	***** Room.
4*	Laboratories.
4A*	***** Lab.
4B*	***** Lab.
4C*	Materials Store.
4D*	Mixing Bay.
4E*	***** Area.
4F*	***** Room.
4G*	Testing Lab.
4H*	Weighing Room.
4I*	Chemical Analysis Lab.
4J*	Data Room.
4K*	Senior Technician's Office.
5*	Workshops.
5A*	Woodworking Workshop.
5B*	General Engineering Workshop.
5C*	First Aid Room.
5D*	Showers.
6*	Task Related Spaces.
7*	External Works.
8*	Others.
9*	Core.
10*	Staircases.
11*	Lifts.
12*	Entrances.
13*	Yard.
14*	Parking.

INTRODUCTION

The analysis programs were specifically designed for this research. Existing packages were assessed in the early stages, but were found to be insufficiently flexible in processing the specialised word content of design team interaction.

Initially, a single analysis program was produced which analysed all aspects of meetings and interviews data files. However it became clear that a single large program could not operate within the processor time limits of the mainframe research computer. It therefore became necessary to write separate programs for meetings and interviews data. It was subsequently found that even two separate programs exceeded the processor time limits when large data files were used. It was found that six separate programs were necessary in order to allow analysis of the largest data files. The six programs analyse the following aspects of the data;

Program 1. Interviews universal design variables (numeric).

This program analyses the numeric category 4 codes (universal design variables) contained in the interviews data files. These codes are presented in Appendix 2 Section 3. It therefore covers the universal design variables together with the architectural, quantity surveying and other specific supplementary codes. For example, an input code of 4 would produce an analysis of references to cost in interview data files.

Program 2. Interviews universal design variables (alphanumeric).

This program analyses the alphanumeric category 4 codes (universal design variables) contained in the interview data files. These codes are presented in Appendix 2 Section 1. It therefore covers all references to Design Team members. For example, an input code of BA would produce an analysis of references to the Primary Client Representative in interview data files.

Program 3. Interviews response type variables (numeric).

This program analyses the category 2 codes (sentence form) contained in the interviews data files. These codes are presented in Appendix 2 Section 2. It therefore covers the various forms of sentence offered by the interviewee in response to interview questions. For example, an input code of 5 would produce an analysis of statements of opinion (comment form self) contained in the interviews data files.

These three programs are therefore concerned with interviews data. Programs 1 and 2 cover references to design variables and individuals respectively, while Program 3 covers the sentence forms which contain references to these variables. The remaining programs are concerned with meetings data.

Program 4. Meetings contributor variables (Alphanumeric).

This program analyses the category 1 codes (contribution origin) contained in the meetings data files. These codes are presented in Appendix 2 Section 1. It therefore covers the Design Team members who made the various contributions at meetings. For example, an input code of AA would produce an analysis of the statements made by the Design Team Architect contained in the meetings data files.

Program 5. Meetings contribution variables (Numeric/Alphanumeric).

This program analyses the category 3 and category 4 codes (contribution type and contribution strength) contained in the meetings data files. These codes are presented in Appendix 2 Section 1. It therefore covers the various contribution types and strengths made by all Design Team members at meetings. For example an input code of 5B would produce an analysis of the opinions made with normal emphasis contained in the meetings data files.

Program 6. Meetings universal design variables (Numeric/
Alphanumeric).

This program analyses the category 7 codes (contribution design variables) contained in the meetings data files. These codes are presented in Appendix 2 Section 1 and Appendix 2 Section 3. It therefore covers the universal design variables together with the

architectural, quantity surveying and other specific supplementary codes. For example an input code of J would produce an analysis of the references to the Design Team, while an input code of 5 would produce an analysis of the references to aesthetics in meetings data files.

PROGRAM FORMAT

The six analysis programs are written in BASIC for use on a Burroughs B6930 Mainframe computer. The format of each program is similar and the same approach logic is used throughout. Program 1 is one of the simpler programs, and a brief description of the operating logic of this program is now presented.

The program essentially asks for a data file reference and an analysis variable. It then reads the data file record by record and counts the incidence of occurrence and calculates the eventual significance of association of the analysis variable with other variables.

The program counts by incrementing a number of variable arrays. These are established at the start of the program. (lines 10 - 160).

The program inputs the analysis variable and selected data file name from an initiating reference file called VARL1. (line 162).

A loop is then established (line 210 to line 1490) whereby the selected data file is searched record by record. References to each aspect of the data file record entries are counted in the following sequence;

1. Numeric design variables (I2 loop: lines 345 - 370).
2. Alphanumeric design variables (I3 loop: lines 380 - 810).
3. Sentence form (line 811).
4. Sentence satisfaction (lines 815, 844, 845 and 847).
5. Sentence strength (lines 820 - 840).
6. Sentence context (lines 841).
7. Sentence tense (lines 855 - 859).

This section of the program therefore produces a count of the occurrences of all design variables and sentence form characteristics in the selected data file. The next section of the program (lines 870 - 1490) only activates if a record contains the selected analysis variable. If a record contains such a reference, then a second set of subloops are used to count the occurrences of the same design variables and sentence characteristics, which occur in the same reference. This second count is necessary in order to provide concordance calculations data later in the program.

The final section of the program calculates frequency of occurrence and significance of association values. A range of different calculations are used. Results are produced on the

visual display unit screen as they are calculated, and are simultaneously written onto a newly created results file.

For example lines 1502 - 1518 produce a simple analysis of percentage frequencies. Occurrancies of the selected analysis variable are recorded in the array C(x). Occurrancies of other numeric design variables of all types are recorded by the incrementation of the counter N (line 356). The calculation on line 1505 therefore shows the proportion of all design variables references which consist of the selected analysis variable. A value of G of 0.10 would show that 10% of all numeric design variable references are actually the selected design variable x.

The program goes on to calculate similar percentage frequencies and concordance analyses for the selected design variables and other content and characteristic variables. Each set of calculations is preceeded by an appropriate heading. The subsequent sets of calculations are therefore;

1. Percentage frequencies (lines 1502 - 1518).

2. Numeric variables
i.e. calculations involving references to specific design variables, covering category 7 (meetings), category 4 (interviews).

3. Alphanumeric variables.
i.e. calculations involving references to Design Team organisations, covering category 1 (meetings), category 4 (interviews).
4. Double alphanumeric variables.
i.e. calculations involving references to specific design Team members, covering category 7 (meetings), category 4 (interviews).
5. Asterisk alphanumeric variables.
i.e. calculations involving references to specific areas of the buildings being designed, covering category 7 (meetings), category 4 (interviews).
6. Sentence type.
i.e. calculations involving the sentence characteristics, covering category 2 (interviews).
7. Sentence strength.
i.e. calculations involving the degree of emphasis placed upon the sentence by the Respondent, covering category 3 (interviews).
8. Sentence context.
i.e. calculations involving the context in which the question was put forward, covering category 7 (meetings), category 4 (interviews).

9. Sentence tense.

i.e. calculations involving the tense in which the sentence was phrased, covering category 6 (interviews).

Each set of calculations involve the same basic calculation format, including percentage frequency and concordance evaluations.

Print outs of the analysis programs, an example results file and example interview and meetings data files are now presented.

ANALYSIS PROGRAMS 1 - 6


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0010 DIM A(6)
0020 DIM B$(4)
0030 DIM C(800)
0040 DIM D(26)
0050 DIM E(16)
0060 DIM F(16)
0070 DIM G(10)
0080 DIM H(10)
0090 DIM I(3)
0100 DIM J(800)
0110 DIM K(26)
0120 DIM L(16)
0130 DIM M(16)
0140 DIM N(10)
0150 DIM O(10)
0152 DIM P(3)
0153 DIM Q(3)
0154 DIM R(3)
0155 DIM S(800)
0156 DIM T(800)
0157 DIM U(4)
0158 DIM V(4)
0159 DIM W(3)
0160 DIM X(3)
0162 FILES *;ONE;VARL1
0180 INPUT £3;X,X$
0200 FILE £1;X$
0210 FOR I1=1 TO 800
0220 INPUT £1;A,B,C$,D,E,F,G,H,I,J$,K$,L$,M$,N$,O$
0230 IF D=0 THEN 1490
0232 N=N+1
0240 A(1)=D
0250 A(2)=E
0260 A(3)=F
0270 A(4)=G
0270 A(4)=G
0280 A(5)=H
0290 A(6)=I
0300 B$(1)=J$
0310 B$(2)=K$
0320 B$(3)=L$
0330 B$(4)=M$
0345 FOR I2=1 TO 6
0350 IF A(I2)=0 THEN 370
0351 IF A(I2)>0 THEN N1=N1+1
0356 C(A(I2))=C(A(I2))+1
0370 NEXT I2
0380 FOR I3=1 TO 4
0385 IF B$(I3)="Z" THEN GO TO 810
0390 IF LEN(B$(I3))>1 THEN 610
0400 IF B$(I3)="A" THEN D(1)=D(1)+1
0410 IF B$(I3)="B" THEN D(2)=D(2)+1
0420 IF B$(I3)="C" THEN D(3)=D(3)+1
0430 IF B$(I3)="D" THEN D(4)=D(4)+1
0440 IF B$(I3)="E" THEN D(5)=D(5)+1
0450 IF B$(I3)="F" THEN D(6)=D(6)+1
0460 IF B$(I3)="G" THEN D(7)=D(7)+1
0470 IF B$(I3)="H" THEN D(8)=D(8)+1
0480 IF B$(I3)="I" THEN D(9)=D(9)+1
0490 IF B$(I3)="J" THEN D(10)=D(10)+1

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0500 IF B$(I3)="K" THEN D(11)=D(11)+1
0510 IF B$(I3)="L" THEN D(12)=D(12)+1
0520 IF B$(I3)="M" THEN D(13)=D(13)+1
0530 IF B$(I3)="N" THEN D(14)=D(14)+1
0540 IF B$(I3)="O" THEN D(15)=D(15)+1
0550 IF B$(I3)="P" THEN D(16)=D(16)+1
0560 IF B$(I3)="Q" THEN D(17)=D(17)+1
0570 IF B$(I3)="R" THEN D(18)=D(18)+1
0580 IF B$(I3)="S" THEN D(19)=D(19)+1
0590 IF B$(I3)="T" THEN D(20)=D(20)+1
0591 N3=N3+1
0600 GO TO 810
0610 IF RIGHT(B$(I3),1)="*" THEN 781
0620 IF B$(I3)="AA" THEN E(1)=E(1)+1
0630 IF B$(I3)="AB" THEN E(2)=E(2)+1
0640 IF B$(I3)="AC" THEN E(3)=E(3)+1
0650 IF B$(I3)="AD" THEN E(4)=E(4)+1
0660 IF B$(I3)="BA" THEN E(5)=E(5)+1
0670 IF B$(I3)="BB" THEN E(6)=E(6)+1
0680 IF B$(I3)="BC" THEN E(7)=E(7)+1
0690 IF B$(I3)="BD" THEN E(8)=E(8)+1
0700 IF B$(I3)="CA" THEN E(9)=E(9)+1
0710 IF B$(I3)="CB" THEN E(10)=E(10)+1
0720 IF B$(I3)="CC" THEN E(11)=E(11)+1
0730 IF B$(I3)="CD" THEN E(12)=E(12)+1
0740 IF B$(I3)="DA" THEN E(13)=E(13)+1
0750 IF B$(I3)="DB" THEN E(14)=E(14)+1
0760 IF B$(I3)="DC" THEN E(15)=E(15)+1
0770 IF B$(I3)="DD" THEN E(16)=E(16)+1
0771 N5=N5+1
0780 GO TO 810
0781 IF B$(I3)="1*" THEN F(1)=F(1)+1
0782 IF B$(I3)="2*" THEN F(2)=F(2)+1
0783 IF B$(I3)="3*" THEN F(3)=F(3)+1
0784 IF B$(I3)="4*" THEN F(4)=F(4)+1
0785 IF B$(I3)="5*" THEN F(5)=F(5)+1
0786 IF B$(I3)="6*" THEN F(6)=F(6)+1
0787 IF B$(I3)="7*" THEN F(7)=F(7)+1
0788 IF B$(I3)="8*" THEN F(8)=F(8)+1
0789 IF B$(I3)="9*" THEN F(9)=F(9)+1
0790 IF B$(I3)="10*" THEN F(10)=F(10)+1
0791 IF B$(I3)="11*" THEN F(11)=F(11)+1
0792 IF B$(I3)="12*" THEN F(12)=F(12)+1
0793 IF B$(I3)="13*" THEN F(13)=F(13)+1
0794 IF B$(I3)="14*" THEN F(14)=F(14)+1
0795 IF B$(I3)="15*" THEN F(15)=F(15)+1
0796 IF B$(I3)="16*" THEN F(16)=F(16)+1
0797 N7=N7+1
0801
0810 NEXT I3
0811 H(B)=H(B)+1
0815 IF N$="X" THEN U(4)=U(4)+1
0820 IF C$="A" THEN I(1)=I(1)+1
0830 IF C$="B" THEN I(2)=I(2)+1
0840 IF C$="C" THEN I(3)=I(3)+1
0841 S(A)=S(A)+1
0843 IF N$="O" THEN 847
0844 IF N$="Y" THEN U(1)=U(1)+1
0845 IF N$="Z" THEN U(2)=U(2)+1
0846 O4=O4+1

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0847 IF N$="O" THEN U(3)=U(3)+1
0855 IF O$="O" THEN 859
0856 IF O$="V" THEN W(1)=W(1)+1
0857 IF O$="W" THEN W(2)=W(2)+1
0858 O2=O2+1
0859 IF O$="O" THEN W(3)=W(3)+1
0860 FOR I5=1 TO 6
0870 IF A(I5)=X THEN 900
0880 NEXT I5
0890 GO TO 1490
0900 FOR I6=1 TO 6
0905 IF A(I6)=0 THEN 1010
0910 IF A(I6)>0 THEN N2=N2+1
1000 J(A(I6))=J(A(I6))+1
1010 NEXT I6
1020 FOR I7=1 TO 4
1021 IF B$(I7)="Z" THEN 1440
1025 IF LEN(B$(I7))>1 THEN 1240
1030 IF B$(I7)="A" THEN K(1)=K(1)+1
1040 IF B$(I7)="B" THEN K(2)=K(2)+1
1050 IF B$(I7)="C" THEN K(3)=K(3)+1
1060 IF B$(I7)="D" THEN K(4)=K(4)+1
1070 IF B$(I7)="E" THEN K(5)=K(5)+1
1080 IF B$(I7)="F" THEN K(6)=K(6)+1
1090 IF B$(I7)="G" THEN K(7)=K(7)+1
1100 IF B$(I7)="H" THEN K(8)=K(8)+1
1110 IF B$(I7)="I" THEN K(9)=K(9)+1
1120 IF B$(I7)="J" THEN K(10)=K(10)+1
1130 IF B$(I7)="K" THEN K(11)=K(11)+1
1140 IF B$(I7)="L" THEN K(12)=K(12)+1
1150 IF B$(I7)="M" THEN K(13)=K(13)+1
1160 IF B$(I7)="N" THEN K(14)=K(14)+1
1170 IF B$(I7)="O" THEN K(15)=K(15)+1
1180 IF B$(I7)="P" THEN K(16)=K(16)+1
1190 IF B$(I7)="Q" THEN K(17)=K(17)+1
1200 IF B$(I7)="R" THEN K(18)=K(18)+1
1210 IF B$(I7)="S" THEN K(19)=K(19)+1
1220 IF B$(I7)="T" THEN K(20)=K(20)+1
1221 N4=N4+1
1230 GO TO 1440
1240 IF RIGHT(B$(I7),1)="*" THEN GO TO 1411
1250 IF B$(I7)="AA" THEN L(1)=L(1)+1
1260 IF B$(I7)="AB" THEN L(2)=L(2)+1
1270 IF B$(I7)="AC" THEN L(3)=L(3)+1
1280 IF B$(I7)="AD" THEN L(4)=L(4)+1
1290 IF B$(I7)="BA" THEN L(5)=L(5)+1
1300 IF B$(I7)="BB" THEN L(6)=L(6)+1
1310 IF B$(I7)="BC" THEN L(7)=L(7)+1
1320 IF B$(I7)="BD" THEN L(8)=L(8)+1
1330 IF B$(I7)="CA" THEN L(9)=L(9)+1
1340 IF B$(I7)="CB" THEN L(10)=L(10)+1
1350 IF B$(I7)="CC" THEN L(11)=L(11)+1
1360 IF B$(I7)="CD" THEN L(12)=L(12)+1
1370 IF B$(I7)="DA" THEN L(13)=L(13)+1
1380 IF B$(I7)="DB" THEN L(14)=L(14)+1
1390 IF B$(I7)="DC" THEN L(15)=L(15)+1
1400 IF B$(I7)="DD" THEN L(16)=L(16)+1
1401 N6=N6+1
1410 GO TO 1440
1411 IF B$(I7)="1*" THEN M(1)=M(1)+1

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1412 IF B$(I7)="2*" THEN M(2)=M(2)+1
1413 IF B$(I7)="3*" THEN M(3)=M(3)+1
1414 IF B$(I7)="4*" THEN M(4)=M(4)+1
1415 IF B$(I7)="5*" THEN M(5)=M(5)+1
1416 IF B$(I7)="6*" THEN M(6)=M(6)+1
1417 IF B$(I7)="7*" THEN M(7)=M(7)+1
1418 IF B$(I7)="8*" THEN M(8)=M(8)+1
1419 IF B$(I7)="9*" THEN M(9)=M(9)+1
1420 IF B$(I7)="10*" THEN M(10)=M(10)+1
1421 IF B$(I7)="11*" THEN M(11)=M(11)+1
1422 IF B$(I7)="12*" THEN M(12)=M(12)+1
1423 IF B$(I7)="13*" THEN M(13)=M(13)+1
1424 IF B$(I7)="14*" THEN M(14)=M(14)+1
1425 IF B$(I7)="15*" THEN M(15)=M(15)+1
1426 IF B$(I7)="16*" THEN M(16)=M(16)+1
1440 NEXT I7
1441 O(B)=O(B)+1
1450 IF C$="A" THEN P(1)=P(1)+1
1455 IF N$="X" THEN V(4)=V(4)+1
1460 IF C$="B" THEN P(2)=P(2)+1
1461 IF C$="C" THEN P(3)=P(3)+1
1462 T(A)=T(A)+1
1463 IF N$="O" THEN 1467
1464 IF N$="Y" THEN V(1)=V(1)+1
1465 IF N$="Z" THEN V(2)=V(2)+1
1466 O5=O5+1
1467 IF N$="O" THEN V(3)=V(3)+1
1468 IF O$="O" THEN 1472
1469 IF O$="V" THEN X(1)=X(1)+1
1470 IF O$="W" THEN X(2)=X(2)+1
1471 O3=O3+1
1472 IF O$="O" THEN X(3)=X(3)+1
1475 N9=N1+N3+N5+N7
1476 O1=N2+N4+N6+N8
1490 NEXT I1
1491: ffff f.ffff f.ffff f.ffff f.ffff f.ffff f.ffff f.ffff
1492:fff fff fff f.fff f.fff f.fff f.fff f.fff f.fff f.fff f.fff
1493: fff.f
1494: 'CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
1495:fff fff fff f.ffff f.ffff f.ffff f.ffff f.ffff f.ffff f.ffff f.ffff
1496 SCRATCH £2
1497 WRITE £2 USING 1494;"RESULTS OF INTERVIEW NUMBER (PROG1) ANALYSIS"
1498 WRITE £2 USING 1494;"FILE....."
1499 WRITE £2 USING 1494;X$
1500 WRITE £2 USING 1494;"NUMERIC VARIABLE....."
1501 WRITE £2 USING 1493;X
1502 PRINT USING 1494;"ANALYSIS OF RECORDS"
1503 WRITE £2 USING 1494;"ANALYSIS OF RECORDS"
1504 IF N1=0 THEN LET G1=0
1505 IF N1>0 THEN LET G1=C(X)/N1
1506 IF N3=0 THEN LET G2=0
1507 IF N3>0 THEN LET G2=C(X)/N3
1508 IF N5=0 THEN LET G3=0
1509 IF N5>0 THEN LET G3=C(X)/N5
1510 IF N7=0 THEN LET G4=0
1511 IF N7>0 THEN LET G4=C(X)/N7
1512 Y7=(N1+N3+N5+N7)
1513 IF Y7=0 THEN LET G5=0
1514 IF Y7>0 THEN LET G5=C(X)/Y7
1515 IF O1=0 THEN LET G6=0

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1516 IF O1>0 THEN LET G6=C(X)/O1
1517 PRINT USING 1491;N;C(X)/N;G1;G2;G3;G4;G5;G6
1518 WRITE £2 USING 1491;N;C(X)/N;G1;G2;G3;G4;G5;G6
1519 PRINT USING 1494;"CONCORDS OF VARIABLE AND NUMBERS"
1520 WRITE £2 USING 1494;"CONCORDS OF VARIABLE AND NUMBERS"
1521 FOR J=1 TO 800
1522 IF C(X)=0 THEN 1550
1523 IF C(J)=0 THEN 1550
1524 A1=(C(J)/N)*(C(X)/N)
1525 IF A1=1 THEN LET A1=0.999999999
1526 A2=J(J)
1527 A3=(A2-(N*A1))/SQR((N*A1)*(1-A1))
1532 A4=(J(J)-((C(J)*C(X))/N))^2/((C(J)*C(X))/N)
1533 A5=C(J)/N
1534 A6=J(J)/N
1535 A7=J(J)/N1
1536 A8=J(J)/N9
1537 A9=J(J)/O1
1545 PRINT USING 1495;J;C(J);J(J);A1;A4;A3;A5;A6;A7;A8;A9
1546 WRITE £2 SING 1492;J;C(J);J(J);A1;A4;A3;A5;A6;A7;A8;A9
1550 NEXT J
1552:ffff ffff ffff f.ffff f.ffff f.ffff f.ffff f.ffff f.ffff f.ffff
1554 WRITE £2 USING 1494;"CONCORDS OF THE VARIABLE AND LETTERS"
1555 PRINT"CONCORDS OF THE VARIABLE AND LETTERS"
1560 FOR J1=1 TO 26
1561 IF D(J1)=0 THEN 1605
1562 IF C(X)=0 THEN 1605
1570 B1=(D(J1)/N)*(C(X)/N)
1575 IF B1=1 THEN LET B1=0.99999999999
1580 B2=K(J1)
1585 B3=(B2-(N*B1))/SQR((N*B1)*(1-B1))
1586 B4=(K(J1)-((C(X)*D(J1))/N))^2/((C(X)*D(J1))/N)
1587 B5=D(J1)/N
1588 B6=K(J1)/N
1590 B8=K(J1)/N9
1591 B9=K(J1)/O1
1601 PRINT USING 1552;J1;D(J1);K(J1);B1;B4;B3;B5;B6;B8;B9
1602 WRITE £2 USING 1552;J1;D(J1);K(J1);B1;B4;B3;B5;B6;B8;B9
1605 NEXT J1
1614 WRITE £2 USING 1494;"CONCORDS OF THE VARIABLE AND DOUBLE LETTERS"
1615 PRINT"CONCORDS OF THE VARIABLE AND DOUBLE LETTERS"
1620 FOR J2=1 TO 16
1621 IF E(J2)=0 THEN 1670
1622 IF C(X)=0 THEN 1670
1630 C1=(E(J2)/N)*(C(X)/N)
1635 IF C1=1 THEN LET C1=0.99999999999
1636 C2=L(J2)
1640
1650 C3=(C2-(N*C1))/SQR((N*C1)*(1-C1))
1651 C4=(L(J2)-((C(X)*E(J2))/N))^2/((C(X)*E(J2))/N)
1652 C5=E(J2)/N
1653 C6=L(J2)/N
1655 C8=L(J2)/N9
1656 C9=L(J2)/O1
1660 PRINT USING 1552;J2;E(J2);L(J2);C1;C4;C3;C5;C6;C8;C9
1661 WRITE £2 USING 1552;J2;E(J2);L(J2);C1;C4;C3;C5;C6;C8;C9
1670 NEXT J2
1674 WRITE £2 USING 1494;"CONCORDS OF THE VARIABLE AND ASTERISK NUMBERS"
1675 PRINT"CONCORDS OF VARIABLES AND ASTERISK NUMBERS"
1680 FOR J3=1 TO 16

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1681 IF F(J3)=0 THEN 1730
1682 IF C(X)=0 THEN 1730
1690 D1=(F(J3)/N)*(C(X)/N)
1695 IF D1=1 THEN LET D1=0.99999999999
1700 D2=M(J3)
1710 D3=(D2-(N*D1))/SQR((N*D1)*(1-D1))
1711     D4=(M(J3)-((C(X)*F(J3))/N))^2/((C(X)*F(J3))/N)
1712 D5=F(J3)/N
1713 D6=M(J3)/N
1715 D8=M(J3)/N9
1716 D9=M(J3)/O1
1720 PRINT USING 1552;J3;F(J3);M(J3);D1;D4;D3;D5;D6;D8;D9
1721 WRITE £2 USING 1552;J3;F(J3);M(J3);D1;D4;D3;D5;D6;D8;D9
1730 NEXT J3
1734 WRITE £2 USING 1494;"CONCORDS OF THE VARIABLE AND SENTANCE TYPE"
1735 PRINT"CONCORDS OF VARIABLE AND SENTANCE TYPE"
1740 FOR J4=1 TO 10
1741 IF H(J4)=0 THEN 1790
1743 IF C(X)=0 THEN 1790
1750 E1=(H(J4)/N)*(C(X)/N)
1755 IF E1=1 THEN LET E1=0.99999999999
1760 E2=O(J4)
1761 IF O(J4)=0 THEN LET O(J4)=0.0000000009
1770 E3=(E2-(N*E1))/SQR((N*E1)*(1-E1))
1771 E5=O(J4)/N
1772 E6=H(J4)/N
1773     E4=(O(J4)-((C(X)*H(J4))/N))^2/((C(X)*H(J4))/N)
1780 PRINT USING 1495;J4;H(J4);O(J4);E1;E4;E3;E5;E6
1781 WRITE £2 USING 1492;J4;H(J4);O(J4);E1;E4;E3;E5;E6
1790 NEXT J4
1794 WRITE £2 USING 1494;"CONCORDS OF VARIABLE AND SENTANCE STRENGTH"
1795 PRINT"CONCORDS OF VARIABLE AND SENTANCE STRENGTH"
1800 FOR J5=1 TO 3
1801 IF I(J5)=0 THEN 1850
1802 IF C(X)=0 THEN 1850
1810 F1=(I(J5)/N)*(C(X)/N)
1815 IF F1=1 THEN LET F1=0.99999999999
1820 F2=P(J5)
1830 F3=(F2-(N*F1))/SQR((N*F1)*(1-F1))
1831     F6=P(J5)/N
1832     F5=I(J5)/N
1834     F4=(P(J5)-((I(J5)*C(X))/N))^2/((I(J5)*C(X))/N)
1836 M4=(P(J5)/N2)*100
1840 PRINT USING 1495;J5;I(J5);P(J5);F1;F4;F3;F5;F6
1841 WRITE £2 USING 1492;J5;I(J5);P(J5);F1;F4;F3;F5;F6
1850 NEXT J5
1855 PRINT "CONCORDS OF THE VARIABLE AND CONTEXTS"
1856 WRITE £2 USING 1494;"CONCORDS OF THE VARIABLE AND CONTEXTS"
1860 FOR J6=1 TO 800
1870 IF C(X)=0 THEN 1960
1880 IF S(J6)=0 THEN 1960
1890 G1=(S(J6)/N)*(C(X)/N)
1895 IF G1=1 THEN LET G1=0.99999999999
1900 G2=T(J6)
1910 G3=(G2-(N*G1))/SQR((N*G1)*(1-G1))
1911 G4=(T(J6)-((C(X)*S(J6))/N))^2/((C(X)*S(J6))/N)
1920 G6=T(J6)/N
1920 G6=T(J6)/N
1921 G5=S(J6)/N
1950 PRINT USING 1495;J6;S(J6);T(J6);G1;G4;G3;G5;G6

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1951 WRITE £2 USING 1492,J6;S(J6);T(J6);G1;G4;G3;G5;G6
1960 NEXT J6
1961:£££ £££ £££ £.££££ £.££££ £.££££ £.££££ £.££££ £.££££
1962 PRINT "CONCORDS OF THE VARIABLE AND SATISFACTION"
1963 WRITE £2 USING 1494;"CONCORDS OF THE VARIABLE AND SATISFACTION"
1965 FOR J7=1 TO 4
1970 IF C(X)=0 THEN 2070
1980 IF U(J7)=0 THEN 2070
1990 H1=(U(J7)/N)*(C(X)/N)
1995 IF H1=1 THEN LET H1=0.9999999999
2000 H2=V(J7)
2010 H3=(H2-(N*H1))/SQR((N*H1)*(1-H1))
2020 H4=(V(J7)-((C(X)*U(J7))/N))^2/((C(X)*U(J7))/N)
2021 H5=U(J7)/N
2022 H6=V(J7)/N
2023 H7=V(J7)/O5
2050 PRINT USING 1961,J7;U(J7);V(J7);H1;H4;H3;H5;H6;H7
2051 WRITE £2 USING 1961,J7;U(J7);V(J7);H1;H4;H3;H5;H6;H7
2070 NEXT J7
2075 PRINT "CONCORDS OF THE VARIABLE AND TENSE"
2076 WRITE £2 USING 1494;"CNCORDS OF THE VARIABLE AND TENSE"
2080 FOR J8=1 TO 3
2090 IF C(X)=0 THEN 2190
2091 IF W(J8)=0 THEN 2190
2100 Z1=(W(J8)/N)*(C(X)/N)
2110 IF Z1=1 THEN LET Z1=0.9999999999
2120 Z2=X(J8)
2130 Z3=(Z2-(N*Z1))/SQR((N*Z1)*(1-Z1))
2140 Z4=(X(J8)-((C(X)*W(J8))/N))^2/((C(X)*W(J8))/N)
2141 Z5=W(J8)/N
2142 Z6=X(J8)/N
2143 Z7=X(J8)/O3
2170 PRINT USING 1961,J8;W(J8);X(J8);Z1;Z4;Z3;Z5;Z6;Z7
2171 WRITE £2 USING 1961,J8;W(J8);X(J8);Z1;Z4;Z3;Z5;Z6;Z7
2190 NEXT J8
2200 STOP
2210 END

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0010 DIM A(6)
0020 DIM B$(4)
0030 DIM C(800)
0040 DIM D(52)
0050 DIM E(10)
0060 DIM F(4)
0070 DIM G(800)
0080 DIM H(4)
0090 DIM I(3)
0100 DIM J(800)
0110 DIM K(52)
0120 DIM L(10)
0130 DIM M(4)
0140 DIM N(800)
0150 DIM O(4)
0160 DIM P(3)
0210 FILES *;TWO;VARL2
0211 INPUT £3;Y$,X,Z9$
0270 FILE £1;Z9$
0280 FOR I1=1 TO 800
0290 INPUT £1;A,B,C$,D,E,F,G,H,I,J$,K$,L$,M$,N$,O$
0300 IF D=0 THEN GO TO 1860
0310 A(1)=D
0320 A(2)=E
0330 A(3)=F
0340 A(4)=G
0350 A(5)=H
0360 A(6)=I
0370 B$(1)=J$
0380 B$(2)=K$
0390 B$(3)=L$
0400 B$(4)=M$
0405 N=N+1
0410 FOR I2=1 TO 6
0411 IF A(I2)=0 THEN 430
0415 IF A(I2)>0 THEN N1=N1+1
0420 C(A(I2))=C(A(I2))+1
0430 NEXT I2
0440 FOR I3=1 TO 4
0443 IF B$(I3)="Z" THEN 970
0445 IF LEN(B$(I3))>1 THEN 645
0450 IF B$(I3)="A" THEN D(1)=D(1)+1
0460 IF B$(I3)="B" THEN D(2)=D(2)+1
0470 IF B$(I3)="C" THEN D(3)=D(3)+1
0480 IF B$(I3)="D" THEN D(4)=D(4)+1
0490 IF B$(I3)="E" THEN D(5)=D(5)+1
0500 IF B$(I3)="F" THEN D(6)=D(6)+1
0510 IF B$(I3)="G" THEN D(7)=D(7)+1
0520 IF B$(I3)="H" THEN D(8)=D(8)+1
0530 IF B$(I3)="I" THEN D(9)=D(9)+1
0540 IF B$(I3)="J" THEN D(10)=D(10)+1
0550 IF B$(I3)="K" THEN D(11)=D(11)+1
0560 IF B$(I3)="L" THEN D(12)=D(12)+1
0570 IF B$(I3)="M" THEN D(13)=D(13)+1
0580 IF B$(I3)="N" THEN D(14)=D(14)+1
0590 IF B$(I3)="O" THEN D(15)=D(15)+1
0600 IF B$(I3)="P" THEN D(16)=D(16)+1
0610 IF B$(I3)="Q" THEN D(17)=D(17)+1
0620 IF B$(I3)="R" THEN D(18)=D(18)+1
0630 IF B$(I3)="S" THEN D(19)=D(19)+1

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0640 IF B$(I3)="T" THEN D(20)=D(20)+1
0641 N3=N3+1
0642 GO TO 970
0645 IF RIGHT(B$(I3),1)="*" THEN 810
0650 IF B$(I3)="AA" THEN D(21)=D(21)+1
0660 IF B$(I3)="AB" THEN D(22)=D(22)+1
0670 IF B$(I3)="AC" THEN D(23)=D(23)+1
0680 IF B$(I3)="AD" THEN D(24)=D(24)+1
0690 IF B$(I3)="BA" THEN D(25)=D(25)+1
0700 IF B$(I3)="BB" THEN D(26)=D(26)+1
0710 IF B$(I3)="BC" THEN D(27)=D(27)+1
0720 IF B$(I3)="BD" THEN D(28)=D(28)+1
0730 IF B$(I3)="CA" THEN D(29)=D(29)+1
0740 IF B$(I3)="CB" THEN D(30)=D(30)+1
0750 IF B$(I3)="CC" THEN D(31)=D(31)+1
0750 IF B$(I3)="CC" THEN D(3)=D(31)+1
0760 IF B$(I3)="CD" THEN D(32)=D(32)+1
0770 IF B$(I3)="DA" THEN D(33)=D(33)+1
0780 IF B$(I3)="DB" THEN D(34)=D(34)+1
0790 IF B$(I3)="DC" THEN D(35)=D(35)+1
0800 IF B$(I3)="DD" THEN D(36)=D(36)+1
0801 N5=N5+1
0805 GO TO 970
0810 IF B$(I3)="1*" THEN D(37)=D(37)+1
0820 IF B$(I3)="2*" THEN D(38)=D(38)+1
0830 IF B$(I3)="3*" THEN D(39)=D(39)+1
0840 IF B$(I3)="4*" THEN D(40)=D(40)+1
0850 IF B$(I3)="5*" THEN D(41)=D(41)+1
0860 IF B$(I3)="6*" THEN D(42)=D(42)+1
0870 IF B$(I3)="7*" THEN D(43)=D(43)+1
0880 IF B$(I3)="8*" THEN D(44)=D(44)+1
0890 IF B$(I3)="9*" THEN D(45)=D(45)+1
0900 IF B$(I3)="10*" THEN D(46)=D(46)+1
0910 IF B$(I3)="11*" THEN D(47)=D(47)+1
0920 IF B$(I3)="12*" THEN D(48)=D(48)+1
0930 IF B$(I3)="13*" THEN D(49)=D(49)+1
0940 IF B$(I3)="14*" THEN D(50)=D(50)+1
0950 IF B$(I3)="15*" THEN D(51)=D(51)+1
0960 IF B$(I3)="16*" THEN D(52)=D(52)+1
0965 N7=N7+1
0970 NEXT I3
0973
0980 E(B)=E(B)+1
0985 IF N$="X" THEN H(4)=H(4)+1
0990 IF C$="A" THEN F(1)=F(1)+1
1000 IF C$="B" THEN F(2)=F(2)+1
1010 IF C$="C" THEN F(3)=F(3)+1
1020 G(A)=G(A)+1
1025 IF N$="O" THEN 1053
1040 IF N$="Y" THEN H(1)=H(1)+1
1050 IF N$="Z" THEN H(2)=H(2)+1
1052 O2=O2+1
1053 IF N$="O" THEN H(3)=H(3)+1
1055 IF O$="O" THEN 1080
1060 IF O$="V" THEN I(1)=I(1)+1
1070 IF O$="W" THEN I(2)=I(2)+1
1075 O4=O4+1
1080 IF O$="O" THEN I(3)=I(3)+1
1090 FOR I4=1 TO 4
1100 IF B$(I4)=Y$ THEN GO TO 1130

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1110 NEXT I4
1120 GO TO 1860
1125 IF N$="0" THEN 1050
1130 FOR I5=1 TO 6
1132 IF A(I5)=0 THEN 1150
1135 IF A(I5)>0 THEN N2=N2+1
1140 J(A(I5))=J(A(I5))+1
1150 NEXT I5
1160 FOR I6=1 TO 4
1163 IF B$(I6)="Z" THEN 1730
1170 IF LEN(B$(I6))>1 THEN 1390
1180 IF B$(I6)="A" THEN K(1)=K(1)+1
1190 IF B$(I6)="B" THEN K(2)=K(2)+1
1200 IF B$(I6)="C" THEN K(3)=K(3)+1
1210 IF B$(I6)="D" THEN K(4)=K(4)+1
1220 IF B$(I6)="E" THEN K(5)=K(5)+1
1230 IF B$(I6)="F" THEN K(6)=K(6)+1
1240 IF B$(I6)="G" THEN K(7)=K(7)+1
1250 IF B$(I6)="H" THEN K(8)=K(8)+1
1260 IF B$(I6)="I" THEN K(9)=K(9)+1
1270 IF B$(I6)="J" THEN K(10)=K(10)+1
1280 IF B$(I6)="K" THEN K(11)=K(11)+1
1290 IF B$(I6)="L" THEN K(12)=K(12)+1
1300 IF B$(I6)="M" THEN K(13)=K(13)+1
1310 IF B$(I6)="N" THEN K(14)=K(14)+1
1320 IF B$(I6)="O" THEN K(15)=K(15)+1
1330 IF B$(I6)="P" THEN K(16)=K(16)+1
1340 IF B$(I6)="Q" THEN K(17)=K(17)+1
1350 IF B$(I6)="R" THEN K(18)=K(18)+1
1360 IF B$(I6)="S" THEN K(19)=K(19)+1
1370 IF B$(I6)="T" THEN K(20)=K(20)+1
1375 N4=N4+1
1380 GO TO 1730
1390 IF RIGHT(B$(I6),1)="*" THEN 1570
1400 IF B$(I6)="AA" THEN K(21)=K(21)+1
1410 IF B$(I6)="AB" THEN K(22)=K(22)+1
1420 IF B$(I6)="AC" THEN K(23)=K(23)+1
1430 IF B$(I6)="AD" THEN K(24)=K(24)+1
1440 IF B$(I6)="BA" THEN K(25)=K(25)+1
1450 IF B$(I6)="BB" THEN K(26)=K(26)+1
1460 IF B$(I6)="BC" THEN K(27)=K(27)+1
1470 IF B$(I6)="BD" THEN K(28)=K(28)+1
1480 IF B$(I6)="CA" THEN K(29)=K(29)+1
1490 IF B$(I6)="CB" THEN K(30)=K(30)+1
1500 IF B$(I6)="CC" THEN K(31)=K(31)+1
1510 IF B$(I6)="CD" THEN K(32)=K(32)+1
1520 IF B$(I6)="DA" THEN K(33)=K(33)+1
1530 IF B$(I6)="DB" THEN K(34)=K(34)+1
1540 IF B$(I6)="DC" THEN K(35)=K(35)+1
1550 IF B$(I6)="DD" THEN K(36)=K(36)+1
1555 N6=N6+1
1560 GO TO 1730
1570 IF B$(I6)="1*" THEN K(37)=K(37)+1
1580 IF B$(I6)="2*" THEN K(38)=K(38)+1
1590 IF B$(I6)="3*" THEN K(39)=K(39)+1
1600 IF B$(I6)="4*" THEN K(40)=K(40)+1
1610 IF B$(I6)="5*" THEN K(41)=K(41)+1
1620 IF B$(I6)="6*" THEN K(42)=K(42)+1
1630 IF B$(I6)="7*" THEN K(43)=K(43)+1
1640 IF B$(I6)="8*" THEN K(44)=K(44)+1

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1650 IF B$(I6)="9*" THEN K(45)=K(45)+1
1660 IF B$(I6)="10*" THEN K(46)=K(46)+1
1670 IF B$(I6)="11*" THEN K(47)=K(47)+1
1680 IF B$(I6)="12*" THEN K(48)=K(48)+1
1690 IF B$(I6)="13*" THEN K(49)=K(49)+1
1700 IF B$(I6)="14*" THEN K(50)=K(50)+1
1710 IF B$(I6)="15*" THEN K(51)=K(51)+1
1720 IF B$(I6)="16*" THEN K(52)=K(52)+1
1725 N8=N8+1
1730 NEXT I6
1740 L(B)=L(B)+1
1745 IF N$="X" THEN O(4)=O(4)+1
1750 IF C$="A" THEN M(1)=M(1)+1
1760 IF C$="B" THEN M(2)=M(2)+1
1770 IF C$="C" THEN M(3)=M(3)+1
1790 N(A)=N(A)+1
1795 IF N$="O" THEN 1820
1800 IF N$="Y" THEN O(1)=O(1)+1
1810 IF N$="Z" THEN O(2)=O(2)+1
1815 O3=O3+1
1820 IF N$="O" THEN O(3)=O(3)+1
1825 IF O$="O" THEN 1850
1830 IF O$="V" THEN P(1)=P(1)+1
1840 IF O$="W" THEN P(2)=P(2)+1
1845 O5=O5+1
1850 IF O$="O" THEN P(3)=P(3)+1
1860 NEXT I1
1865 N9=N1+N3+N5+N7
1866 O1=N2+N4+N6+N8
1870: 'CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
1880:   $$$.$$
1881:           $$$$
1885:   $$$$ $.$$$$ $.$$$$ $.$$$$ $.$$$$ $.$$$$ $.$$$$ $.$$$$
1889: $$$ $$$ $$$ $.$$$ $.$$$ $.$$$ $.$$$ $.$$$ $.$$$ $.$$$ $.$$$
1890: $$$ $$$ $$$ $.$$$$ $.$$$$ $.$$$$ $.$$$$ $.$$$$ $.$$$$ $.$$$$
1892: $$$$ $$$$ $$$$ $.$$$$ $.$$$$ $.$$$$ $.$$$$ $.$$$$ $.$$$$ $.$$$$
1900 SCRATCH £2
1910 WRITE £2 USING 1870;"RESULTS OF CHARACTER (PROG2) ANALYSIS"
1911 WRITE £2 USING 1870;"FILE....."
1912 WRITE £2 USING 1870;Z9$
1913 WRITE £2 USING 1870;"ALPHANUMERIC VARIABLE....."
1914 WRITE £2 USING 1870;Y$
1915 WRITE £2 USING 1870;"CORRESPONDING NUMERIC CODE....."
1916 WRITE £2 USING 1881;X
1920 PRINT USING 1870;"ANALYSIS OF RECORDS"
1925 WRITE £2 USING 1870;"ANALYSIS OF RECORDS"
1926 Y7=(N4+N6+N8)
1927 IF N2=0 THEN LET G1=0
1928 IF N2>0 THEN LET G1=D(X)/N2
1929 IF N4=0 THEN LET G2=0
1930 IF N4>0 THEN LET G2=D(X)/N4
1931 IF N6=0 THEN LET G3=0
1932 IF N6>0 THEN LET G3=D(X)/N6
1933 IF N8=0 THEN LET G4=0
1934 IF N8>0 THEN LET G4=D(X)/N8
1935 IF Y7=0 THEN LET G5=0
1936 IF Y7>0 THEN LET G5=D(X)/Y7
1937 IF O1=0 THEN LET G6=0
1938 IF O1>0 THEN LET G6=D(X)/O1
1939 PRINT USING 1885;N;D(X)/N;G1;G2;G3;G4;G5;G6

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1940 WRITE £2 USING 1885;N;D(X)/N;G1;G2;G3;G4;G5;G6
1965 PRINT USING 1870;"CONCORDS OF VARIABLE AND NUMBERS"
1966 WRITE £2 USING 1870;"CONCORDS OF VARIABLES AND NUMBERS"
1970
1980 FOR J1=1 TO 800
1990 IF C(J1)=0 THEN 2130
2000 IF D(X)=0 THEN 2130
2010 A1=(C(J1)/N)*(D(X)/N)
2020 A2=J(J1)
2030 IF A1=1 THEN LET A1=0.9999999999
2040 A3=(A2-(N*A1))/SQR((N*A1)*(1-A1))
2045     A4=(J(J1)-((D(X)*C(J1))/N))^2/((D(X)*C(J1))/N)
2055     A5=C(J1)/N
2060     A6=J(J1)/N
2070     A7=J(J1)/N9
2080     A8=J(J1)/O1
2110 PRINT USING 1890;J1;C(J1);J(J1);A1;A4;A3;A5;A6;A7;A8
2120 WRITE £2 USING 1889;J1;C(J1);J(J1);A1;A4;A3;A5;A6;A7;A8
2130 NEXT J1
2132 PRINT USING 1870;"CONCORDS OF VARIABLE AD CHARACTERS"
2133 WRITE £2 USING 1870;"CONCORDS OF VARIABLE AND CHARACTERS"
2140 FOR J2=1 TO 52
2150 IF D(X)=0 THEN 3000
2160 IF K(J2)=0 THEN 3000
2170 B1=(D(J2)/N)*(D(X)/N)
2180 B2=K(J2)
2185 IF B1=1 THEN LET B1=0.999999999999
2190 B3=(B2-(N*B1))/SQR((N*B1)*(1-B1))
2200     B4=(K(J2)-((D(X)*D(J2))/N))^2/((D(X)*D(J2))/N)
2300     B5=D(J2)/N
2400     B6=K(J2)/N
2600     B8=K(J2)/N9
2700     B9=K(J2)/O1
2800 PRINT USING 1892;J2;D(J2);K(J2);B1;B4;B3;B5;B6;B8;B9
2900 WRITE £2 USING 1892;J2;D(J2);K(J2);B1;B4;B3;B5;B6;B8;B9
3000 NEXT J2
3010 PRINT USING 1870;"CONCORDS OF VARIABLE AND SENTANCE TYPE"
3020 WRITE £2 USING 1870;"CONCORDS OF VARIABLE AND SENTANCE TYPE"
3030 FOR J3=1 TO 10
3040 IF E(J3)=0 THEN 3180
3050 IF D(X)=0 THEN 3180
3060 C1=(E(J3)/N)*(D(X)/N)
3080 C2=L(J3)
3085 IF C1 =1 THEN LET C1=0.9999999999
3090 C3=(C2-(N*C1))/SQR((N*C1)*(1-C1))
3150     C5=L(J3)/N
3155     C4=(L(J3)-((D(X)*E(J3))/N))^2/((D(X)*E(J3))/N)
3160     PRINT USING 1890;J3;E(J3);L(J3);C1;C4;C3;C5
3170     WRITE £2 USING 1889;J3;E(J3);L(J3);C1;C4;C3;C5
3180 NEXT J3
3190 PRINT USING 1870;"CONCORDS OF VARIABLE AND SENTANCE STRENGTH"
3195 WRITE £2 USING 1870;"CONCORDS OF VARIABLE AND SENTANCE STRENGTH"
3210 FOR J4=1 TO 4
3220 IF D(X)=0 THEN 3350
3230 IF F(J4)=0 THEN 3350
3240 D1=(D(X)/N)*(F(J4)/N)
3250 D2=M(J4)
3255 IF D1=1 THEN LET D1=0.999999999999
3260 D3=(D2-(N*D1))/SQR((N*D1)*(1-D1))
3270     D4=(M(J4)-((D(X)*F(J4))/N))^2/((D(X)*F(J4))/N)

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3280 D5=F(J4)/N
3330 PRINT USING 1890;J4;D(J4);M(J4);D1;D4;D3;D5;D2/N
3340 WRITE £2 USING 1889;J4;D(J4);M(J4);D1;D4;D3;D5;D2/N
3350 NEXT J4
3360 PRINT USING 1870;"CONCORDS OF VARIABLE AND CONTEXT"
3370 WRITE £2 USING 1870;"CONCORDS OF VARIABLE AND CONTEXT"
3380 FOR J5=1 TO 10
3390 IF D(X)=0 THEN 3520
3400 IF G(J5)=0 THEN 3520
3401 E1=(D(X)/N)*(G(J5)/N)
3410 E2=N(J5)
3420 IF E1=1 THEN LET E1=0.99999999999
3430 E3=(E2-(N*E1))/SQR((N*E1)*(1-E1))
3440 E4=(N(J5)-((D(X)*G(J5))/N))^2/((D(X)*G(J5))/N)
3450 E5=G(J5)/N
3460 E6=N(J5)/N
3500 PRINT USING 1890;J5;G(J5);N(J5);E1;E4;E3;E5;E6
3510 WRITE £2 USING 1889;J5;G(J5);N(J5);E1;E4;E3;E5;E6
3520 NEXT J5
3530 PRINT USING 1870;"CONCORDS OF VARIABLE AND SATISFACTION"
3540 WRITE £2 USING 1870;"CONCORDS OF VARIABLE AND SATISFACTION"
3550 FOR J6=1 TO 4
3560 IF D(X)=0 THEN 3690
3570 IF H(J6)=0 THEN 3690
3580 F1=(D(X)/N)*(H(J6)/N)
3590 F2=O(J6)
3595 IF F1=1 THEN LET F1=0.99999999999
3600 F3=(F2-(N*F1))/SQR((N*F1)*(1-F1))
3610 F4=(O(J6)-((D(X)*H(J6))/N))^2/(D(X)*H(J6))/N
3620 F5=H(J6)/N
3630 F6=O(J6)/N
3640 F7=O(J6)/O3
3670 PRNT USING 1890;J6;H(J6);O(J6);F1;F4;F3;F5;F6;F7
3680 WRITE £2 USING 1889;J6;H(J6);O(J6);F1;F4;F3;F5;F6;F7
3690 NEXT J6
3700 PRINT USING 1870;"CONCORDS OF VARIABLE AND TENSE"
3702 WRITE £2 USING 1870;"CONCORDS OF VARIABLE AND TENSE"
3704 FOR J7=1 TO 3
3706 IF D(X)=0 THEN 3750
3708 IF I(J7)=0 THEN 3750
3710 G1=(D(X)/N)*(I(J7)/N)
3712 G2=P(J7)
3714 IF G1=1 THEN LET G1=0.99999999999
3716 G3=(G2-(N*G1))/SQR((N*G1)*(1-G1))
3718 G4=(P(J7)-((D(X)*I(J7))/N))^2/((D(X)*I(J7))/N)
3720 G5=I(J7)/N
3722 G6=P(J7)/N
3724 G7=P(J7)/O5
3730 PRINT USING 1890;J7;I(J7);P(J7);G1;G4;G3;G5;G6;G7
3740 WRITE £2 USING 1889;J7;I(J7);P(J7);G1;G4;G3;G5;G6;G7
3750 NEXT J7
3760 STOP
3770 END

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0010 DIM A(6)
0020 DIM B$(4)
0022 DIM C(800)
0025 DIM D(52)
0028 DIM E(10)
0032 DIM F(10)
0035 DIM G(10)
0040 DIM H(800)
0045 DIM I(4)
0047 DIM J(3)
0048 DIM K(800)
0050 DIM L(52)
0052 DIM M(10)
0054 DIM N(10)
0056 DIM O(10)
0058 DIM P(800)
0060 DIM Q(4)
0062 DIM R(3)
0064 FILES *;THREE;VARL3
0068 INPUT £3,X1,X1$,Z9$
0110 FILE £1,Z9$
0111 FOR I1=1 TO 600
0112 INPUT £1,A,B,C$,D,E,F,G,H,I,J$,K$,L$,M$,N$,O$
0114 IF B=0 THEN 482
0115 N=N+1
0116 A(1)=D
0117 A(2)=E
0118 A(3)=F
0119 A(4)=G
0120 A(5)=H
0121 A(6)=I
0124 B$(1)=J$
0125 B$(2)=K$
0126 B$(3)=L$
0127 B$(4)=M$
0132 FOR I2=1 TO 6
0134 IF A(I2)=0 THEN 138
0135 N1=N1+1
0137 C(A(I2))=C(A(I2))+1
0138 NEXT I2
0160 FOR I3=1 TO 4
0161 IF B$(I3)="Z" THEN GO TO 245
0162 IF LEN(B$(I3))>1 THEN 193
0170 IF B$(I3)="A" THEN D(1)=D(1)+1
0171 IF B$(I3)="B" THEN D(2)=D(2)+1
0172 IF B$(I3)="C" THEN D(3)=D(3)+1
0173 IF B$(I3)="D" THEN D(4)=D(4)+1
0174 IF B$(I3)="E" THEN D(5)=D(5)+1
0175 IF B$(I3)="F" THEN D(6)=D(6)+1
0176 IF B$(I3)="G" THEN D(7)=D(7)+1
0177 IF B$(I3)="H" THEN D(8)=D(8)+1
0178 IF B$(I3)="I" THEN D(9)=D(9)+1
0179 IF B$(I3)="J" THEN D(10)=D(10)+1
0180 IF B$(I3)="K" THEN D(11)=D(11)+1
0181 IF B$(I3)="L" THEN D(12)=D(12)+1
0182 IF B$(I3)="M" THEN D(13)=D(13)+1
0183 IF B$(I3)="N" THEN D(14)=D(14)+1
0184 IF B$(I3)="O" THEN D(15)=(15)+1
0185 IF B$(I3)="P" THEN D(16)=D(16)+1
0186 IF B$(I3)="Q" THEN D(17)=D(17)+1

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0187 IF B$(I3)="R" THEN D(18)=D(18)+1
0188 IF B$(I3)="S" THEN D(19)=D(19)+1
0189 IF B$(I3)="T" THEN D(20)=D(20)+1
0190 N3=N3+1
0192 GO TO 245
0193 IF RIGHT(B$(I3),1)="*" THEN 220
0195 IF B$(I3)="AA" THEN D(21)=D(21)+1
0196 IF B$(I3)="AB" THEN D(22)=D(22)+1
0197 IF B$(I3)="AC" THEN D(23)=D(23)+1
0198 IF B$(I3)="AD" THEN D(24)=D(24)+1
0199 IF B$(I3)="BA" THEN D(25)=D(25)+1
0200 IF B$(I3)="BB" THEN D(26)=D(26)+1
0201 IF B$(I3)="BC" THEN D(27)=D(27)+1
0202 IF B$(I3)="BD" THEN D(28)=D(28)+1
0203 IF B$(I3)="CA" THEN D(29)=D(29)+1
0204 IF B$(I3)="CB" THEN D(30)=D(30)+1
0205 IF B$(I3)="CC" THEN D(31)=D(31)+1
0206 IF B$(I3)="CD" THEN D(32)=D(32)+1
0207 IF B$(I3)="DA" THEN D(33)=D(33)+1
0208 IF B$(I3)="DB" THEN D(34)=D(34)+1
0209 IF B$(I3)="DC" THEN D(35)=D(35)+1
0210 IF B$(I3)="DD" THEN D(36)=D(36)+1
0212 N5=N5+1
0215 GO TO 245
0220 IF B$(I3)="1*" THEN D(37)=D(37)+1
0221 IF B$(I3)="2*" THEN D(38)=D(38)+1
0222 IF B$(I3)="3*" THEN D(39)=D(39)+1
0223 IF B$(I3)="4*" THEN D(40)=D(40)+1
0224 IF B$(I3)="5*" THEN D(41)=D(41)+1
0225 IF B$(I3)="6*" THEN D(42)=D(42)+1
0226 IF B$(I3)="7*" THEN D(43)=D(43)+1
0227 IF B$(I3)="8*" THEN D(44)=D(44)+1
0228 IF B$(I3)="9*" THEN D(45)=D(45)+1
0229 IF B$(I3)="10*" THEN D(46)=D(46)+1
0230 IF B$(I3)="11*" THEN D(47)=D(47)+1
0231 IF B$(I3)="12*" THEN D(48)=D(48)+1
0232 IF B$(I3)="13*" THEN D(49)=D(49)+1
0233 IF B$(I3)="14*" THEN D(50)=D(50)+1
0234 IF B$(I3)="15*" THEN D(51)=D(51)+1
0235 IF B$(I3)="16*" THEN D(52)=D(52)+1
0240 N7=N7+1
0245 NEXT I3
0250 IF C$="A" THEN E(B)=E(B)+1
0251 IF C$="B" THEN F(B)=F(B)+1
0252 IF C$="C" THEN G(B)=G(B)+1
0253 IF N$="X" THEN I(4)=I(4)+1
0255 H(A)=H(A)+1
0260 IF N$="O" THEN 270
0262 IF N$="Y" THEN I(1)=I(1)+1
0264 IF N$="Z" THEN I(2)=I(2)+1
0266 O4=O4+1
0270 IF N$="O" THEN I(3)=I(3)+1
0272 IF O$="O" THEN 278
0274 IF O$="V" THEN J(1)=J(1)+1
0276 IF O$="W" THEN J(2)=J(2)+1
0277 O2=O2+1
0278 IF O$="O" THEN J(3)=J(3)+1
0285 REM CONCORD SELECTION ROUTINE
0290 IF B=X1 THEN 295
0292 GO TO 339

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0295 IF X1$="A" THEN 300
0296 IF X1$="B" THEN GO TO 310
0298 IF X1$="C" THEN GO TO 320
0299 GO TO 330
0300 REM SUBLOOP STRONG CONTRIBS
0302 IF C$="A" THEN GO TO 340
0304 GO TO 339
0310 REM SUBLOOP MEDIUM CONTRIBS
0312 IF C$="B" THEN GO TO 340
0314 GO TO 339
0320 REM SUBLOOP WEAK CONTRIBS
0322 IF C$="C" THEN GO TO 340
0324 GO TO 339
0330 REM SUBLOOP ALL CONTRIBS
0332 GO TO 340
0339 GO TO 482
0340 REM CONTRIB LOOP
0342 FOR I4=1 TO 6
0344 IF A(I4)=0 THEN 350
0346 N2=N2+1
0348 K(A(I4))=K(A(I4))+1
0350 NEXT I4
0352 FOR I5=1 TO 4
0353 IF B$(I5)="Z" THEN 428
0354 IF LEN(B$(I5))>1 THEN 382
0356 IF B$(I5)="A" THEN L(1)=L(1)+1
0357 IF B$(I5)="B" THEN L(2)=L(2)+1
0358 IF B$(I5)="C" THEN L(3)=L(3)+1
0359 IF B$(I5)="D" THEN L(4)=L(4)+1
0360 IF B$(I5)="E" THEN L(5)=L(5)+1
0361 IF B$(I5)="F" THEN L(6)=L(6)+1
0362 IF B$(I5)="G" THEN L(7)=L(7)+1
0363 IF B$(I5)="H" THEN L(8)=L(8)+1
0364 IF B$(I5)="I" THEN L(9)=L(9)+1
0365 IF B$(I5)="J" THEN L(10)=L(10)+1
0366 IF B$(I5)="K" THEN L(11)=L(11)+1
0367 IF B$(I5)="L" THEN L(12)=L(12)+1
0368 IF B$(I5)="M" THEN L(13)=L(13)+1
0369 IF B$(I5)="N" THEN L(14)=L(14)+1
0370 IF B$(I5)="O" THEN L(15)=L(15)+1
0371 IF B$(I5)="P" THEN L(16)=L(16)+1
0372 IF B$(I5)="Q" THEN L(17)=L(17)+1
0373 IF B$(I5)="R" THEN L(18)=L(18)+1
0374 IF B$(I5)="S" THEN L(19)=L(19)+1
0375 IF B$(I5)="T" THEN L(20)=L(20)+1
0380 N4=N4+1
0381 GO TO 428
0382 IF RIGHT(B$(I5),1)="*" THEN 412
0390 IF B$(I5)="AA" THEN L(21)=L(21)+1
0391 IF B$(I5)="AB" THEN L(22)=L(22)+1
0392 IF B$(I5)="AC" THEN L(23)=L(23)+1
0393 IF B$(I5)="AD" THEN L(24)=L(24)+1
0395 IF B$(I5)="BA" THEN L(25)=L(25)+1
0396 IF B$(I5)="BB" THEN L(26)=L(26)+1
0397 IF B$(I5)="BC" THEN L(27)=L(27)+1
0397 IF B$(I5)="BC" THEN L(27)=L(27)+1
0398 IF B$(I5)="BD" THEN L(28)=L(28)+1
0399 IF B$(I5)="CA" THEN L(29)=L(29)+1
0400 IF B$(I5)="CB" THEN L(30)=L(30)+1
0402 IF B$(I5)="CC" THEN L(31)=L(31)+1

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0403 IF B$(I5)="CD" THEN L(32)=L(32)+1
0404 IF B$(I5)="DA" THEN L(33)=L(33)+1
0405 IF B$(I5)="DB" THEN L(34)=L(34)+1
0406 IF B$(I5)="DC" THEN L(35)=L(35)+1
0407 IF B$(I5)="DD" THEN L(36)=L(36)+1
0409 N6=N6+1
0410 GO TO 428
0411 IF B$(I5)="8*" THEN L(44)=L(44)+1
0412 IF B$(I5)="1*" THEN L(37)=L(37)+1
0413 IF B$(I5)="2*" THEN L(38)=L(38)+1
0414 IF B$(I5)="3*" THEN L(39)=L(39)+1
0415 IF B$(I5)="4*" THEN L(40)=L(40)+1
0416 IF B$(I5)="5*" THEN L(41)=L(41)+1
0417 IF B$(I5)="6*" THEN L(42)=L(42)+1
0418 IF B$(I5)="7*" THEN L(43)=L(43)+1
0419 IF B$(I5)="9*" THEN L(45)=L(45)+1
0420 IF B$(I5)="10*" THEN L(46)=L(46)+1
0421 IF B$(I5)="11*" THEN L(47)=L(47)+1
0422 IF B$(I5)="12*" THEN L(48)=L(48)+1
0423 IF B$(I5)="13*" THEN L(49)=L(49)+1
0424 IF B$(I5)="14*" THEN L(50)=L(50)+1
0425 IF B$(I5)="15*" THEN L(51)=L(51)+1
0426 IF B$(I5)="16*" THEN L(52)=L(52)+1
0427 N8=N8+1
0428 NEXT I5
0430 IF C$="A" THEN M(B)=M(B)+1
0432 IF C$="B" THEN N(B)=N(B)+1
0434 IF C$="C" THEN O(B)=O(B)+1
0455 P(A)=P(A)+1
0457 IF N$="X" THEN Q(4)=Q(4)+1
0460 IF N$="O" THEN 470
0462 IF N$="Y" THEN Q(1)=Q(1)+1
0464 IF N$="Z" THEN Q(2)=Q(2)+1
0466 O5=O5+1
0470 IF N$="O" THEN Q(3)=Q(3)+1
0472 IF O$="O" THEN 478
0474 IF O$="V" THEN R(1)=R(1)+1
0476 IF O$="W" THEN R(2)=R(2)+1
0477 O5=O5+1
0478 IF O$="O" THEN R(3)=R(3)+1
0480 N9=N3+N5+N7+N9
0481 O1=N2+N4+N6+N8
0482 NEXT I1
0490 REM ANALYSIS SECTION
0499:      fff
0500: 'CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
0501 SCRATCH f2
0504: ffff ffff ffff f.ffff f.ffff f.ffff f.ffff f.ffff f.ffff
0505: ffff ffff ffff f.ffff f.ffff f.ffff f.ffff f.ffff f.ffff
0506: ffff f.ffff f.ffff f.ffff f.ffff f.ffff f.ffff
0507 WRITE f2 USING 500;"RESULTS OF A CONTRIB (PROG3) ANALYSIS"
0508 WRITE f2 USING 500;"FILE....."
0509 WRITE f2 USING 500;Z9$
0510 WRITE f2 USING 500;"CONTRIBUTION....."
0510 WRITE f2 USING 500;"CONTRIBUTION....."
0511 WRITE f2 USING 499;X1
0512 WRITE f2 USING 500;"STRENGTH CHARACTERISTIC....."
0513 WRITE f2 USING 500;X1$
0514 IF X1$="A" THEN A1=E(X1)
0515 IF X1$="B" THEN A1=F(X1)

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0516 IF X1$="C" THEN A1=G(X1)
0517 IF X1$="D" THEN A1=(E(X1)+F(X1)+G(X1))
0518 PRINT USING 500;"ANALYSIS OF RECORDS"
0519 WRITE £2 USING 500;"ANALYSIS OF RECORDS"
0520 Y7=(E(X1)+F(X1)+G(X1))
0521 IF Y7=0 THEN G1=0
0522 IF Y7>0 THEN G1=A1/Y7
0523 IF N2=0 THEN G2=0
0524 IF N2>0 THEN G2=A1/N2
0525 Y8=N4+N6+N8
0526 IF Y8=0 THEN G3=0
0527 IF Y8>0 THEN G3=A1/Y8
0528 IF N1=0 THEN G4=0
0529 IF N1>0 THEN G4=A1/N1
0530 Y9=N3+N5+N7
0531 IF Y9=0 THEN G5=0
0532 IF Y9>0 THEN G5=A1/Y9
0533 PRINT USING 506;N,A1/N,G1,G2,G3,G4,G5
0534 WRITE £2 USING 506;N,A1/N,G1,G2,G3,G4,G5
0548 PRINT USING 500;"CONCORDS OF CONTRIB AND NUMBERS"
0549 WRITE £2 USING 500;"CONCORDS OF CONTRIB AND NUMBERS"
0552 FOR K1=1 TO 800
0553 IF A1=0 THEN 565
0554 IF C(K1)=0 THEN 565
0556 A2=K(K1)
0557 A3=(A1/N)*(C(K1)/N)
0558 A5=(A2-(N*A3))/SQR((N*A3)*(1-A3))
0559 A4=(K(K1)-((A1*C(K1))/N))^2/((A1*C(K1))/N)
0560 A6=K(K1)/N1
0562 PRINT USING 505;K1,C(K1),K(K1),C(K1)/N,A3,K(K1)/N,A4,A5,A6
0563 WRITE £2 USING 505;K1,C(K1),K(K1),C(K1)/N,A3,K(K1)/N,A4,A5,A6
0565 NEXT K1
0570 PRINT USING 500;"CONCORDS OF CONTRIB AND LETTERS"
0572 WRITE £2 USING 500;"CONCORDS OF CONTRIB AND LETTERS"
0575 FOR K2=1 TO 20
0576 IF D(K2)=0 THEN 590
0578 IF A1=0 THEN 590
0580 B2=L(K2)
0581 B3=(A1/N)*(D(K2)/N)
0582 IF B3=1 THEN LET B3=0.99999999
0583 B5=(B2-(N*B3))/SQR((N*B3)*(1-B3))
0585 B4=(L(K2)-((A1*D(K2))/N))^2/((A1*D(K2))/N)
0586 B6=L(K2)/O1
0588 PRINT USING 505;K2,D(K2),L(K2),D(K2)/N,B3,L(K2)/N,B4,B5,B6
0589 WRITE £2 USING 505;K2,D(K2),L(K2),D(K2)/N,B3,L(K2)/N,B4,B5,B6
0590 NEXT K2
0595 PRINT USING 500;"CONCORDS OF CONTRIB AND DOUBLE LETTERS"
0597 WRITE £2 USING 500;"CONCORDS OF CONTRIB AND DOUBLE LETTERS"
0599 FOR K3=21 TO 36
0600 IF D(K3)=0 THEN 620
0602 IF A1=0 THEN 620
0604 C2=L(K3)
0606 C3=(A1/N)*(D(K3)/N)
0608 IF C3=0 THEN LET C3=0.99999999
0609 C5=(C2-(N*C3))/SQR((N*C3)*(1-C3))
0610 C4=(L(K3)-((A1*D(K3))/N))^2/((A1*D(K3))/N)
0612 C6=L(K3)/O1
0614 PRINT USING 505;K3,D(K3),L(K3),D(K3)/N,C3,L(K3)/N,C4,C5,C6
0616 WRITE £2 USING 505;K3,D(K3),L(K3),D(K3)/N,C3,L(K3)/N,C4,C5,C6
0620 NEXT K3

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0622 PRINT USING 500;"CONCORDS OF VARIABLE AND ASERISK NUMBERS"
0624 WRITE £2 USING 500;"CONCORDS OF VARIABLE AND ASTERISK NUMBERS"
0626 FOR K4=37 TO 52
0628 IF D(K4)=0 THEN 646
0630 IF A1=0 THEN 646
0632 D2=L(K4)
0634 D3=(A1/N)*(D(K4)/N)
0635 IF D3=0 THEN LET D3=0.999999999
0636 D5=(D2-(N*D3))/SQR((N*D3)*(1-D3))
0638 D4=(L(K4)-((A1*D(K4))/N))^2/((A1*D(K4))/N)
0640 D6=L(K4)/O1
0642 PRINT USING 505;K4;D(K4);L(K4);D(K4)/N;D3;L(K4)/N;D4;D5;D6
0644 WRITE £2 USING 505;K4;D(K4);L(K4);D(K4)/N;D3;L(K4)/N;D4;D5;D6
0646 NEXT K4
0648 PRINT USING 500;"CONCORDS OF CONTRIB AND SATISFACTION"
0650 WRITE £2 USING 500;"CONCORDS OF CONTRIB AND SATISFACTION"
0652 FOR K5=1 TO 4
0653 IF A1=0 THEN 665
0655 IF I(K5)=0 THEN 665
0657 E2=Q(K5)
0658 E3=(A1/N)*(I(K5)/N)
0659 E5=(E2-(N*E3))/SQR((N*E3)*(1-E3))
0659 E5=(E2-(N*E3))/SQR((N*E3)*(1-E3))
0660 E4=(Q(K5)-((I(K5)*A1)/N))^2/((I(K5)*A1)/N)
0661 E6=Q(K5)/O1
0662 PRINT USING 505;K5;I(K5);Q(K5);I(K5)/N;E3;Q(K5)/N;E4;E5;E6
0664 WRITE £2 USING 505;K5;I(K5);Q(K5);I(K5)/N;E3;Q(K5)/N;E4;E5;E6
0665 NEXT K5
0670 PRINT USING 500;"CONCORDS OF CONTRIB AND TENSE"
0672 WRITE £2 USING 500;"CONCORDS OF CONTRIB AND TENSE"
0674 FOR K6=1 TO 3
0676 IF A1=0 THEN 694
0678 IF J(K6)=0 THEN 694
0680 F2=R(K6)
0682 F3=(A1/N)*(J(K6)/N)
0684 F5=(F2-(N*F3))/SQR((N*F3)*(1-F3))
0686 F4=(R(K6)-((A1*J(K6))/N))^2/((A1*J(K6))/N)
0688 F6=R(K6)/O1
0690 PRINT USING 505;K6;J(K6);R(K6);J(K6)/N;F3;R(K6)/N;F4;F5;F6
0692 WRITE £2 USING 505;K6;J(K6);R(K6);J(K6)/N;F3;R(K6)/N;F4;F5;F6
0694 NEXT K6
0696 STOP
0698 END

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0010 DIM A(5)
0020 DIM A$(3)
0030 DIM A1(800)
0040 DIM A2(52)
0050 DIM A3(16)
0060 DIM A4(24)
0070 DIM A5(24)
0080 DIM A6(24)
0090 DIM A7(15)
0100 DIM A8(15)
0110 DIM A9(15)
0130 DIM B1(800)
0140 DIM B2(52)
0150 DIM B3(16)
0160 DIM B4(24)
0170 DIM B5(24)
0180 DIM B6(24)
0190 DIM B7(15)
0200 DIM B8(15)
0210 DIM B9(15)
0212 DIM C1(2)
0214 DIM C2(2)
0215 FILES *;FOUR;VARL4
0217 INPUT £3;Y$;Z9$
0230 FILE £1;Z9$
0240 FOR I1=1 TO 1000
0250 INPUT £1;A$;B;C;D$;E;F$;G;H;I;J;K;L$;M$;N$
0260 IF C=0 THEN 1070
0265 N=N+1
0270 IF A$="AA" THEN A3(1)=A3(1)+1
0280 IF A$="AB" THEN A3(2)=A3(2)+1
0290 IF A$="AC" THEN A3(3)=A3(3)+1
0300 IF A$="AD" THEN A3(4)=A3(4)+1
0310 IF A$="BA" THEN A3(5)=A3(5)+1
0320 IF A$="BB" THEN A3(6)=A3(6)+1
0330 IF A$="BC" THEN A3(7)=A3(7)+1
0340 IF A$="BD" THEN A3(8)=A3(8)+1
0350 IF A$="CA" THEN A3(9)=A3(9)+1
0360 IF A$="CB" THEN A3(10)=A3(10)+1
0370 IF A$="CC" THEN A3(11)=A3(11)+1
0380 IF A$="CD" THEN A3(12)=A3(12)+1
0390 IF A$="DA" THEN A3(13)=A3(13)+1
0400 IF A$="DB" THEN A3(14)=A3(14)+1
0410 IF A$="DC" THEN A3(15)=A3(15)+1
0420 IF A$="DD" THEN A3(16)=A3(16)+1
0423 IF B=1 THEN C1(1)=C1(1)+1
0425 IF B=2 THEN C1(2)=C1(2)+1
0427 IF D$="Z" THEN 455
0430 IF D$="A" THEN A4(C)=A4(C)+1
0440 IF D$="B" THEN A5(C)=A5(C)+1
0450 IF D$="C" THEN A6(C)=A6(C)+1
0455 IF F$="Z" THEN 490
0460 IF F$="D" THEN A7(E)=A7(E)+1
0470 IF F$="E" THEN A8(E)=A8(E)+1
0480 IF F$="F" THEN A9(E)=A9(E)+1
0490 A(1)=G
0500 A(2)=H
0510 A(3)=I
0520 A(4)=J
0530 A(5)=K

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0540 A$(1)=L$
0550 A$(2)=M$
0560 A$(3)=N$
0570 FOR I2=1 TO 5
0573 IF A(I2)=0 THEN 590
0575 IF A(I2)>0 THEN N1=N1+1
0580 A1(A(I2))=A1(A(I2))+1
0590 NEXT I2
0610 FOR I3=1 TO 3
0615 IF A$(I3)="Z" THEN 1060
0620 IF LEN(A$(I3))>1 THEN 840
0630 IF A$(I3)="A" THEN A2(1)=A2(1)+1
0640 IF A$(I3)="B" THEN A2(2)=A2(2)+1
0650 IF A$(I3)="C" THEN A2(3)=A2(3)+1
0660 IF A$(I3)="D" THEN A2(4)=A2(4)+1
0670 IF A$(I3)="E" THEN A2(5)=A2(5)+1
0680 IF A$(I3)="F" THEN A2(6)=A2(6)+1
0690 IF A$(I3)="G" THEN A2(7)=A2(7)+1
0700 IF A$(I3)="H" THEN A2(8)=A2(8)+1
0710 IF A$(I3)="I" THEN A2(9)=A2(9)+1
0720 IF A$(I3)="J" THEN A2(10)=A2(10)+1
0730 IF A$(I3)="K" THEN A2(11)=A2(11)+1
0740 IF A$(I3)="L" THEN A2(12)=A2(12)+1
0750 IF A$(I3)="M" THEN A2(13)=A2(13)+1
0760 IF A$(I3)="N" THEN A2(14)=A2(14)+1
0770 IF A$(I3)="O" THEN A2(15)=A2(15)+1
0780 IF A$(I3)="P" THEN A2(16)=A2(16)+1
0790 IF A$(I3)="Q" THEN A2(17)=A2(17)+1
0800 IF A$(I3)="R" THEN A2(18)=A2(18)+1
0810 IF A$(I3)="S" THEN A2(19)=A2(19)+1
0820 IF A$(I3)="T" THEN A2(20)=A2(20)+1
0825 N2=N2+1
0830 GO TO 1060
0840 IF RIGHT(A$(I3),1)="*" THEN 1030
0850 IF A$(I3)="AA" THEN A2(21)=A2(21)+1
0860 IF A$(I3)="AB" THEN A2(22)=A2(22)+1
0870 IF A$(I3)="AC" THEN A2(23)=A2(23)+1
0880 IF A$(I3)="AD" THEN A2(24)=A2(24)+1
0890 IF A$(I3)="BA" THEN A2(25)=A2(25)+1
0900 IF A$(I3)="BB" THEN A2(26)=A2(26)+1
0910 IF A$(I3)="BC" THEN A2(27)=A2(27)+1
0920 IF A$(I3)="BD" THEN A2(28)=A2(28)+1
0930 IF A$(I3)="CA" THEN A2(29)=A2(29)+1
0940 IF A$(I3)="CB" THEN A2(30)=A2(30)+1
0950 IF A$(I3)="CC" THEN A2(31)=A2(31)+1
0960 IF A$(I3)="CD" THEN A2(32)=A2(32)+1
0970 IF A$(I3)="DA" THEN A2(33)=A2(33)+1
0980 IF A$(I3)="DB" THEN A2(34)=A2(34)+1
0990 IF A$(I3)="DC" THEN A2(35)=A2(35)+1
1000 IF A$(I3)="DD" THEN A2(36)=A2(36)+1
1005 N3=N3+1
1010 GO TO 1060
1030 IF A$(I3)="1*" THEN A2(37)=A2(37)+1
1040 IF A$(I3)="2*" THEN A2(38)=A2(38)+1
1041 IF A$(I3)="3*" THEN A2(39)=A2(39)+1
1042 IF A$(I3)="4*" THEN A2(40)=A2(40)+1
1044 IF A$(I3)="5*" THEN A2(41)=A2(41)+1
1045 IF A$(I3)="6*" THEN A2(42)=A2(42)+1
1046 IF A$(I3)="7*" THEN A2(43)=A2(43)+1
1047 IF A$(I3)="8*" THEN A2(44)=A2(44)+1

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1048 IF A$(I3)="9*" THEN A2(45)=A2(45)+1
1049 IF A$(I3)="10*" THEN A2(46)=A2(46)+1
1050 IF A$(I3)="11*" THEN A2(47)=A2(47)+1
1051 IF A$(I3)="12*" THEN A2(48)=A2(48)+1
1052 IF A$(I3)="13*" THEN A2(49)=A2(49)+1
1053 IF A$(I3)="14*" THEN A2(50)=A2(50)+1
1054 IF A$(I3)="15*" THEN A2(51)=A2(51)+1
1055 IF A$(I3)="16*" THEN A2(52)=A2(52)+1
1057 N4=N4+1
1060 NEXT I3
1065 IF A$=Y$ THEN GOSUB 3000
1070 NEXT I1
1500 SCRATCH £2
1520:'CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
1521:'CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
1530:  ££££ ££££ ££.££ ££££ ££££ ££.££ ££££ ££££ ££.££
1532 WRITE £2 USING 1520;"RESULTS OF CONTRIBUTOR (PROG4) ANALYSIS"
1533 WRITE £2 USING 1520;"MEETING....."
1534 WRITE £2 USING 1520;Z9$
1535 WRITE £2 USING 1520;"CONTRIBUTOR....."
1536 WRITE £2 USING 1520;Y$
1540 PRINT USING 1520;"ANALYSIS OF RECORDS"
1541 WRITE £2 USING 1521;"ANALYSIS OF RECORDS"
1542 IF C1(1)=0 THEN 1545
1543 C1=(C2(1)/C1(1))
1544 GO TO 1546
1545 C1=0
1546 IF C1(2)=0 THEN 1549
1547 C2=(C2(2)/C1(2))
1548 GO TO 1555
1549 C2=0
1555 PRINT USING 1530;N,N5,(N5/N);C1(1);C2(1);C1;C1(2);C2(2);C2
1556 WRITE £2 USING 1530;N,N5,(N5/N);C1(1);C2(1);C1;C1(2);C2(2);C2
1570 PRINT
1574:£££ £££ £££ £.£££ £££ £££ £.£££ £££ £££ £.£££ £££ £££ £.£££
1575:£££ £££ £££ £.£££ £££ £££ £.£££ £££ £££ £.£££ £££ £££ £.£££
1577 PRINT USING 1520;"ANALYSIS OF CONTRIBUTIONS"
1578 WRITE £2 USING 1521;"ANALYSIS OF CONTRIBUTIONS"
1580 FOR K1=1 TO 24
1581 D1=A4(K1)+A5(K1)+A6(K1)
1582 D2=B4(K1)+B5(K1)+B6(K1)
1583 IF D1=0 THEN LET D1=0.0000000009
1584 D3=D2/D1
1585 IF A4(K1)=0 THEN LET A4(K1)=0.0000000009
1586 D6=(B4(K1))/(A4(K1))
1587 IF A5(K1)=0 THEN LET A5(K1)=0.0000000009
1588 D8=(B5(K1))/(A5(K1))
1589 IF A6(K1)=0 THEN LET A6(K1)=0.0000000009
1590 D9=(B6(K1))/(A6(K1))
1591 D5=B4(K1)
1613 D4=A4(K1)
1616 D7=A5(K1)
1619 PRINT USING 1575;K1;D1;D2;D3;D4;D5;D6;D7;B5(K1);D8;A6(K1);B6(K1);D9
1620 Z7=B6(K1)
1621 WRITE £2 USING 1575;K1;D1;D2;D3;D4;D5;D6;D7;B5(K1);D8;A6(K1);Z7
1625 NEXT K1
1629 PRINT USING 1520;"ANALYSIS OF SUBJECT"
1630 WRITE £2 USING 1520;"ANALYSIS OF SUBJECT"
1631 FOR K2=1 TO 15
1632 IF A7(K2)=0 THEN LET A7(K2)=0.000000009

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1633 IF A8(K2)=0 THEN LET A8(K2)=0.000000009
1634 IF A9(K2)=0 THEN LET A9(K2)=0.000000009
1637 E1=A7(K2)+A8(K2)+A9(K2)
1638 E2=B7(K2)+B8(K2)+B9(K2)
1639 E3=E2/E1
1640 E4=A7(K2)
1641 E5=B7(K2)
1642 E6=(B7(K2))/(A7(K2))
1643 E7=A8(K2)
1644 E8=(B8(K2))/(A8(K2))
1645 E9=(B9(K2))/(A9(K2))
1646 PRINT USING 1575;K2,E1,E2,E3,E4,E5,E6,E7,B8(K2),E8,A9(K2),B9(K2),E9
1647 Z8=B9(K2)
1648 WRITE £2 USING 1574;K2,E1,E2,E3,E4,E5,E6,E7,B8(K2),E8,A9(K2),Z8,E9
1652 NEXT K2
1665 FOR K3=1 TO 800
1666 O2=O2+A1(K3)
1667 O3=O3+B1(K3)
1668 NEXT K3
1669 FOR K4=1 TO 52
1670 O4=O4+A2(K4)
1671 O5=O5+B2(K4)
1672 NEXT K4
1673:   fff  ffff  ffff  ff.ffff
1674 PRINT USING 1520;"ANALYSIS OF NUMERIC ARIABLES"
1675 WRITE £2 USING 1520;"ANALYSIS OF NUMERIC VARIABLES"
1678 FOR K5=1 TO 800
1679 IF A1(K5)=0 THEN 1685
1680 PRINT USING 1673;K5,A1(K5),B1(K5),(B1(K5))/(A1(K5))
1681 WRITE £2 USING 1673;K5,A1(K5),B1(K5),(B1(K5))/(A1(K5))
1685 NEXT K5
1686 PRINT USING 1520;"ANALYSIS OF CHARACTERS"
1687 WRITE £2 USING 1520;"ANALYSIS OF CHARACTERS"
1690 FOR K6=1 TO 52
1691 IF A2(K6)=0 THEN 1753
1692 PRINT USING 1673;K6,A2(K6),B2(K6),(B2(K6))/(A2(K6))
1693 WRITE £2 USING 1673;K6,A2(K6),B2(K6),(B2(K6))/(A2(K6))
1695
1753 NEXT K6
1755: ffff ffff ffff f.ffff f.ffff f.ffff f.ffff f.ffff f.ffff
1756 PRINT USING 1520;"CONCORDS OF VARIABLE AND IN/OUTPUTS"
1757 WRITE £2 USING 1520;"CONCORDS OF VARIABLE AND IN/OUTPUTS"
1760 M1=(C1(1)/N)*(N5/N)
1761 IF M1=1 THEN LET M1=0.999999999999
1762 IF M1=0 THEN LET M1=0.000000000009
1770 M2=C2(1)
1775 M3=(M2-(N*M1))/SQR((N*M1)*(1-M1))
1777 M4=(C2(1)-((C1(1)*N5)/N))^2/((C1(1)*N5)/N)
1778 M5=C1(1)/N
1779 M6=C2(1)/N
1780 :   ffff  ffff  f.fff  f.fff  f.fff  f.fff  f.fff
1785 PRINT USING 1780;C1(1),C2(1),M1,M4,M3,M5,M6
1786 WRITE £2 USING 1780;C1(1),C2(1),M1,M4,M3,M5,M6
1790 Q1=(C2(1)/N)*(N5/N)
1791 Q2=C2(2)
1792 Q3=(Q2-(N*Q1))/SQR((N*Q1)*(1-Q1))
1794 Q4=(C2(2)-((N5*C2(1))/N))^2/((N5*C2(1))/N)
1796 Q5=C1(2)/N
1798 Q6=C2(2)/N
1800 PRINT USING 1780;C2(1),C2(2),Q1,Q4,Q3,Q5,Q6

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1805 WRITE £2 USING 1780;C2(1);C2(2);Q1;Q4;Q3;Q5;Q6
1810 PRINT USING 1520;"COCNCORDS OF VARIABLE AND CONTRIBUTION TYPE"
1811 WRITE £2 USING 1520;"CONCORDS OF VARIABLE AND CONTRIBUTION TYPE"
1812 PRINT
1813 PRINT
1820 PRINT USING 1520;"(A).. CONCORDS OF VARIABLE AND STRONG CONTRIBS"
1821 WRITE £2 USING 1520;"(A)..CONCORDS OF VARIABLE AND STRONG CNTRIBS"
1825 FOR K7=1 TO 24
1826 IF A4(K7)<0.0009 THEN 1838
1827 R1=(C2(1)/N)*(A4(K7)/N)
1828 IF R1=1 THEN LET R1=0.99999999999
1830 R2=B4(K7)
1831 R3=(R2-(N*R1))/SQR((N*R1)*(1-R1))
1832 R4=(B4(K7)-((C2(1)*A4(K7))/N))^2/((C2(1)*A4(K7))/N)
1833 R5=A4(K7)/N
1835 R6=B4(K7)/N
1836 PRINT USING 1755;K7;A4(K7);B4(K7);R1;R4;R3;R5;R6
1837 WRITE £2 USING 1755;K7;A4(K7);B4(K7);R1;R4;R3;R5;R6
1838 NEXT K7
1839 PRINT
1840 PRINT USING 1520;"(B)..CONCORDS OF VARIABLE AND MED CONTRIBS"
1841 WRITE £2 USING 1520;"(B)..CONCORDS OF VARIABLE AND MED CONTRIBS"
1845 FOR K8=1 TO 24
1846 IF A5(K8)<0.0009 THEN 1862
1849 R7=(C2(1)/N)*(A5(K8)/N)
1850 IF R7=1 THEN LET R7=0.99999999999
1851 R8=B5(K8)
1852 R9=(R8-(N*R7))/SQR((N*R7)*(1-R7))
1853 S1=(B5(K8)-((C2(1)*A5(K8))/N))^2/((C2(1)*A5(K8))/N)
1854 S2=A5(K8)/N
1855 S3=B5(K8)/N
1860 PRINT USING 1755;K8;A5(K8);B5(K8);R7;S1;R9;S2;S3
1861 WRITE £2 USING 1755;K8;A5(K8);B5(K8);R7;S1;R9;S2;S3
1862 NEXT K8
1870 PRINT
1871 PRINT USING 1520;"(C)..CONCORDS OF VARIABLE AND WEAK CONTRIBS"
1872 WRITE £2 USING 1520;"(C)..CONCORDS OF VARIABLE AND WEAK CONTRIBS"
1873 FOR K9=1 TO 22
1874 IF A6(K9)<0.0009 THEN 1886
1876 S4=(C2(1)/N)*(A6(K9)/N)
1877 IF S4=1 THEN LET S4=0.99999999999
1878 S5=B6(K9)
1879 S6=(S5-(N*S4))/SQR((N*S4)*(1-S4))
1880 S7=(B6(K9)-((C2(1)*A6(K9))/N))^2/((C2(1)-A6(K9))/N)
1881 S8=A6(K9)/N
1882 S9=B6(K9)/N
1884 PRINT USING 1755;K9;A6(K9);B6(K9);S4;S7;S6;S8;S9
1885 WRITE £2 USING 1755;K9;A6(K9);B6(K9);S4;S7;S6;S8;S9
1886 NEXT K9
1887 PRINT
1890 PRINT USING 1520;"CONCORDS OF VARIABLE AND SUBJECT"
1891 WRITE £2 USING 1520;"CONCORDS OF VARIABLE AND SUBJECT"
1892 PRINT
1893 PRINT USING 1520;"(A)..CONCORDS OF VARIABLE AND BRIEFED SUBJECTS"
1894 WRITE £2 USING 1520;"(A)..CONCORDS OF VARIABLE AND B'FD SUBJECTS"
1895 FOR L1=1 TO 15
1896 IF A7(L1)<0.0009 THEN 1915
1900 T1=(C2(1)/N)*(A7(L1)/N)
1901 IF T1=1 THEN LET T1=0.99999999999
1906 T2=B7(L1)

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2058 W4=(B2(L5)-((C2(1)*A2(L5))/N))^2/((C2(1)*A2(L5))/N)
2060 W5=A2(L5)/N
2065 W6=B2(L5)/N
2080 PRINT USING 1755;L5;A2(L5);B2(L5);W1;W4;W3;W5;W6
2081 WRITE £2 USING 1755;L5;A2(L5);B2(L5);W1;W4;W3;W5;W6
2090 NEXT L5
2100 PRINT USING 1520;"CONCORDS OF CONTRIBUTOR AND ALL CONTRIBS"
2105 WRITE £2 USING 1520;"CONCORDS OF CONTRIBUTOR AND ALL CONTRIBS"
2110 FOR L8=1 TO 24
2115 Y1=(A4(L8)+A5(L8)+A6(L8))
2116 IF Y1=0 THEN 2145
2120 Y2=(B4(L8)+B5(L8)+B6(L8))
2125 Y3=(C2(1)/N)*((A4(L8)+A5(L8)+A6(L8))/N)
2126 IF Y3=1 THEN LET Y3=0.9999999999
2130 Y4=(Y2-(N*Y3))/SQR((N*Y3)*(1-Y3))
2132 Z8=(C2(1)*(A4(L8)+A5(L8)+A6(L8)))/N
2133 Z7=(Y2-Z8)^2/Z8
2135 PRINT USING 1755;L8;Y1;Y2;Y3;Y2/N;Z7;Y4;Y1/N;Y2/N
2140 WRITE £2 USING 1755;L8;Y1;Y2;Y3;Y2/N;Z7;Y4;Y1/N;Y2/N
2145 NEXT L8
2150 PRINT USING 1520;"CONCORDS OF CONTRIBUTOR AND ALL SUBS"
2155 WRITE £2 USING 1520;"CONCORDS OF CONTRIBUTOR AND ALL SUBS"
2160 FOR L9=1 TO 15
2165 Y5=(A7(L9)+A8(L9)+A9(L9))
2170 IF Y5=0 THEN 2250
2180 Y6=(B7(L9)+B8(L9)+B9(L9))
2185 Y7=(C2(1)/N)*((A7(L9)+A8(L9)+A9(L9))/N)
2190 IF Y7=1 THEN LET Y7=0.99999999
2195 Y8=(Y6-(N*Y7))/SQR((N*Y7)*(1-Y7))
2197 Z4=(C2(1)*(A7(L9)+A8(L9)+A9(L9)))/N
2199 Z5=(Y6-Z4)^2/Z4
2200 PRINT USING 1755;L9;Y5;Y6;Y7;Y6/N;Z5;Y8;Y5/N;Y6/N
2220 WRITE £2 USING 1755;L9;Y5;Y6;Y7;Y6/N;Z5;Y8;Y5/N;Y6/N
2250 NEXT L9
2260 GO TO 3221
3000 REM SUBROUTINE 3000
3080 N5=N5+1
3084 IF B$="AA" THEN B3(1)=B3(1)+1
3086 IF A$="AB" THEN B3(2)=B3(2)+1
3088 IF A$="AC" THEN B3(3)=B3(3)+1
3090 IF A$="AD" THEN B3(4)=B3(4)+1
3092 IF A$="BA" THEN B3(5)=B3(5)+1
3093 IF A$="BB" THEN B3(6)=B3(6)+1
3094 IF A$="BC" THEN B3(7)=B3(7)+1
3094 IF A$="BC" THEN B3(7)=B3(7)+1
3095 IF A$="BD" THEN B3(8)=B3(8)+1
3096 IF A$="CA" THEN B3(9)=B3(9)+1
3097 IF A$="CB" THEN B3(10)=B3(10)+1
3098 IF A$="CC" THEN B3(11)=B3(11)+1
3099 IF A$="CD" THEN B3(12)=B3(12)+1
3100 IF A$="DA" THEN B3(13)=B3(13)+1
3101 IF A$="DB" THEN B3(14)=B3(14)+1
3102 IF A$="DC" THEN B3(15)=B3(15)+1
3103 IF A$="DD" THEN B3(16)=B3(16)+1
3104 IF B≈1 THEN C2(1)=C2(1)+1
3105 IF B≈2 THEN C2(2)=C2(2)+1
3106 IF D$="Z" THEN 3110
3107 IF D$="A" THEN B4(C)=B4(C)+1
3108 IF D$="B" THEN B5(C)=B5(C)+1
3109 IF D$="C" THEN B6(C)=B6(C)+1

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3110 IF F$="Z" THEN 3115
3111 IF F$="D" THEN B7(E)=B7(E)+1
3112 IF F$="E" THEN B8(E)=B8(E)+1
3113 IF F$="F" THEN B9(E)=B9(E)+1
3114 N6=N6+1
3115 FOR J3=1 TO 5
3116 IF A(J3)=0 THEN 3119
3117 IF A(J3)>0 THEN N7=N7+1
3118 B1(A(J3))=B1(A(J3))+1
3119 NEXT J3
3120 FOR J4=1 TO 3
3121 IF A$(J4)="Z" THEN 3200
3122 IF LEN(A$(J4))>1 THEN 3150
3125 IF A$(J4)="A" THEN B2(1)=B2(1)+1
3126 IF A$(J4)="B" THEN B2(2)=B2(2)+1
3127 IF A$(J4)="C" THEN B2(3)=B2(3)+1
3128 IF A$(J4)="D" THEN B2(4)=B2(4)+1
3129 IF A$(J4)="E" THEN B2(5)=B2(5)+1
3130 IF A$(J4)="F" THEN B2(6)=B2(6)+1
3131 IF A$(J4)="G" THEN B2(7)=B2(7)+1
3132 IF A$(J4)="H" THEN B2(8)=B2(8)+1
3133 IF A$(J4)="I" THEN B2(9)=B2(9)+1
3134 IF A$(J4)="J" THEN B2(10)=B2(10)+1
3135 IF A$(J4)="K" THEN B2(11)=B2(11)+1
3136 IF A$(J4)="L" THEN B2(12)=B2(12)+1
3137 IF A$(J4)="M" THEN B2(13)=B2(13)+1
3138 IF A$(J4)="N" THEN B2(14)=B2(14)+1
3139 IF A$(J4)="O" THEN B2(15)=B2(15)+1
3140 IF A$(J4)="P" THEN B2(16)=B2(16)+1
3141 IF A$(J4)="Q" THEN B2(17)=B2(17)+1
3142 IF A$(J4)="R" THEN B2(18)=B2(18)+1
3143 IF A$(4)="S" THEN B2(19)=B2(19)+1
3144 IF A$(J4)="T" THEN B2(20)=B2(20)+1
3145 N8=N8+1
3146 GO TO 3200
3150 IF RIGHT(A$(J4),1)="*" THEN 3180
3155 IF A$(J4)="AA" THEN B2(21)=B2(21)+1
3156 IF A$(J4)="AB" THEN B2(22)=B2(22)+1
3157 IF A$(J4)="AC" THEN B2(23)=B2(23)+1
3158 IF A$(J4)="AD" THEN B2(24)=B2(24)+1
3159 IF A$(J4)="BA" THEN B2(25)=B2(25)+1
3160 IF A$(J4)="BB" THEN B2(26)=B2(26)+1
3161 IF A$(J4)="BC" THEN B2(27)=B2(27)+1
3162 IF A$(J4)="BD" THEN B2(28)=B2(28)+1
3163 IF A$(J4)="CA" THEN B2(29)=B2(29)+1
3164 IF A$(J4)="CB" THEN B2(30)=B2(30)+1
3165 IF A$(J4)="CC" THEN B2(31)=B2(31)+1
3166 IF A$(J4)="CD" THEN B2(32)=B2(32)+1
3167 IF A$(J4)="DA" THEN B2(33)=B2(33)+1
3168 IF A$(J4)="DB" THEN B2(34)=B2(34)+1
3169 IF A$(J4)="DC" THEN B2(35)=B2(35)+1
3170 IF A$(J4)="DD" THEN B2(36)=B2(36)+1
3171 N9=N9+1
3172 GO TO 3200
3180 IF A$(J4)="1*" THEN B2(37)=B2(37)+1
3181 IF A$(J4)="2*" THEN B2(38)=B2(38)+1
3182 IF A$(J4)="3*" THEN B2(39)=B2(39)+1
3183 IF A$(J4)="4*" THEN B2(40)=B2(40)+1
3184 IF A$(J4)="5*" THEN B2(41)=B2(41)+1
3185 IF A$(J4)="6*" THEN B2(42)=B2(42)+1

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3186 IF A$(J4)="7*" THEN B2(43)=B2(43)+1
3187 IF A$(J4)="8*" THEN B2(44)=B2(44)+1
3188 IF A$(J4)="9*" THEN B2(45)=B2(45)+1
3189 IF A$(J4)="10*" THEN B2(46)=B2(46)+1
3190 IF A$(J4)="11*" THEN B2(47)=B2(47)+1
3191 IF A$(J4)="12*" THEN B2(48)=B2(48)+1
3192 IF A$(J4)="13*" THEN B2(49)=B2(49)+1
3193 IF A$(J4)="14*" THEN B2(50)=B2(50)+1
3194 IF A$(J4)="15*" THEN B2(51)=B2(51)+1
3195 IF A$(J4)="16*" THEN B2(52)=B2(52)+1
3197 O1=O1+1
3200 NEXT J4
3220 RETURN
3221 STOP
3222 END
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0010 DIM A(5)
0012 DIM A$(3)
0014 DIM A1(800)
0016 DIM A2(52)
0018 DIM A3(16)
0020 DIM A4(24)
0022 DIM A5(24)
0024 DIM A6(24)
0026 DIM A7(15)
0028 DIM A8(15)
0030 DIM A9(15)
0032 DIM B1(800)
0034 DIM B2(52)
0036 DIM B3(16)
0038 DIM B4(24)
0040 DIM B5(24)
0042 DIM B6(24)
0044 DIM B7(15)
0046 DIM B8(15)
0048 DIM B9(15)
0050 DIM C1(2)
0052 DIM C2(2)
0055 FILES *,FIVE;VARL5
0062 INPUT £3,X$,X1,X1$,Z9$
0090 FILE £1;Z9$
0092 FOR I1=1 TO 1000
0095 INPUT £1,A$,B,C,D$,E,F$,G,H,I,J,K,L$,M$,N$
0100 IF C=0 THEN 340
0105 N=N+1
0110 IF A$="AA" THEN A3(1)=A3(1)+1
0111 IF A$="AB" THEN A3(2)=A3(2)+1
0112 IF A$="AC" THEN A3(3)=A3(3)+1
0113 IF A$="AD" THEN A3(4)=A3(4)+1
0114 IF A$="BA" THEN A3(5)=A3(5)+1
0115 IF A$="BB" THEN A3(6)=A3(6)+1
0116 IF A$="BC" THEN A3(7)=A3(7)+1
0118 IF A$="CA" THEN A3(9)=A3(9)+1
0119 IF A$="CB" THEN A3(10)=A3(10)+1
0120 IF A$="CC" THEN A3(11)=A3(11)+1
0121 IF A$="CD" THEN A3(12)=A3(12)+1
0122 IF A$="DA" THEN A3(13)=A3(13)+1
0123 IF A$="DB" THEN A3(14)=A3(14)+1
0124 IF A$="DC" THEN A3(15)=A3(15)+1
0125 IF A$="DD" THEN A3(16)=A3(16)+1
0130 IF B=1 THEN C1(1)=C1(1)+1
0131 IF B=2 THEN C1(2)=C1(2)+1
0132 IF D$="Z" THEN 138
0135 IF D$="A" THEN A4(C)=A4(C)+1
0136 IF D$="B" THEN A5(C)=A5(C)+1
0137 IF D$="C" THEN A6(C)=A6(C)+1
0138 IF F$="Z" THEN 150
0139 IF F$="D" THEN A7(E)=A7(E)+1
0140 IF F$="E" THEN A8(E)=A8(E)+1
0141 IF F$="F" THEN A9(E)=A9(E)+1
0150 A(1)=G
0151 A(2)=H
0152 A(3)=I
0153 A(4)=J
0154 A(5)=K
0155 A$(1)=L$

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0156 A$(2)=M$
0157 A$(3)=N$
0158 FOR I2=1 TO 5
0159 IF A(I2)=0 THEN 170
0160 IF A(I2)>0 THEN N1=N1+1
0165 A1(A(I2))=A1(A(I2))+1
0170 NEXT I2
0175 FOR I3=1 TO 3
0177 IF A$(I3)="Z" THEN 250
0180 IF LEN(A$(I3))>1 THEN 209
0185 IF A$(I3)="A" THEN A2(1)=A(1)+1
0186 IF A$(I3)="B" THEN A2(2)=A2(2)+1
0187 IF A$(I3)="C" THEN A2(3)=A2(3)+1
0188 IF A$(I3)="D" THEN A2(4)=A2(4)+1
0189 IF A$(I3)="E" THEN A2(5)=A2(5)+1
0190 IF A$(I3)="F" THEN A2(6)=A2(6)+1
0191 IF A$(I3)="G" THEN A2(7)=A2(7)+1
0192 IF A$(I3)="H" THEN A2(8)=A2(8)+1
0193 IF A$(I3)="I" THEN A2(9)=A2(9)+1
0194 IF A$(I3)="J" THEN A2(10)=A2(10)+1
0195 IF A$(I3)="K" THEN A2(11)=A2(11)+1
0196 IF A$(I3)="L" THEN A2(12)=A2(12)+1
0197 IF A$(I3)="M" THEN A2(13)=A2(13)+1
0198 IF A$(I3)="N" THEN A2(14)=A2(14)+1
0199 IF A$(I3)="O" THEN A2(15)=A2(15)+1
0200 IF A$(I3)="P" THEN A2(16)=A2(16)+1
0201 IF A$(I3)="Q" THEN A2(17)=A2(17)+1
0202 IF A$(I3)="R" THEN A2(18)=A2(18)+1
0203 IF A$(I3)="S" THEN A2(19)=A2(19)+1
0204 IF A$(I3)="T" THEN A2(20)=A2(20)+1
0205 N2=N2+1
0207 GO TO 250
0209 IF RIGHT(A$(I3),1)="*" THEN 230
0210 IF A$(I3)="AA" THEN A2(21)=A2(21)+1
0211 IF A$(I3)="AB" THEN A2(22)=A2(22)+1
0212 IF A$(I3)="AC" THEN A2(23)=A2(23)+1
0213 IF A$(I3)="AD" THEN A2(24)=A2(24)+1
0214 IF A$(I3)="BA" THEN A2(25)=A2(25)+1
0215 IF A$(I3)="BB" THEN A2(26)=A2(26)+1
0216 IF A$(I3)="BC" THEN A2(27)=A2(27)+1
0217 IF A$(I3)="BD" THEN A2(28)=A2(28)+1
0218 IF A$(I3)="CA" THEN A2(29)=A2(29)+1
0219 IF A$(I3)="CB" THEN A2(30)=A2(30)+1
0220 IF A$(I3)="CC" THEN A2(31)=A2(31)+1
0221 IF A$(I3)="CD" THEN A2(32)=A2(32)+1
0222 IF A$(I3)="DA" THEN A2(33)=A2(33)+1
0223 IF A$(I3)="DB" THEN A2(34)=A2(34)+1
0224 IF A$(I3)="DC" THEN A2(35)=A2(35)+1
0225 IF A$(I3)="DD" THEN A2(36)=A2(36)+1
0226 N3=N3+1
0228 GO TO 250
0230 IF A$(I3)="1*" THEN A2(37)=A2(37)+1
0231 IF A$(I3)="2*" THEN A2(38)=A2(38)+1
0232 IF A$(I3)="3*" THEN A2(39)=A2(39)+1
0233 IF A$(I3)="4*" THEN A2(40)=A2(40)+1
0234 IF A$(I3)="5*" THEN A2(41)=A2(41)+1
0235 IF A$(I3)="6*" THEN A2(42)=A2(42)+1
0237 IF A$(I3)="8*" THEN A2(44)=A2(44)+1
0238 IF A$(I3)="9*" THEN A2(45)=A2(45)+1
0239 IF A$(I3)="10*" THEN A2(46)=A2(46)+1

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0240 IF A$(I3) = "11*" THEN A2(47)=A2(47)+1
0241 IF A$(I3) = "12*" THEN A2(48)=A2(48)+1
0242 IF A$(I3) = "13*" THEN A2(49)=A2(49)+1
0243 IF A$(I3) = "14*" THEN A2(50)=A2(50)+1
0244 IF A$(I3) = "15*" THEN A2(51)=A2(51)+1
0245 IF A$(I3) = "16*" THEN A2(52)=A2(52)+1
0246 N4=N4+1
0250 NEXT I3
0260 IF X$="B" THEN 300
0270 REM OPTION CONTRIBUTIONS
0275 IF X1$="O" THEN 290
0280 IF D$=X1$ THEN 290
0285 GO TO 340
0290 IF C=X1 THEN GOSUB 2000
0295 GO TO 340
0300 REM SUBROUTINE SUBJECTS
0305 IF X1$="O" THEN 320
0310 IF F$=X1$ THEN 320
0315 GO TO 340
0320 IF E=X1 THEN GOSUB 2000
0340 NEXT I1
0350 REM ANALYSIS SECTION
0352 SCRATCH £2
0353:                                     £££
0355: 'CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
0360: ££££ ££££ £.£££ £.£££ £.£££ £.£££
0361 WRITE £2 USING 355;"RESULTS OF CONTRIB/SUB (PROG5) ANALYSIS"
0362 WRITE £ USING 355;"FILE....."
0363 WRITE £2 USING 355;Z9$
0364 IF X$="B" THEN 370
0365 WRITE £2 USING 355;"CONTRIBUTION TYPE....."
0366 WRITE £2 USING 353;X1
0367 WRITE £2 USING 355;"CONTRIBUTION STRENGTH....."
0368 WRITE £2 USING 355;X1$
0369 GO TO 374
0370 WRITE £2 USING 355;"SUBJECT TYPE....."
0371 WRITE £2 USING 353;X1
0372 WRITE £2 USING 355;"SUBJECT ORIGIN....."
0373 WRITE £2 USING 355;X1$
0374 IF X$="A" THEN GO TO 377
0375 IF X$="B" THEN GOSUB 1000
0376 GO TO 2141
0377 REM CONTRIBUTION ANALYSIS
0378 PRINT USING 355;"ANALYSIS OF RECORDS"
0379 WRITE £2 USING 355;"ANALYSIS OF RECORDS"
0393 PRINT USING 360;N;N5;N5/N;A4(X1)/N;A5(X1)/N;A6(X1)/N
0394 WRITE £2 USING 360;N;N5;N5/N;A4(X1)/N;A5(X1)/N;A6(X1)/N
0400 PRINT USING 355;"ANALYSIS OF INPUT/OUTPUTS"
0401 WRITE £2 USING 355;"ANALYSIS OF INPUTS/OUTPUTS"
0409 A2=C2(1)/C1(1)
0410 A3=A4(X1)/C1(1)
0411 A4=A5(X1)/C1(1)
0413 PRINT USING 360;C1(1);C2(1);A2;A3;A4;A6(X1)/C1(1)
0414 WRITE £2 USING 360;C1(1);C2(1);A2;A3;A4;A6(X1)/C1(1)
0415 A5=C2(2)/C1(2)
0416 A6=A4(X1)/C1(2)
0417 A7=A5(X1)/C1(2)
0418 PRINT USING 360;C1(2);C2(2);A5;A6;A7;A6(X1)/C1(2)
0419 WRITE £2 USING 360;C1(2);C2(2);A5;A6;A7;A6(X1)/C1(2)
0430 PRINT USING 355;"CONCORDANCE ANALYSIS SECTION"

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0431 WRITE £2 USING 355;"CONCORDANCE ANALYSIS SECTION"
0432 PRINT
0433 PRINT
0434 A8=0
0435 PRINT USING 355;"CONCORDS OF CONTRIB AND CONTRIBUTORS"
0436 WRITE £2 USING 355;"CONCORDS OF CONTRIB AND CONTRIBUTOR"
0437 FOR K1=1 TO 16
0438 IF A3(K1)=0 THEN 455
0439 IF X1$="O" THEN GOSUB 460
0440 IF X1$="A" THEN GOSUB 470
0441 IF X1$="B" THEN GOSUB 480
0442 IF X1$="C" THEN GOSUB 490
0443 IF A8=0 THEN LET A8=0.000009
0444 IF A8=1 THEN LET A8=0.999999
0445 Z8=(A9-(A8*N))^2/(A8*N)
0446 Z7=B3(K1)/N5
0450:££ ££££ £££££ £.££££ £.££££ £.££££ £.££££ £.££££ £.££££ £.££££
0451 B1=(A9-(N*A8))/SQR((N*A8)*(1-A8))
0452 IF N5=0 THEN LET N5=0.000009
0453 PRINT USING 450;K1,A3(K1),B3(K1),A8,A9/N,Z8,B1,B3(K1)/N,B3(K1)/N5
0454 WRITE £2 USING 450;K1,A3(K1),B3(K1),A8,A9/N,Z8,B1,B3(K1)/N,Z7
0455 NEXT K1
0457 GO TO 500
0460 REM SUBROUTINE ALL CONTRIBUTIONS
0463 A8=((A4(X1)+A5(X1)+A6(X1))/N)*(A3(K1)/N)
0464 A9=B3(K1)
0465 IF A8=0 THEN LET A8=0.0000009
0469 RETURN
0470 REM SUBROUTINE STRONG CONTRIBUTIONS
0472 A8=(A4(X1)/N)*(A3(K1)/N)
0473 A9=B3(K1)
0474 IF A8=0 THEN LET A8=0.0000009
0479 RETURN
0480 REM SUBROUTINE MEDIUM CONTRIBUTIONS
0482 A8=(A5(X1)/N)*(A3(K1)/N)
0485 A9=B3(K1)
0486 IF A8=0 THEN LET A8=0.0000009
0489 RETURN
0490 REM SUBROUTINE WEAK CONTRIBUTIONS
0492 A8=(A6(X1)/N)*(A3(K1)/N)
0495 A9=B3(K1)
0496 IF A8=0 THEN LET A8=0.0000009
0499 RETURN
0500 REM CONC ANALYSIS AREA
0537 IF X1$="O" THEN B4=(A4(X1)+A5(X1)+A6(X1))/N
0538 IF X1$="A" THEN B4=A4(X1)/N
0539 IF X1$="B" THEN B4=A5(X1)/N
0540 IF X1$="C" THEN B4=A6(X1)/N
0541:££££ ££££ ££££ £.££££ £.££££ £.££££ £.££££ £.££££ £.££££ £.££££
0545 PRINT USING 355;"CONCORD OF CONTRIB AND ALL SUBJECTS"
0546 WRITE £2 USING 355;"CONCORDS OF CONTRIB AND ALL SUBJECTS"
0547 FOR K3=1 TO 15
0548 IF B4=0 THEN 556
0549 GOSUB 600
0550 B2=C2*N
0552 B3=(B2-(C3*N))/SQR((N*C3)*(1-C3))
0553 T1=(B2-(C3*N))^2/(C3*N)
0554 PRINT USING 541;K3,C1*N,C2*N,C1,C3,C2,T1,B3,(C2*N)/N5
0555 WRITE £2 USING 541;K3,C1*N,C2*N,C1,C3,C2,T1,B3,(C2*N)/N5
0556 NEXT K3

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0557 PRINT USING 355;"CONCORDS OF CONTRIB AND BRIEFED SUBJECTS"
0558 WRITE £2 USING 355;"CONCORDS OF CONTRIB AND BRIEFED SUBJECTS"
0559 FOR K4=1 TO 15
0560 IF B4=0 THEN 569
0561 GOSUB 620
0562 B2=C2*N
0565 B3=(B2-(N*C3))/SQR((N*C3)*(1-C3))
0566 T1=(B2-(C3*N))^2/(C3*N)
0567 PRINT USING 541;K4;A7(K4);C2*N;A7(K4)/N;C3;C2;T1;B3;(C2*N)/N5
0568 WRITE £2 USING 541;K4;A7(K4);C2*N;A7(K4)/N;C3;C2;T1;B3;(C2*N)/N5
0569 NEXT K4
0573 PRINT USING 355;"CONCORDS OF CONTRIB AND DISCOVERED SUBJECTS"
0574 WRITE £2 USING 355;"CONCORDS OF CONTRIB AND DISCOVERED SUBJECTS"
0575 FOR K5=1 TO 15
0576 IF B4=0 THEN 585
0577 GOSUB 640
0579 B2=C2*N
0581 B3=(B2-(N*C3))/SQR((N*C3)*(1-C3))
0582 T1=(B2-(C3*N))^2/(C3*N)
0583 PRINT USING 541;K5;A8(K5);C2*N;A8(K5)/N;C3;C2;T1;B3;(C2*N)/N5
0584 WRITE £2 USING 541;K5;A8(K5);C2*N;A8(K5)/N;C3;C2;T1;B3;(C2*N)/N5
0585 NEXT K5
0586 PRINT USING 355;"CONCORDS OF CONTRIB AND NEW SUBJECTS"
0587 WRITE £2 USING 355;"CONCORDS OF CONTRIB AND NEW SUBJECTS"
0588 FOR K6=1 TO 15
0589 IF B4=0 THEN 598
0590 GOSUB 660
0592 B2=C2*N
0594 B3=(B2-(C3*N))/SQR((N*C3)*(1-C3))
0595 T1=(B2-(C3*N))^2/(C3*N)
0596 PRINT USING 541;K6;A9(K6);C2*N;A9(K6)/N;C3;C2;T1;B3;(C2*N)/N5
0597 WRITE £2 USING 541;K6;A9(K6);C2*N;A9(K6)/N;C3;C2;T1;B3;(C2*N)/N5
0598 NEXT K6
0599 GO TO 680
0600 REM ALL CONTRIBS
0605 C1=(A7(K3)+A8(K3)+A9(K3))/N
0606 C2=(B7(K3)+B8(K3)+B9(K3))/N
0607 C3=B4*C1
0608 IF C3=0 THEN LET C3=0.000000000009
0609 IF C3=1 THEN LET C3=0.999999999999
0610 RETURN
0620 REM STRONG CONTRIBS
0625 C1=A7(K4)/N
0626 C2=B7(K4)/N
0627 C3=B4*C1
0628 IF C3=0 THEN LET C3=0.000000000009
0629 IF C3=1 THEN LET C3=0.999999999999
0630 RETURN
0640 REM INTERMEDIATE CONTRIBS
0645 C1=A8(K5)/N
0646 C2=B8(K5)/N
0647 C3=B4*C1
0648 IF C3=1 THEN LET C3=0.999999999999
0649 IF C3=0 THEN LET C3=0.000000000009
0650 RETURN
0660 REM WEAK CONTRIBS
0665 C1=A9(K6)/N
0666 C2=B9(K6)/N
0667 C3=B4*C1
0668 IF C3=0 THEN LET C3=0.000000000009

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0669 IF C3=1 THEN LET C3=0.999999999999
0670 RETURN
0680 PRINT
0681 PRINT
0682 PRINT USING 355;"CONCORDS OF CONTRIB AND NUMBERS"
0683 WRITE £2 USING 355;"CONCORDS OF CONTRIB AND NUMBERS"
0688 FOR K7=1 TO 800
0689 IF B4=0 THEN 700
0690 IF A1(K7)=0 THEN 700
0691 C5=A1(K7)/N
0692 C6=C5*B4
0693 C7=B1(K7)
0694 IF C6=1 THEN LET C6=0.999999999999
0695 IF C6=0 THEN LET C6=0.000000000009
0696 C8=(C7-(C6*N))/SQR((N*C6)*(1-C6))
0697 T2=(C7-(C6*N))^2/(C6*N)
0698 PRINT USING 541;K7,A1(K7);C7;C5;C6;C7/N;T2;C8;B1(K7)/N5
0699 WRITE £2 USING 541;K7,A1(K7);C7;C5;C6;C7/N;T2;C8;B1(K7)/N5
0700 NEXT K7
0710 PRINT USING 355;"CONCORDS OF CONTRIB AND CHARACTERS"
0711 WRITE £2 USING 355;"CONCORDS OF CONTRIB AND CHARACTERS"
0715 FOR K8=1 TO 52
0716 IF B4=0 THEN 735
0717 IF A2(K8)=0 THEN 735
0720 D1=A2(K8)/N
0722 D2=D1*B4
0724 D3=B2(K8)
0726 IF D2=0 THEN LET D2=0.000000000009
0727 IF D2=1 THEN LET D2=0.999999999999
0728 D4=(D3-(N*D2))/SQR((N*D2)*(1-D2))
0729 T3=(D3-(D2*N))^2/(D2*N)
0730 PRINT USING 541;K8,A2(K8);D3;D1;D2;D3/N;D4;B2(K8)/N5
0731 WRITE £2 USING 541;K8,A2(K8);D3;D1;D2;D3/N;D4;B2(K8)/N5
0735 NEXT K8
0800 GO TO 2141
1000 REM SUBJECT ANALYSIS
1005 PRINT
1006 PRINT USING 355;"ANALYSIS OF RECORDS"
1007 WRITE £2 USING 355;"ANALYSIS OF RECORDS"
1012 PRINT USING 360;N;N5;N5/N;A7(X1)/N;A8(X1)/N;A9(X1)/N
1013 WRITE £2 USING 360;N;N5;N5/N;A7(X1)/N;A8(X1)/N;A9(X1)/N
1015 PRINT
1020 PRINT USING 355;"ANALYSIS OF INPUT/OUTPUTS"
1021 WRITE £2 USING 355;"ANALYSIS OF INPIUT/OUTPUTS"
1025 A2=C2(1)/C1(1)
1026 A3=A7(X1)/C1(1)
1027 A4=A8(X1)/C1(1)
1029 PRINT USING 360;C1(1);C2(1);A2;A3;A4;A9(X1)/C1(1)
1030 WRITE £2 USING 360;C1(1);C2(1);A2;A3;A4;A9(X1)/C1(1)
1031 A5=C2(2)/C1(2)
1032 A6=A7(X1)/C1(2)
1033 A7=A8(X1)/C1(2)
1034 PRINT USING 360;C1(2);C2(2);A5;A6;A7;A9(X1)/C1(2)
1035 WRITE £2 USING 360;C1(2);C2(2);A5;A6;A7;A9(X1)/C1(2)
1036 PRINT USING 355;"CONCORDANCE ANALYSIS SECTION"
1037 WRITE £2 USING 355;"CONCORDANCE ANALYSIS SECTION"
1039 PRINT
1040 PRINT
1041 PRINT USING 355;"CONCORDS OF SUBJECT AND CONTRIBUTIONS"
1042 WRITE £2 USING 355;"CONCORDS OF SUBJECT AND CONTRIBUTIONS"

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1045 FOR K1=1 TO 16
1047 IF A3(K1)=0 THEN 1067
1050 IF X1$="O" THEN GOSUB 1070
1051 IF X1$="D" THEN GOSUB 1080
1052 IF X1$="E" THEN GOSUB 1090
1053 IF X1$="F" THEN GOSUB 1100
1055 IF A8=1 THEN LET A8=0.999999999999
1057 IF A8=0 THEN LET A8=0.000000000009
1059 :  $\epsilon\epsilon$   $\epsilon\epsilon\epsilon\epsilon$   $\epsilon\epsilon\epsilon\epsilon$   $\epsilon.\epsilon\epsilon\epsilon$   $\epsilon.\epsilon\epsilon\epsilon$   $\epsilon\epsilon.\epsilon\epsilon\epsilon$   $\epsilon.\epsilon\epsilon\epsilon$   $\epsilon.\epsilon\epsilon\epsilon$   $\epsilon.\epsilon\epsilon\epsilon$ 
1060 T4=B3(K1)/N5
1061 IF N5=0 THEN LET N5=0.000009
1062 B1=(A9-(A8*N))/SQR((N*A8)*(1-A8))
1064 PR=INT(A9$A8$N)052/KASAN(K1);B3(K1);A8;A9/N;T3;B1;B3(K1)/N;B3(K1)/N5
1065 WRITE  $\epsilon$ 2 USING 1059;K1;A3(K1);B3(K1);A8;A9/N;T3;B1;B3(K1)/N;T4
1067 NEXT K1
1068 GO TO 1110
1070 REM SUBROUTINE ALL CONTRIBUTIONS
1072 A8=((A7(X1)+A8(X1)+A9(X1))/N)*(A3(K1)/N)
1074 A9=(B7(X1)+B8(X1)+B9(X1))
1076 RETURN
1080 REM SUBROUTINE BRIEFED SUBJECTS
1082 A8=(A7(X1)/N)*(A3(K1)/N)
1084 A9=B7(X1)
1086 RETURN
1090 REM SUBROUTINE DISCOVERED SUBJECTS
1092 A8=(A8(X1)/N)*(A3(K1)/N)
1094 A9=B8(X1)
1096 RETURN
1100 REM SUBROUTINE NEW SUBJECTS
1102 A8=(A9(X1)/N)*(A3(K1)/N)
1104 A9=A9(X1)
1106 RETURN
1110 REM CONCORD ANALYSIS AREA
1112 IF X1$="O" THEN B4=(A7(X1)+A8(X1)+A9(X1))/N
1114 IF X1$="D" THEN B4=A7(X1)/N
1115 IF X1$="E" THEN B4=A8(X1)/N
1116 IF X1$="F" THEN B4=A9(X1)/N
1117:  $\epsilon\epsilon\epsilon\epsilon$   $\epsilon\epsilon\epsilon\epsilon$   $\epsilon\epsilon\epsilon\epsilon$   $\epsilon.\epsilon\epsilon\epsilon\epsilon$   $\epsilon.\epsilon\epsilon\epsilon\epsilon$   $\epsilon.\epsilon\epsilon\epsilon\epsilon$   $\epsilon.\epsilon\epsilon\epsilon\epsilon$   $\epsilon.\epsilon\epsilon\epsilon\epsilon$   $\epsilon.\epsilon\epsilon\epsilon\epsilon$ 
1120 PRINT USING 355;"CONCORDS OF SUBJECT AND ALL CONTRIBUTIONS"
1121 WRITE  $\epsilon$ 2 USING 355;"CONCORDS OF SUBJECT AND ALL CONTRIBUTIONS"
1125 FOR K3=1 TO 24
1127 IF B4=0 THEN 1144
1130 GOSUB 1200
1133 B2=C2*N
1136 B3=(B2-(C3*N))/SQR((N*C3)*(1-C3))
1137 T5=(B2-(C3*N))^2/(C3*N)
1140 PRINT USING 1117;K3;C1*N;C2*N;C1;C3;C2;T5;B3;(C2*N)/N5
1141 WRITE  $\epsilon$ 2 USING 1117;K3;C1*N;C2*N;C1;C3;C2;T5;B3;(C2*N)/N5
1144 NEXT K3
1145 PRINT USING 355;"CONCORDS OF SUBJECT AND STRONG CONTRIBUTIONS"
1146 WRITE  $\epsilon$ 2 USING 355;"CONCORDS OF SUBJECT AND STRONG CONTRIBUTIONS"
1147 FOR K4=1 TO 24
1149 IF B4=0 THEN 1160
1150 GOSUB 1220
1153 B2=C2*N
1154 T5=(B2-(C3*N))^2/(C3*N)
1155 B3=(B2-(N*C3))/SQR((N*C3)*(1-C3))
1156 T6=(C2*N)/N5
1157 B3=(B2-(N*C3))/SQR((N*C3)*(1-C3))
1158 PRINT USING 1117;K4;A4(K4);B4(K4);A4(K4)/N;C3;C2;T5;B3;(C2*N)/N5

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1159 WRITE £2 USING 1117,K4,A4(K4),B4(K4),A4(K4)/N,C3,C2,T5,B3,T6
1160 NEXT K4
1162 PRINT USING 355;"CONCORDS OF CONTRIB AND MED CONTRIBUTIONS"
1163 WRITE £2 USING 355;"CONCORDS OF CONTRIB AND MED CONTRIBUTIONS"
1165 FOR K5=1 TO 24
1166 IF B4=0 THEN 1180
1167 GOSUB 1240
1168 T6=C2*N/N5
1170 B2=C2*N
1175 B3=(B2-(C3*N))/SQR((N*C3)*(1-C3))
1176 T5=(B2-(C3*N))^2/(C3*)
1177 PRINT USING 1117,K5,A5(K5),B5(K5),A5(K5)/N,C3,C2,T5,B3,C2*N/N5
1179 WRITE £2 USING 1117,K5,A5(K5),B5(K5),A5(K5)/N,C3,C2,T5,B3,T6
1180 NEXT K5
1185 PRINT USING 355;"CONCORDS OF SUBJECT AND WEAK CONTRIBUTIONS"
1186 WRITE £2 USING 355;"CONCORDS OF SUBJECT AND WEAK CONTRIBUTIONS"
1187 FOR K6=1 TO 24
1188 IF B4=0 THEN 1197
1189 GOSUB 1260
1190 T6=C2*N/N5
1191 B2=C2*N
1193 B3=(B2-(C3*N))/SQR((C3*N)*(1-C3))
1194 T5=(B2-(C3*N))^2/(C3*N)
1195 PRINT USING 1117,K6,A6(K6),B6(K6),A6(K6)/N,C3,C2,T5,B3,(C2*N)/N5
1196 WRITE £2 USING 1117,K6,A6(K6),B6(K6),A6(K6)/N,C3,C2,T5,B3,T6
1197 NEXT K6
1199 GO TO 1270
1200 REM ALL CONTRIBS
1202 C1=(A4(K3)+A5(K3)+A6(K3))/N
1204 C2=(B4(K3)+B5(K3)+B6(K3))/N
1205 C3=B4*C1
1206 IF C3=0 THEN LET C3=0.0000000009
1207 IF C3=1 THEN LET C3=0.9999999999
1210 RETURN
1220 REM STRONG CONTRIBS
1222 C1=A4(K4)/N
1224 C2=B4(K4)/N
1225 C3=B4*C1
1226 IF C3=0 THEN LET C3=0.0000000009
1227 IF C3=1 THEN LET C3=0.9999999999
1230 RETURN
1240 REM MEDIUM CONTRIBS
1242 C1=A5(K5)/N
1244 C2=B5(K5)/N
1245 C3=B4*C1
1246 IF C3=0 THEN LET C3=0.0000000009
1247 IF C3=1 THEN LET C3=0.9999999999
1250 RETURN
1260 REM WEAK ONTRIBS
1262 C1=A6(K6)/N
1264 C2=B6(K6)/N
1265 C3=B4*C1
1266 IF C3=0 THEN LET C3=0.0000000009
1267 IF C3=1 THEN LET C3=0.9999999999
1268 RETURN
1270 PRINT
1272 PRINT
1274 PRINT USING 355;"CONCORDS OF SUBJECT AND NUMBERS"
1275 WRITE £2 USING 355;"CONCORDS OF SUBJECT AND NUMBERS"
1280 FOR K7=1 TO 800

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1282 IF A1(K7)=0 THEN 1293
1283 C5=A1(K7)/N
1284 C6=C5*B4
1285 C7=B1(K7)
1286 IF C6=1 THEN LET C6=0.9999999999
1287 IF C6=0 THEN LET C6=0.0000000009
1288 C8=(C7-(C6*N))/SQR((N*C6)*(1-C6))
1289 T7=(C7-(C6*N))^2/(C6*N)
1290 PRINT USING 1117;K7;A1(K7);B1(K7);A1(K7)/N;C6;C7/N;T7;C8;C7/N5
1291 WRITE £2 USING 1117;K7;A1(K7);B1(K7);A1(K7)/N;C6;C7/N;T7;C8;C7/N5
1293 NEXT K7
1295 PRINT
1296 PRINT USING 355;"CONCORDS OF SUBJECT AND CHARACTERS"
1297 WRITE £2 USING 355;"CONCORDS OF SUBJECT AND CHARACTERS"
1298 FOR K8=1 TO 52
1299 IF B4=0 THEN 1310
1300 IF A2(K8)=0 THEN 1310
1301 D1=A2(K8)/N
1302 D2=D1*B4
1303 D3=B2(K8)
1304 IF D2=0 THEN LET D2=0.000009
1305 IF D2=1 THEN LET D2=0.999999999999
1306 D4=(D3-(D2*N))/SQR((N*D2)*(-D2))
1307 T8=(D3-(D2*N))^2/(D2*N)
1308 PRINT USING 1117;K8;A2(K8);B2(K8);A2(K8)/N;D2;D3/N;T8;D4;D3/N5
1309 WRITE £2 USING 1117;K8;A2(K8);B2(K8);A2(K8)/N;D2;D3/N;T8;D4;D3/N5
1310 NEXT K8
1312 GO TO 2141
1500 GO TO 2141
2000 REM SUBROUTINE 2000
2001 N5=N5+1
2002 FOR J2=1 TO 5
2003 IF A(J2)=0 THEN 2009
2004 IF A(J2)>0 THEN N7=N7+1
2005 B1(A(J2))=B1(A(J2))+1
2009 NEXT J2
2010 IF A$="AA" THEN B3(1)=B3(1)+1
2011 IF A$="AB" THEN B3(2)=B3(2)+1
2012 IF A$="AC" THEN B3(3)=B3(3)+1
2013 O1=O1+1
2014 IF A$="BA" THEN B3(5)=B3(5)+1
2015 IF A$="BB" THEN B3(6)=B3(6)+1
2016 IF A$="BC" THEN B3(7)=B3(7)+1
2017 IF A$="BD" THEN B3(8)=B3(8)+1
2018 IF A$="CA" THEN B3(9)=B3(9)+1
2019 IF A$="CB" THEN B3(10)=B3(10)+1
2020 IF A$="CC" THEN B3(11)=B3(11)+1
2021 IF A$="CD" THEN B3(12)=B3(12)+1
2022 IF A$="DA" THEN B3(13)=B3(13)+1
2023 IF A$="DB" THEN B3(14)=B3(14)+1
2024 IF A$="DC" THEN B3(15)=B3(15)+1
2025 IF A$="DD" THEN B3(16)=B3(16)+1
2026 IF D$="Z" THEN 2030
2027 IF D$="A" THEN B4(C)=B4(C)+1
2028 IF D$="B" THEN B5(C)=B5(C)+1
2029 IF D$="C" THEN B6(C)=B6(C)+1
2030 IF F$="Z" THEN 2035
2031 IF F$="D" THEN B7(E)=B7(E)+1
2032 IF F$="E" THEN B8(E)=B8(E)+1
2033 IF F$="F" THEN B9(E)=B9(E)+1

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2034 N6=N6+1
2035 IF B=1 THEN C2(1)=C2(1)+1
2036 IF B=2 THEN C2(2)=C2(2)+1
2037
2055 FOR J4=1 TO 3
2056 IF A$(J4)="Z" THEN 2135
2058 IF LEN(A$(J4))>1 THEN 2080
2060 IF A$(J4)="A" THEN B2(1)=B2(1)+1
2061 IF A$(J4)="B" THEN B2(2)=B2(2)+1
2062 IF A$(J4)="C" THEN B2(3)=B2(3)+1
2063 IF A$(J4)="D" THEN B2(4)=B2(4)+1
2064 IF A$(J4)="E" THEN B2(5)=B2(5)+1
2065 IF A$(J4)="F" THEN B2(6)=B2(6)+1
2066 IF A$(J4)="G" THEN B2(7)=B2(7)+1
2067 IF A$(J4)="H" THEN B2(8)=B2(8)+1
2068 IF A$(J4)="I" THEN B2(9)=B2(9)+1
2069 IF A$(J4)="J" THEN B2(10)=B2(10)+1
2070 IF A$(J4)="K" THEN B2(11)=B2(11)+1
2071 IF A$(J4)="L" THEN B2(12)=B2(12)+1
2072 IF A$(J4)="M" THEN B2(13)=B2(13)+1
2073 IF A$(J4)="N" THEN B2(14)=B2(14)+1
2074 IF A$(J4)="O" THEN B2(15)=B2(15)+1
2075 IF A$(J4)="P" THEN B2(16)=B2(16)+1
2076 IF A$(J4)="Q" THEN B2(17)=B2(17)+1
2077 IF A$(J4)="R" THEN B2(18)=B2(18)+1
2078 IF A$(J4)="T" THEN B2(20)=B2(20)+1
2079 N8=N8+1
2080 GO TO 2135
2081 IF RIGHT(A$(J4),1)="*" THEN 2110
2085 IF A$(J4)="AA" THEN B2(21)=B2(21)+1
2086 IF A$(J4)="AB" THEN B2(22)=B2(22)+1
2087 IF A$(J4)="AC" THEN B2(23)=B2(23)+1
2088 IF A$(J4)="AD" THEN B2(24)=B2(24)+1
2089 IF A$(J4)="BA" THEN B2(25)=B2(25)+1
2090 IF A$(J4)="BB" THEN B2(26)=B2(26)+1
2091 IF A$(J4)="BC" THEN B2(27)=B2(27)+1
2092 IF A$(J4)="BD" THEN B2(28)=B2(28)+1
2093 IF A$(J4)="CA" THEN B2(29)=B2(29)+1
2094 IF A$(J4)="CB" THEN B2(30)=B2(30)+1
2095 IF A$(J4)="CC" THEN B2(31)=B2(31)+1
2096 IF A$(J4)="CD" THEN B2(32)=B2(32)+1
2097 IF A$(J4)="DA" THEN B2(33)=B2(33)+1
2098 IF A$(J4)="DB" THEN B2(34)=B2(34)+1
2099 IF A$(J4)="DC" THEN B2(35)=B2(35)+1
2100 IF A$(J4)="DD" THEN B2(36)=B2(36)+1
2102 N9=N9+1
2104 GO TO 2135
2110 IF A$(J4)="1*" THEN B2(37)=B2(37)+1
2111 IF A$(J4)="2*" THEN B2(38)=B2(38)+1
2112 IF A$(J4)="3*" THEN B2(39)=B2(39)+1
2113 IF A$(J4)="4*" THEN B2(40)=B2(40)+1
2114 IF A$(J4)="5*" THEN B2(41)=B2(41)+1
2115 IF A$(J4)="6*" THEN B2(42)=B2(42)+1
2116 IF A$(J4)="7*" THEN B2(43)=B2(43)+1
2117 IF A$(J4)="8*" THEN B2(44)=B2(44)+1
2118 IF A$(J4)="9*" THEN B2(45)=B2(45)+1
2119 IF A$(J4)="10*" THEN B2(46)=B2(46)+1
2120 IF A$(J4)="11*" THEN B2(47)=B2(47)+1
2121 IF A$(J4)="12*" THEN B2(48)=B2(48)+1
2122 IF A$(J4)="13*" THEN B2(49)=B2(49)+1

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2123 IF A\$(J4)="14*" THEN B2(50)=B2(50)+1
2124 IF A\$(J4)="15*" THEN B2(51)=B2(51)+1
2124 IF A\$(J4)="15*" THEN B2(51)=B2(51)+1
2125 IF A\$(J4)="16*" THEN B2(52)=B2(52)+1
2135 NEXT J4
2140 RETURN
2141 STOP
2142 END

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0010 DIM A(5)
0012 DIM A$(3)
0014 DIM A1(800)
0016 DIM A2(52)
0018 DIM A3(16)
0020 DIM A4(24)
0022 DIM A5(24)
0024 DIM A6(24)
0026 DIM A7(15)
0028 DIM A8(15)
0029 DIM A9(15)
0032 DIM B1(800)
0034 DIM B2(52)
0036 DIM B3(16)
0038 DIM B4(24)
0040 DIM B5(24)
0042 DIM B6(24)
0044 DIM B7(15)
0046 DIM B8(15)
0048 DIM B9(15)
0050 DIM C1(2)
0052 DIM C2(2)
0054 FILES *;SIX;VARL6
0056 INPUT £3;X$;X1,X1$;Z9$
0100 FILE £1;Z9$
0120 FOR I1=1 TO 700
0125 INPUT £1;A$;B,C;D$;E,F$;G,H,I,J;K,L$;M$;N$
0130 IF C=0 THEN 309
0135 N=N+1
0140 IF A$="AA" THEN A3(1)=A3(1)+1
0141 IF A$="AB" THEN A3(2)=A3(2)+1
0142 IF A$="AC" THEN A3(3)=A3(3)+1
0143 IF A$="AD" THEN A3(4)=A3(4)+1
0144 IF A$="BA" THEN A3(5)=A3(5)+1
0145 IF A$="BB" THEN A3(6)=A3(6)+1
0146 IF A$="BC" THEN A3(7)=A3(7)+1
0147 IF A$="BD" THEN A3(8)=A3(8)+1
0148 IF A$="CA" THEN A3(9)=A3(9)+1
0149 IF A$="CB" THEN A3(10)=A3(10)+1
0150 IF A$="CC" THEN A3(11)=A3(11)+1
0151 IF A$="CD" THEN A3(12)=A3(12)+1
0152 IF A$="DA" THEN A3(13)=A3(13)+1
0153 IF A$="DB" THEN A3(14)=A3(14)+1
0154 IF A$="DC" THEN A3(15)=A3(15)+1
0155 IF A$="DD" THEN A3(16)=A3(16)+1
0160 IF B=1 THEN C1(1)=C1(1)+1
0165 IF B=2 THEN C1(2)=C1(2)+1
0166 IF D$="Z" THEN 175
0170 IF D$="A" THEN A4(C)=A4(C)+1
0172 IF D$="B" THEN A5(C)=A5()+1
0174 IF D$="C" THEN A6(C)=A6(C)+1
0175 IF F$="Z" THEN 185
0176 IF F$="D" THEN A7(E)=A7(E)+1
0178 IF F$="E" THEN A8(E)=A8(E)+1
0180 IF F$="F" THEN A9(E)=A9(E)+1
0185 A(1)=G
0186 A(2)=H
0187 A(3)=I
0188 A(4)=J
0189 A(5)=K

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0190 A$(1)=L$
0191 A$(2)=M$
0192 A$(3)=N$
0194 FOR I2=1 TO 5
0195 IF A(I2)=0 THEN 198
0196 N1=N1+1
0197 A1(A(I2))=A1(A(I2))+1
0198 NEXT I2
0200 FOR I3=1 TO 3
0201 IF A$(I3)="Z" THEN 277
0202 IF LEN(A$(I3))>1 THEN 238
0204 IF A$(I3)="A" THEN A2(1)=A2(1)+1
0205 IF A$(I3)="B" THEN A2(2)=A2(2)+1
0206 IF A$(I3)="C" THEN A2(3)=A2(3)+1
0207 IF A$(I3)="D" THEN A2(4)=A2(4)+1
0208 IF A$(I3)="E" THEN A2(5)=A2(5)+1
0209 IF A$(I3)="F" THEN A2(6)=A2(6)+1
0210 IF A$(I3)="G" THEN A2(7)=A2(7)+1
0211 IF A$(I3)="H" THEN A2(8)=A2(8)+1
0212 IF A$(I3)="I" THEN A2(9)=A2(9)+1
0213 IF A$(I3)="J" THEN A2(10)=A2(10)+1
0214 IF A$(I3)="K" THEN A2(11)=A2(11)+1
0215 IF A$(I3)="L" THEN A2(12)=A2(12)+1
0216 IF A$(I3)="M" THEN A2(13)=A2(13)+1
0217 IF A$(I3)="N" THEN A2(14)=A2(14)+1
0218 IF A$(I3)="O" THEN A2(15)=A2(15)+1
0219 IF A$(I3)="P" THEN A2(16)=A2(16)+1
0220 IF A$(I3)="Q" THEN A2(17)=A2(17)+1
0221 IF A$(I3)="R" THEN A2(18)=A2(18)+1
0222 IF A$(I3)="S" THEN A2(19)=A2(19)+1
0223 IF A$(I3)="T" THEN A2(20)=A2(20)+1
0230 N2=N2+1
0235 GO TO 290
0238 IF RIGHT(A$(I3),1)="*" THEN 260
0240 IF A$(I3)="AA" THEN A2(21)=A2(21)+1
0241 IF A$(I3)="AB" THEN A2(22)=A2(22)+1
0242 IF A$(I3)="AC" THEN A2(23)=A2(23)+1
0243 IF A$(I3)="AD" THEN A2(24)=A2(24)+1
0244 IF A$(I3)="BA" THEN A2(25)=A2(25)+1
0245 IF A$(I3)="BB" THEN A2(26)=A2(26)+1
0246 IF A$(I3)="BC" THEN A2(27)=A2(27)+1
0247 IF A$(I3)="BD" THEN A2(28)=A2(28)+1
0248 IF A$(I3)="CA" THEN A2(29)=A2(29)+1
0249 IF A$(I3)="CB" THEN A2(30)=A2(30)+1
0250 IF A$(I3)="CC" THEN A2(31)=A2(31)+1
0251 IF A$(I3)="CD" THEN A2(32)=A2(32)+1
0252 IF A$(I3)="DA" THEN A2(33)=A2(33)+1
0253 IF A$(I3)="DB" THEN A2(34)=A2(34)+1
0254 IF A$(I3)="DC" THEN A2(35)=A2(35)+1
0255 IF A$(I3)="DD" THEN A2(36)=A2(36)+1
0256 N3=N3+1
0257 GO TO 290
0260 IF A$(I3)="1*" THEN A2(37)=A2(37)+1
0261 IF A$(I3)="2*" THEN A2(38)=A2(38)+1
0262 IF A$(I3)="3*" THEN A2(39)=A2(39)+1
0263 IF A$(I3)="4*" THEN A2(40)=A2(40)+1
0264 IF A$(I3)="5*" THEN A2(41)=A2(41)+1
0265 IF A$(I3)="6*" THEN A2(42)=A2(42)+1
0266 IF A$(I3)="7*" THEN A2(43)=A2(43)+1
0267 IF A$(I3)="8*" THEN A2(44)=A2(44)+1

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0268 IF A$(I3)="9*" THEN A2(45)=A2(45)+1
0269 IF A$(I3)="10*" THEN A2(46)=A2(46)+1
0270 IF A$(I3)="11*" THEN A2(42)=A2(42)+1
0271 IF A$(I3)="12*" THEN A2(48)=A2(48)+1
0272 IF A$(I3)="13*" THEN A2(49)=A2(49)+1
0273 IF A$(I3)="14*" THEN A2(50)=A2(50)+1
0274 IF A$(I3)="15*" THEN A2(51)=A2(51)+1
0275 IF A$(I3)="16*" THEN A2(52)=A2(52)+1
0276 N4=N4+1
0277 NEXT I3
0290 IF X$="B" THEN 300
0292 REM SUBROUTINE NUMERICS
0293 FOR I4=1 TO 5
0294 IF A(I4)=X1 THEN GOSUB 2000
0295 NEXT I4
0298 GO TO 309
0300 REM SUBROUTINE ALPHANUMERICS
0302 FOR I5=1 TO 3
0304 IF A$(I5=X1$ THEN GOSUB 2000
0305 NEXT I5
0309 NEXT I1
0310 IF X$="B" THEN 645
0311 REM NUMERICAL ANALYSIS SECTION
0312 SCRATCH £2
0315: 'CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
0316:          ££££
0317: ££££ ££££ £.££££
0318 REM NUMERICAL ANALYSIS SECTION
0319 WRITE £2 USING 315;"RESULTS OF NUMBER/CHARACTER (PROG6) ANALYSIS"
0320 WRITE £2 USING 315;"FILE....."
0321 WRITE £2 USING 315;Z9$
0322 WRITE £2 USING 315;"NUMERIC VARIABLE....."
0323 WRITE £2 USING 316;X1
0324 PRINT USING 315;"ANALYSIS OF RECORDS"
0325 WRITE £2 USING 315;"ANALYSIS OF RECORDS"
0326 PRINT USING 317;N;N5;N5/N
0327 WRITE £2 USING 317;N;N5;N5/N
0330 PRINT USING 315;"ANALYSIS OF INPUTS/OUTPUTS"
0331 WRITE £2 USING 315;"ANALYSIS OF INPUTS/OUTPUTS"
0333
0335 PRINT USING 317;C1(1);C2(1);C2(1)/C1(1)
0337 WRITE £2 USING 317;C1(1);C2(1);C2(1)/C1(1)
0340 PRINT USING 317;C2(1);C2(2);C2(2)/C2(1)
0342 WRITE £2 USING 317;C2(1);C2(2);C2(2)/C2(1)
0345: ££££ ££££ ££££ £.££££ £.££££ £.££££ £.££££ £.££££ £.££££
0346 PRINT USING 315;"CONCORDANCE ANALYSIS SECTION"
0347 WRITE £2 USING 315;"CONCORDANCE ANALYSIS SECTION"
0348 PRINT
0349 PRINT USING 315;"CONCORDS OF NUMERIC VARIABLE AND CONTRIBUTORS"
0350 WRITE £2 USING 315;"CONCORDS OF NUMERIC VARIABLE AND CONTRIBUTORS"
0352 FOR K1=1 TO 16
0353 IF A1(X1)=0 THEN 364
0355 A1=(A3(K1)/N)*(A1(X1)/N)
0356 IF A1=0 THEN LET A1=0.00000009
0357 IF A1=1 THEN LET A1=0.99999999
0358 A2=B3(K1)
0359 A3=(A2-(A1*N))/SQR((N*A1)*(1-A1))
0360 T1=(A2-(A1*N))^2/(A1*N)
0361 PRINT USING 345;K1;A3(K1);B3(K1);A3(K1)/N;A1;A2/N;T1;A3;A2/N5
0362 WRITE £2 USING 345;K1;A3(K1);B3(K1);A3(K1)/N;A1;A2/N;T1;A3;A2/N5

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0364 NEXT K1
0368 PRINT USING 315;"CONCORDS OF VARIABLE AND ALL CONTRIBUTIONS"
0370 WRITE £2 USING 315;"CONCORDS OF VARIABLE AND ALL CONTRIBUTIONS"
0371 FOR K2=1 TO 24
0373 IF A1(X1)=0 THEN 385
0375 A4=((A4(K2)+A5(K2)+A6(K2))/N)*(A1(X1)/N)
0376 IF A4=0 THEN LET A4=0.000000009
0377 IF A4=1 THEN LET A4=0.999999999
0378 A5=(B4(K2)+B5(K2)+B6(K2))
0379 A6=(A5-(N*A4))/SQR((N*A4)*(1-A4))
0380 A7=A4(K2)+A5(K2)+A6(K2)
0381 T2=(A5-(A4*N))^2/(A4*N)
0382 PRINT USING 345;K2;A7;A5;A7/N;A4;A5/N;T2;A6;A5/N5
0383 WRITE £2 USING 345;K2;A7;A5;A7/N;A4;A5/N;T2;A6;A5/N5
0385 NEXT K2
0390 PRINT USING 315;"CONCORDS OF VARIABLE AND STRONG CONTRIBS"
0392 WRITE £2 USING 315;"CONCORDS OF VARIABLE AND STRONG CONTRIBS"
0395 FOR K3=1 TO 24
0396 IF A1(X1)=0 THEN 408
0397 A8=(A4(K3)/N)*(A1(X1)/N)
0398 IF A8=0 THEN LET A8=0.000000009
0399 IF A8=1 THEN LET A8=0.999999999
0400 A9=B4(K3)
0402 B1=(A9-(N*A8))/SQR((N*A8)*(1-A8))
0403 T3=(A9-(A8*N))^2/(A8*N)
0404 PRINT USING 345;K3;A4(K3);A9;A4(K3)/N;A8;A9/N;T3;B1;A9/N5
0406 WRITE £2 USING 345;K3;A4(K3);A9;A4(K3)/N;A8;A9/N;T3;B1;A9/N5
0408 NEXT K3
0410 PRINT USING 315;"CONCORDS OF VARIABLE AND MEDIUM CONTRIBS"
0412 WRITE £2 USING 315;"CONCORDS OF VARIABLE AND MEDIUM CONTRIBS"
0413 FOR K4=1 TO 24
0414 IF A1(X1)=0 THEN 430
0416 B2=(A5(K4)/N)*(A1(X1)/N)
0418 IF B2=0 THEN LET B2=0.000000009
0420 IF B2=1 THEN LET B2=0.999999999
0422 B3=B5(K4)
0424 B4=(B3-(N*B2))/SQR((N*B2)*(1-B2))
0425 T4=(B3-(B2*N))^2/(B2*N)
0426 PRINT USING 345;K4;A5(K4);B3;A5(K4)/N;B2;B3/N;T4;B4;B3/N5
0427 WRITE £2 USING 345;K4;A5(K4);B3;A5(K4)/N;B2;B3/N;T4;B4;B3/N5
0430 NEXT K4
0435 PRINT USING 315;"CONCORDS OF VARIABLE AND WEAK CONTRIBS"
0437 WRITE £2 USING 315;"CONCORDS OF VARIABLE AND WEAK CONTRIBS"
0438 FOR K5=1 TO 24
0440 IF A1(X1)=0 THEN 456
0442 B5=(A6(K5)/N)*(A1(X1)/N)
0444 IF B5=0 THEN LET B5=0.000000009
0446 IF B5=1 THEN LET B5=0.999999999
0448 B6=B6(K5)
0450 B7=(B6-(N*B5))/SQR((N*B5)*(1-B5))
0451 T5=(B6-(B5*N))^2/(B5*N)
0452 PRINT USING 345;K5;A6(K5);B6;A6(K5)/N;B5;B6/N;T5;B7;B6/N5
0454 WRITE £2 USING 345;K5;A6(K5);B6;A6(K5)/N;B5;B6/N;T5;B7;B6/N5
0456 NEXT K5
0460 PRINT USING 315;"CONCORDS OF VARIABLE AND ALL SUBJECTS"
0462 WRITE £2 USING 315;"CONCORDS OF VARIABLE AND ALL SUBJECTS"
0463 FOR K6=1 TO 15
0465 IF A1(X1)=0 THEN 482
0466 B8=((A7(K6)+A8(K6)+A9(K6))/N)*(A1(X1)/N)
0468 IF B8=0 THEN LET B8=0.000000009

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0469 IF B8=1 THEN LET B8=0.9999999999
0472 B9=(B7(K6)+B8(K6)+B9(K6))
0474 C1=(B9-(N*B8))/SQR((N*B8)*(1-B8))
0476 C2=A7(K6)+A8(K6)+A9(K6)
0477 T6=(B9-(B8*N))^2/(B8*N)
0478 PRINT USING 345;K6;C2;B9;C2/N;B8;B9/NT6;C1;B9/N5
0480 WRITE £2 USING 345;K6;C2;B9;C2/N;B8;B9/N;T6;C1;B9/N5
0482 NEXT K6
0483 PRINT USING 315;"CONCORDS OF VARIABLE AND BRIEFED SUBJECTS"
0484 WRITE £2 USING 315;"CONCORDS OF VARIABLE AND BRIEFED SUBJECTS"
0485 FOR K7=1 TO 15
0486 IF A1(X1)=0 THEN 497
0489 C3=(A7(K7)/N)*(A1(X1)/N)
0490 IF C3=0 THEN LET C3=0.0000000009
0491 IF C3=1 THEN LET C3=0.9999999999
0492 C4=B7(K7)
0493 C5=(C4-(N*C3))/SQR((N*C3)*(1-C3))
0494 T7=(C4-(C3*N))^2/(C3*N)
0495 PRINT USING 345;K7;A7(K7);C4;A7(K7)/N;C3;C4/N;T7;C5;C4/N5
0496 WRITE £2 USING 345;K7;A7(K7);C4;A7(K7)/N;C3;C4/N;T7;C5;C4/N5
0497 NEXT K7
0498 PRINT USING 315;"CONCORDS OF VARIABLE AND DISCOVERED SUBJECTS"
0499 WRITE £2 USING 315;"CONCORDS OF VARIABLE AND DISCOVERED SUBJECTS"
0503 FOR K8=1 TO 15
0504 IF A1(X1)=0 THEN 520
0506 C6=(A8(K)/N)*(A1(X1)/N)
0508 IF C6=0 THEN LET C6=0.000000000009
0510 IF C6=1 THEN LET C6=0.999999999999
0512 C7=B8(K8)
0514 C8=(C7-(N*C6))/SQR((N*C6)*(1-C6))
0515 T8=(C7-(C6*N))^2/(C6*N)
0516 PRINT USING 345;K8;A8(K8);B8(K8);A8(K8)/N;C6;C7/N;T8;C8;C7/N5
0518 WRITE £2 USING 345;K8;A8(K8);B8(K8);A8(K8)/N;C6;C7/N;T8;C8;C7/N5
0520 NEXT K8
0522 PRINT USING 315;"CONCORDS OF VARIABLE AND NEW SUBJECTS"
0524 WRITE £2 USING 315;"CONCORDS OF VARIABLE AND NEW SUBJECTS"
0525 FOR K9=1 TO 15
0526 IF A1(X1)=0 THEN 542
0528 C9=(A9(K9)/N)*(A1(X1)/N)
0530 IF C9=0 THEN LET C9=0.000000000009
0532 IF C9=1 THEN LET C9=0.999999999999
0534 D1=B9(K9)
0535 D2=(D1-(N*C9))/SQR((N*C9)*(1-C9))
0536 T9=(D1-(C9*N))^2/(C9*N)
0538 PRINT USING 345;K9;A9(K9);D1;A9(K9)/N;C9;B9(K9)/N;T9;D2;D1/N5
0540 WRITE £2 USING 345;K9;A9(K9);D1;A9(K9)/N;C9;B9(K9)/N;T9;D2;D1/N5
0542 NEXT K9
0548 PRINT USING 315;"CONCORDS OF VARIABLE AND NUMBERS"
0550 WRITE £2 USING 315;"CONCORDS OF VARIABLE AND NUMBERS"
0551 FOR L1=1 TO 800
0552 IF A1(L1)=0 THEN 568
0553 IF A1(X1)=0 THEN 568
0554 D3=(A1(L1)/N)*(A1(X1)/N)
0556 IF D3=0 THEN LET D3=0.000000000009
0558 IF D3=1 THEN LET D3=0.999999999999
0560 D4=B1(L1)
0562 D5=(D4-(N*D3))/SQR((N*D3)*(1-D3))
0563 U1=(D4-(D3*N))^2/(D3*N)
0564 PRINT USING 345;L1;A1(L1);D4;A1(L1)/N;D3;D4/N;U1;D5;D4/N5
0566 WRITE £2 USING 345;L1;A1(L1);D4;A1(L1)/N;D3;D4/N;U1;D5;D4/N5

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0568 NEXT L1
0570 PRINT USING 315;"CONCORDS OF VARIABLE AND CHARACTERS"
0572 WRITE £2 USING 315;"CONCORDS OF VARIABLE AND CHARACTERS"
0573 FOR L2=1 TO 52
0574 IF A2(L2)=0 THEN 590
0575 IF A1(X1)=0 THEN 590
0576 D6=(A2(L2)/N)*(A1(X1)/N)
0578 IF D6=0 THEN LET D6=0.000000009
0580 IF D6=1 THEN LET D6=0.9999999999
0582 D7=B2(L2)
0583 D8=(D7-(N*D6))/SQR((N*D6)*(1-D6))
0584 U2=(D7-(D6*N))^2/(D6*N)
0586 PRINT USING 345,L2,A2(L2),D7,A2(L2)/N,D6,D7/N,U2,D8,D7/N5
0588 WRITE £2 USING 345,L2,A2(L2),D7,A2(L2)/N,D6,D7/N,U2,D8,D7/N5
0590 NEXT L2
0600 GO TO 2140
0645 REM ALPHANUMERIC ANALYSIS SECTION
0647 SCRATCH £2
0648:      ffff
0650 REM ALPHANUMERIC ANALYSIS SECTION
0651: 'CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
0652:  ffff ffff £.ffff
0653 WRITE £2 USING 651;"RESULTS OF NUMBER/CHARACTER (PROG6) ANALYSIS"
0654 WRITE £2 USING 651;"FILE....."
0655 WRITE £2 USING 651;Z9$
0656 WRITE £2 USING 651;"ALPHANUMERIC VARIABLE....."
0657 WRITE £2 USING 651;X1$
0658 PRINT USING 651;"ANALYSIS OF RECORDS"
0659 WRITE £2 USING 651;"ANALYSIS OF RECORDS"
0660 PRINT USING 652;N,N5,N5/N
0661 WRITE £2 USING 652;N,N5,N5/N
0662 PRINT USING 651;"ANALYSIS OF INPUTS/OUTPUTS"
0663 WRITE £2 USING 651;"ANALYSIS OF INPUTS/OUTPUTS"
0664 PRINT USING 652;C1(1),C2(1),C2(1)/C1(1)
0666 WRITE £2 USING 652;C1(1),C2(1),C2(1)/C1(1)
0668 PRINT USING 652;C2(1),C2(2),C2(2)/C2(1)
0670 WRITE £2 USING 652;C2(1),C2(2),C2(2)/C1(2)
0672: ffff ffff ffff £.ffff £.ffff £.ffff £.ffff £.ffff £.ffff
0675 PRINT USING 651;"CONCORDANCE ANALYSIS SECTION"
0677 WRITE £2 USING 651;"CONCORDANCE ANALYSIS SECTION"
0680 PRINT
0685 PRINT USING 651;"CONCORDS OF VARIABLE AND CONTRIBUTORS"
0686 WRITE £2 USING 651;"CONCORDS OF VARIABLE AND CONTRIBUTORS"
0688 FOR K1=1 TO 16
0689 IF A2(X1)=0 THEN 704
0690 A1=(A3(K1)/N)*(A2(X1)/N)
0692 IF A1=0 THEN LET A1=0.000000009
0694 IF A1=1 THEN LET A1=0.9999999999
0696 A2=B3(K1)
0698 A3=(A2-(N*A1))/SQR((N*A1)*(1-A1))
0699 T1=(A2-(A1*N))^2/(A1*N)
0700 PRINT USING 672,K1,A3(K1),A2,A3(K1)/N,A1,A2/N,T1,A3,A2/N5
0702 WRITE £2 USING 672,K1,A3(K1),A2,A3(K1)/N,A1,A2/N,T1,A3,A2/N5
0704 NEXT K1
0706 PRINT USING 651;"CONCORDS OF VARIABLE AND ALL CONTRIBUTIONS"
0708 WRITE £2 USING 651;"CONCORDS OF VARIABLE AND ALL CONTRIBUTIONS"
0710 FOR K2=1 TO 24
0711 IF A2(X1)=0 THEN 726
0712 A4=((A4(K2)+A5(K2)+A6(K2))/N)*(A2(X1)/N)
0714 IF A4=0 THEN LET A4=0.000000009

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0716 IF A4=1 THEN LET A4=0.9999999999
0718 A5=(B4(K2)+B5(K2)+B6(K2))
0719 A6=(A5-(N*A4))/SQR((N*A4)*(1-A4))
0720 A7=A4(K2)+A5(K2)+A6(K2)
0721 T2=(A5-(A4*N))^2/(A4*N)
0722 PRINT USING 672;K2;A7;A5;A7/N;A4;A5/N;T2;A6;A5/N5
0724 WRITE £2 USING 672;K2;A7;A5;A7/N;A4;A5/N;T2;A6;A5/N5
0726 NEXT K2
0730 PRINT USING 651;"CONCORDS OF VARIABLE AND STRONG CONTRIBUTIONS"
0732 WRITE £2 USING 651;"CONCORDS OF VARIABLE AND STRONG CONTRIBUTIONS"
0734 FOR K3=1 TO 24
0735 IF A2(X1)=0 THEN 752
0736 A8=(A4(K3)/N)*(A2(X1)/N)
0738 IF A8=0 THEN LET A8=0.00000000009
0740 IF A8=1 THEN LET A8=0.99999999999
0742 A9=B4(K3)
0746 B1=(A9-(N*A8))/SQR((N*A8)*(1-A8))
0747 T3=(A9-(A8*N))^2/(A8*N)
0748 PRINT USING 672;K3;A4(K3);A9;A4(K3)/N;A8;A9/N;T3;B1;A9/N5
0750 WRITE £2 USING 672;K3;A4(K3);A9;A4(K3)/N;A8;A9/N;T3;B1;A9/N5
0752 NEXT K3
0754 PRINT USING 651;"CONCORDS OF VARIABLE AND MEDIUM CONTRIBUTIONS"
0756 WRITE £2 USING 651;"CONCORDS OF VARIABLE AND MEDIUM CONTRIBUTIONS"
0758 FOR K4=1 TO 24
0759 IF A2(X1)=0 THEN 774
0760 B2=(A5(K4)/N)*(A2(X1)/N)
0762 IF B2=0 THEN LET B2=0.00000000009
0764 IF B2=1 THEN LET B2=0.99999999999
0766 B3=B5(K4)
0768 B4=(B3-(N*B2))/SQR((N*B2)*(1-B2))
0769 T4=(B3-(B2*N))^2/(B2*N)
0770 PRINT USING 672;K4;A5(K4);B3;A5(K4)/N;B2;B3/N;T4;B4;B3/N5
0772 WRITE £2 USING 672;K4;A5(K4);B3;A5(K4)/N;B2;B3/N;T4;B4;B3/N5
0774 NEXT K4
0776 PRINT USING 651;"CONCORDS OF VARIABLE AN WEAK CONTRIBUTIONS"
0778 WRITE £2 USING 651;"CONCORDS OF VARIABLE AND WEAK CONTRIBUTIONS"
0780 FOR K5=1 TO 24
0781 IF A2(X1)=0 THEN 796
0782 B5=(A6(K5)/N)*(A2(X1)/N)
0784 IF B5=0 THEN LET B5=0.00000000009
0786 IF B5=1 THEN LET B5=0.99999999999
0788 B6=B6(K5)
0790 B7=(B6-(N*B5))/SQR((N*B5)*(1-B5))
0791 T5=(B6-(B5*N))^2/(B5*N)
0792 PRINT USING 672;K5;A6(K5);B6;A6(K5)/N;B5;B6/N;T5;B7;B6/N5
0794 WRITE £2 USING 672;K5;A6(K5);B6;A6(K5)/N;B5;B6/N;T5;B7;B6/N5
0796 NEXT K5
0800 PRINT USING 651;"CONCORDS OF VARIABLE AND ALL SUBJECTS"
0802 WRITE £2 USING 651;"CONCORDS OF VARIABLE AND ALL SUBJECTS"
0804 FOR K6=1 TO 15
0805 IF A2(X1)=0 THEN 822
0806 B8=((A7(K6)+A8(K6)+A9(K6))/N)*(A2(X1)/N)
0808 IF B8=0 THEN LET B8=0.0000000009
0810 IF B8=1 THEN LET B8=0.9999999999
0812 B9=B7(K6)+B8(K6)+B9(K6)
0814 C1=(B9-(N*B8))/SQR((N*B8)*(1-B8))
0816 C2=A7(K6)+A8(K6)+A9(K6)
0817 T6=(B9-(B8*N))^2/(B8*N)
0818 PRINT USING 672;K6;C2;B9;C2/N;B8;B9/N;T6;C1;B9/N5
0820 WRITE £2 USING 672;K6;C2;B9;C2/N;B8;B9/N;T6;C1;B9/N5

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0822 NEXT K6
0824 PRINT USING 651;"CONCORDS OF VARIABLE AND BRIEFED SUBJECTS"
0826 WRITE £2 USING 651;"CONCORDS OF VARIABLE AND BRIEFED SUBJECTS"
0828 FOR K7=1 TO 15
0829 IF A2(X1)=0 THEN 844
0830 C3=(A7(K7)/N)*(A2(X1)/N)
0832 IF C3=0 THEN LET C3=0.0000000009
0834 IF C3=1 THEN LET C3=0.9999999999
0836 C4=B7(K7)
0838 C5=(C4-(N*C3))/SQR((N*C3)*(1-C3))
0839 T7=(C4-(C3*N))^2/(C3*N)
0840 PRINT USING 672,K7,A7(K7);C4;A7(K7)/N;C3;C4/N;T7;C5;C4/N5
0842 WRITE £2 USING 672,K7,A7(K7);C4;A7(K7)/N;C3;C4/N;T7;C5;C4/N5
0844 NEXT K7
0846 PRINT USING 651;"CONCORDS OF VARIABLE AND DISCOVERED SUBJECTS"
0848 WRITE £2 USING 651;"CONCORDS OF VARIABLE AND DISCOVERED SUBJECTS"
0850 FOR K8=1 TO 15
0851 IF A2(X1)=0 THEN 874
0852 C6=(A8(K8)/N)*(A2(X1)/N)
0854 IF C6=0 THEN LET C6=0.0000000009
0856 IF C6=1 THEN LET C6=0.9999999999
0858 C7=B8(K8)
0860 C8=(C7-(N*C6))/SQR((N*C6)*(1-C6))
0861 T8=(C7-(C6*N))^2/(C6*N)
0862 PRINT USING 672,K8,A8(K8);C7;A8(K8)/N;C6;C7/N;T8;C8;C7/N5
0864 WRITE £2 USING 672,K8,A8(K8);C7;A8(K8)/N;C6;C7/N;T8;C8;C7/N5
0866 NEXT K8
0870 PRINT USING 651;"CONCORDS OF VARIABLE AND NEW SUBJECTS"
0872 WRITE £2 USING 651;"CONCORDS OF VARIABLE AND NEW SUBJECTS"
0874 FOR K9=1 TO 15
0876 C9=(A9(K9)/N)*(A2(X1)/N)
0878 IF C9=0 THEN LET C9=0.0000000009
0880 IF C9=1 THEN LET C9=0.9999999999
0885 D1=B9(K9)
0890 D2=(D1-(N*C9))/SQR((N*C9)*(1-C9))
0892 T9=(D1-(C9*N))^2/(C9*N)
0895 PRINT USING 672,K9,A9(K9);D1;A9(K9)/N;C9;D1/N;T9;D2;D1/N5
0900 WRITE £2 USING 672,K9,A9(K9);D1;A9(K9)/N;C9;D1/N;T9;D2;D1/N5
0902 NEXT K9
0904 PRINT USING 651;"CONCORDS OF VARIABLE AND NUMBERS"
0906 WRITE £2 USING 651;"CONCORDS OF VARIABLE AND NUMBERS"
0907 FOR L1=1 TO 800
0908 IF A1(L1)=0 THEN 924
0909 IF A2(X1)=0 THEN 924
0910 D3=(A1(L1)/N)*(A2(X1)/N)
0912 IF D3=0 THEN LET D3=0.0000000009
0914 IF D3=1 THEN LET D3=0.9999999999
0916 D4=B1(L1)
0918 D5=(D4-(N*D3))/SQR((N*D3)*(1-D3))
0919 U1=(D4-(D3*N))^2/(D3*N)
0920 PRINT USING 672,L1,A1(L1);D4;A1(L1)/N;D3;D4/N;U1;D5;D4/N5
0922 WRITE £2 USING 672,L1,A1(L1);D4;A1(L1)/N;D3;D4/N;U1;D5;D4/N5
0924 NEXT L1
0926 PRINT USING 651;"CONCORDS OF VARIABLE AND CHARACTERS"
0928 WRITE £2 USING 651;"CONCORDS OF VARIABLE AND CHARACTERS"
0929 FOR L2=1 TO 52
0930 IF A2(L2)=0 THEN 955
0931 IF A2(X1)=0 THEN 955
0932 D6=(A2(L2)/N)*(A2(X1)/N)
0933 IF D6=0 THEN LET D6=0.0000000009

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0934 IF D6=1 THEN LET D6=0.9999999999
0936 D7=B2(L2)
0938 D8=(D7-(N*D6))/SQR((N*D6)*(1-D6))
0939 U2=(D7-(D6*N))^2/(D6*N)
0940 PRINT USING 672;L2;A2(L2);D7;A(L2)/N;D6;D7/N;U2;D8;D7/N5
0950 WRITE £2 USING 672;L2;A2(L2);D7;A2(L2)/N;D6;D7/N;U2;D8;D7/N5
0955 NEXT L2
0960 GO TO 2140
2000 REM SUBROUTINE 2000
2005 N5=N5+1
2010 FOR J2=1 TO 5
2011 IF A(J2)=0 THEN 2014
2012 B1(A(J2))=B1(A(J2))+1
2014 NEXT J2
2016 IF A$="AA" THEN B3(1)=B3(1)+1
2017 IF A$="AB" THEN B3(2)=B3(2)+1
2018 IF A$="AC" THEN B3(3)=B3(3)+1
2019 IF A$="AD" THEN B3(4)=B3(4)+1
2020 IF A$="BA" THEN B3(5)=B3(5)+1
2021 IF A$="BB" THEN B3(6)=B3(6)+1
2022 IF A$="BC" THEN B3(7)=B3(7)+1
2023 IF A$="BD" THEN B3(8)=B3(8)+1
2024 IF A$="CA" THEN B3(9)=B3(9)+1
2025 IF A$="CB" THEN B3(10)=B3(10)+1
2026 IF A$="CC" THEN B3(11)=B3(11)+1
2027 IF A$="CD" THEN B3(12)=B3(12)+1
2028 IF A$="DA" THEN B3(13)=B3(13)+1
2029 IF A$="DB" THEN B3(14)=B3(14)+1
2030 IF A$="DC" THEN B3(15)=B3(15)+1
2031 IF A$="DD" THEN B3(16)=B3(16)+1
2032 IF D$="Z" THEN 2036
2033 IF D$="A" THEN B4(C)=B4(C)+1
2034 IF D$="B" THEN B5(C)=B5(C)+1
2035 IF D$="C" THEN B6(C)=B6(C)+1
2036 IF F$="Z" THEN 2040
2037 IF F$="D" THEN B7(E)=B7(E)+1
2038 IF F$="E" THEN B8(E)=B8(E)+1
2039 IF F$="F" THEN B9(E)=B9(E)+1
2040 IF B=1 THEN C2(1)=C2(1)+1
2045 IF B=2 THEN C2(2)=C2(2)+1
2046 N6=N6+1
2047 FOR J3=1 TO 5
2048 IF A(J3)>0 THEN N7=N7+1
2049 NEXT J3
2050 FOR J4=1 TO 3
2053 IF A$(J4)="Z" THEN 2130
2055 IF LEN(A$(J4))>1 THEN 2082
2060 IF A$(J4)="A" THEN B2(1)=B2(1)+1
2061 IF A$(J4)="B" THEN B2(2)=B2(2)+1
2062 IF A$(J4)="C" THEN B2(3)=B2(3)+1
2063 IF A$(J4)="D" THEN B2(4)=B2(4)+1
2064 IF A$(J4)="E" THEN B2(5)=B2(5)+1
2065 IF A$(J4)="F" THEN B2(6)=B2(6)+1
2066 IF A$(J4)="G" THEN B2(7)=B2(7)+1
2067 IF A$(J4)="H" THEN B2(8)=B2(8)+1
2068 IF A$(J4)="I" THEN B2(9)=B2(9)+1
2069 IF A$(J4)="J" THEN B2(10)=B2(10)+1
2070 IF A$(J4)="K" THEN B2(11)=B2(11)+1
2071 IF A$(J4)="L" THEN B2(12)=B2(12)+1
2072 IF A$(J4)="M" THEN B2(13)=B2(13)+1

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2073 IF A$(J4)="N" THEN B2(14)=B2(14)+1
2074 IF A$(J4)="O" THEN B2(15)=B2(15)+1
2075 IF A$(J4)="P" THEN B2(16)=B2(16)+1
2076 IF A$(J4)="Q" THEN B2(17)=B2(17)+1
2077 IF A$(J4)="R" THEN B2(18)=B2(18)+1
2078 IF A$(J4)="S" THEN B2(19)=B2(19)+1
2079 IF A$(J4)="T" THEN B2(20)=B2(20)+1
2080 N8=N8+1
2081 GO TO 2130
2082 IF RIGHT(A$(J4),1)="*" THEN 2110
2085 IF A$(J4)="AA" THEN B2(21)=B2(21)+1
2086 IF A$(J4)="AB" THEN B2(22)=B2(22)+1
2087 IF A$(J4)="AC" THEN B2(23)=B2(23)+1
2088 IF A$(J4)="AD" THEN B2(24)=B2(24)+1
2089 IF A$(J4)="BA" THEN B2(25)=B2(25)+1
2090 IF A$(J4)="BB" THEN B2(26)=B2(26)+1
2091 IF A$(J4)="BC" THEN B2(27)=B2(27)+1
2092 IF A$(J4)="BD" THEN B2(28)=B2(28)+1
2093 IF A$(J4)="CA" THEN B2(29)=B2(29)+1
2095 IF A$(J4)="CC" THEN B2(31)=B2(31)+1
2096 IF A$(J4)="CD" THEN B2(32)=B2(32)+1
2097 IF A$(J4)="DA" THEN B2(33)=B2(33)+1
2098 IF A$(J4)="DB" THEN B2(34)=B2(34)+1
2099 IF A$(J4)="DC" THEN B2(35)=B2(35)+1
2100 IF A$(J4)="DD" THEN B2(36)=B2(36)+1
2105 N9=N9+1
2106 GO TO 2130
2110 IF A$(J4)="1*" THEN B2(37)=B2(37)+1
2111 IF A$(J4)="2*" THEN B2(38)=B2(38)+1
2112 IF A$(J4)="3*" THEN B2(39)=B2(39)+1
2113 IF A$(J4)="4*" THEN B2(40)=B2(40)+1
2114 IF A$(J4)="5*" THEN B2(41)=B2(41)+1
2115 IF A$(J4)="6*" THEN B2(42)=B2(42)+1
2116 IF A$(J4)="7*" THEN B2(43)=B2(43)+1
2117 IF A$(J4)="8*" THEN B2(44)=B2(44)+1
2118 IF A$(J4)="9*" THEN B2(45)=B2(45)+1
2119 IF A$(J4)="10*" THEN B2(46)=B2(46)+1
2120 IF A$(J4)="11*" THEN B2(47)=B2(47)+1
2121 IF A$(J4)="12*" THEN B2(48)=B2(48)+1
2122 IF A$(J4)="13*" THEN B2(49)=B2(49)+1
2123 IF A$(J4)="14*" THEN B2(50)=B2(50)+1
2124 IF A$(J4)="15*" THEN B2(51)=B2(51)+1
2125 IF A$(J4)="16*" THEN B2(52)=B2(52)+1
2130 NEXT J4
2131 RETURN
2140 STOP
2150 END

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97,5,B,97,0,0,0,0,0,BA,Z,Z,Z,O,O;
 97,5,B,119,32,238,97,0,0,BA,Z,Z,Z,Z,O;
 97,3,B,124,139,238,0,0,0,Z,Z,Z,Z,Z,O;
 97,3,A,124,301,261,139,0,0,BA,Z,Z,Z,Z,V;
 97,5,B,124,121,401,139,0,0,BA,L,Z,Z,O,O;
 97,1,B,261,124,201,10,0,0,BA,L,Z,Z,O,V;
 97,3,B,261,0,0,0,0,0,BA,Z,Z,Z,O,V;
 97,1,B,261,111,90,0,0,0,G,H,Z,Z,O,V;
 97,8,B,90,0,0,0,0,0,H,G,Z,Z,O,V;
 97,3,B,261,124,401,139,0,0,G,Z,Z,Z,O,V;
 97,5,B,261,401,124,139,0,0,BA,A,L,Z,O,V;
 97,3,B,261,276,89,90,0,0,BA,Z,Z,Z,O,V;
 97,5,B,417,152,0,0,0,0,BA,Z,Z,Z,O,O;
 97,5,B,119,238,261,417,89,90,BA,Z,Z,Z,Z,V;
 97,3,A,124,139,238,0,0,0,B,Z,Z,Z,Z,O;
 97,1,B,124,139,0,0,0,0,B,Z,Z,Z,O,O;
 97,1,B,29,124,0,0,0,0,B,Z,Z,Z,O,O;
 97,1,B,124,139,0,0,0,0,D,Z,Z,Z,O,O;
 97,3,B,112,238,139,0,0,0,D,B,Z,Z,Z,O;
 97,5,B,139,238,42,0,0,0,BA,Z,Z,Z,O,O;
 97,3,B,238,112,139,0,0,0,BA,B,D,Z,Z,O;
 97,3,A,238,112,139,0,0,0,BA,B,D,Z,Z,O;
 97,5,B,112,238,139,0,0,0,BA,DB,B,Z,Z,O;
 97,5,B,139,238,0,0,0,0,BA,B,Z,Z,Z,O;
 97,5,C,119,238,139,0,0,0,BA,B,DB,Z,Z,O;
 97,3,B,0,0,0,0,0,0,BA,Z,Z,Z,O,O;
 97,3,B,261,238,139,0,0,0,B,D,Z,Z,O,V;
 97,3,B,261,139,111,130,0,0,BA,J,Z,Z,O,V;
 97,3,B,261,139,111,238,0,0,B,D,Z,Z,Z,V;
 97,3,B,261,124,139,119,238,0,BA,Z,Z,Z,Z,V;
 97,3,B,111,130,238,139,0,0,BA,Z,Z,Z,O,O;
 97,3,B,261,139,0,0,0,0,BA,Z,Z,Z,O,V;
 97,3,B,238,111,139,0,0,0,BA,DB,Z,Z,Z,V;
 97,3,A,261,90,139,0,0,0,DB,J,Z,Z,O,V;
 97,3,B,261,90,139,0,0,0,DB,J,Z,Z,O,V;
 97,3,C,261,90,110,139,0,0,DB,J,Z,Z,Z,V;
 97,3,B,119,238,261,139,0,0,DB,J,BA,Z,Z,V;
 201,3,B,30,238,0,0,0,0,Z,Z,Z,Z,Z,O;
 201,3,B,29,30,238,0,0,0,L,Z,Z,Z,Z,O;
 201,3,B,238,30,0,0,0,0,B,L,Z,Z,Z,O;
 201,3,A,261,112,13,0,0,0,Z,Z,Z,Z,O,V;
 201,3,A,261,112,13,238,0,0,Z,Z,Z,Z,Z,V;
 201,3,B,261,238,401,13,111,0,B,Z,Z,Z,Z,V;
 201,1,B,261,111,401,13,0,0,B,Z,Z,Z,Z,V;
 201,3,B,261,111,401,13,90,112,J,BA,Z,Z,Z,V;
 201,5,B,112,401,13,238,0,0,BA,D,A,Q,Z,V;
 201,3,A,238,112,401,13,0,0,D,Z,Z,Z,O,O;
 201,1,B,124,139,111,401,13,0,A,Q,BA,Z,O,V;
 201,5,B,261,401,13,112,0,0,BA,D,A,Q,Z,V;
 201,5,B,0,0,0,0,0,0,BA,B,Z,Z,O,O;
 201,3,B,238,11,0,0,0,0,Z,Z,Z,Z,Z,O;
 201,3,B,238,37,9,0,0,0,BA,Z,Z,Z,Z,O;
 201,3,B,261,111,201,0,0,0,DA,BA,Z,Z,O,V;
 201,2,C,111,124,261,0,0,0,DA,Z,Z,Z,Z,V;
 201,1,B,261,109,37,0,0,0,B,Z,Z,Z,O,V;
 201,3,B,261,37,110,109,276,0,BA,B,Z,Z,Y,V;
 201,5,B,424,4,37,109,131,0,BA,A,Z,Z,X,W;
 201,1,B,261,111,203,201,0,0,B,D,Z,Z,Z,V;
 201,5,B,11,238,124,0,0,0,BA,Z,Z,Z,O,O;
 201,3,B,127,11,57,0,0,0,BA,Z,Z,Z,O,O;

EXAMPLE INTERVIEW DATA FILE

201,5,B,124,238,57,11,0,0,BA,D,B,Z,Z,O,
97,5,B,124,238,57,11,0,0,BA,D,B,Z,Z,O,
97,5,C,124,238,57,11,0,0,BA,D,B,Z,Z,O,
97,3,B,261,124,238,57,11,0,B,Z,Z,Z,Z,V,
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121,1,B,261,111,0,0,0,0,0,BB,Z,Z,Z,O,V,
121,8,B,276,251,4,121,238,251,BB,O,Z,Z,Y,V,
121,3,B,261,119,34,88,29,55,BB,B,I,Z,Z,V,
121,3,A,261,34,121,55,88,0,B,I,Z,Z,Z,V,
121,5,A,261,88,55,119,34,121,BA,B,L,Z,Z,V,
121,3,A,34,121,119,0,0,0,0,B,L,Z,Z,Z,V,
121,5,A,261,276,252,0,0,0,0,BA,B,L,Z,Y,V,
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121,3,B,263,223,401,55,203,34,M,B,Z,Z,Y,O,
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97,5,B,238,139,124,0,0,0,BA,D,Z,Z,Z,O,
97,3,B,238,0,0,0,0,0,Z,Z,Z,Z,Z,O,
97,5,B,251,139,276,97,124,0,BA,D,O,Z,X,O,
97,3,B,110,124,139,276,251,0,Z,Z,Z,Z,O,O,

EXAMPLE INTERVIEW RESULTS PRINT OUT

Analysis of the example interview data file for
references to cost using program 1.

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00100      RESULTS OF INTERVIEW NUMBER (PROG1) ANALYSIS
00110      FILE.....
00120      DBBA6
00130      NUMERIC VARIABLE.....
00140      4.00;
00150      ANALYSIS OF RECORDS
00160      553; .1410; .0389; .1595; .2400; 2.1667; .0273; .1703;
00170      CONCORDS OF VARIABLE AND NUMBERS
00180      3; 11; 1; .003; .196; -.443; .020; .002; .000; .000; .
00190      4; 78; 78; .020; *408.002; *20.403; .141; .141; .039; .02
00200      5; 8; 0; .002; 1.128; *-1.063; .014; .000; .000; .000; .
00210      6; 2; 0; .001; .282; -.531; .004; .000; .000; .000; .
00220      7; 2; 0; .001; .282; -.531; .004; .000; .000; .000; .
00230      9; 15; 0; .004; 2.116; *-1.457; .027; .000; .000; .000; .
00240      10; 5; 2; .001; 2.377; 1.543; .009; .004; .001; .001; .
00250      11; 10; 1; .003; .119; -.346; .018; .002; .000; .000; .
00260      12; 1; 1; .000; 5.231; 2.287; .002; .002; .000; .000; .
00270      13; 14; 0; .004; 1.975; *-1.408; .025; .000; .000; .000; .
00280      14; 8; 2; .002; .673; .821; .014; .004; .001; .001; .
00290      17; 4; 1; .001; .337; .580; .007; .002; .000; .000; .
00300      18; 16; 0; .004; 2.257; *-1.505; .029; .000; .000; .000; .
00310      21; 1; 0; .000; .141; -.376; .002; .000; .000; .000; .
00320      23; 3; 0; .001; .423; -.651; .005; .000; .000; .000; .
00330      27; 7; 0; .002; .987; -.995; .013; .000; .000; .000; .
00340      28; 7; 0; .002; .987; -.995; .013; .000; .000; .000; .
00350      29; 22; 1; .006; 1.425; *-1.197; .040; .002; .000; .000; .
00360      30; 27; 2; .007; .859; -.930; .049; .004; .001; .001; .
00370      32; 13; 1; .003; .379; -.617; .024; .002; .000; .000; .
00380      34; 24; 0; .006; 3.385; *-1.846; .043; .000; .000; .000; .
00390      35; 6; 0; .002; .846; -.921; .011; .000; .000; .000; .
00400      37; 35; 2; .009; 1.747; *-1.328; .063; .004; .001; .001; .
00410      38; 7; 4; .002; 9.192; 3.035; .013; .007; .002; .001; .
00420      39; 1; 0; .000; .141; -.376; .002; .000; .000; .000; .
00430      40; 2; 0; .001; .282; -.531; .004; .000; .000; .000; .
00440      42; 14; 1; .004; .481; -.695; .025; .002; .000; .000; .
00450      46; 1; 0; .000; .141; -.376; .002; .000; .000; .000; .
00460      48; 1; 1; .000; 5.231; 2.287; .002; .002; .000; .000; .
00470      50; 1; 1; .000; 5.231; 2.287; .002; .002; .000; .000; .
00480      51; 2; 0; .001; .282; -.531; .004; .000; .000; .000; .
00490      54; 1; 0; .000; .141; -.376; .002; .000; .000; .000; .
00500      55; 4; 0; .001; .564; -.752; .007; .000; .000; .000; .
00510      57; 50; 6; .013; .157; -.399; .090; .011; .003; .002; .
00520      58; 1; 0; .000; .141; -.376; .002; .000; .000; .000; .
00530      68; 14; 2; .004; .000; .018; .025; .004; .001; .001; .
00540      77; 3; 0; .001; .423; -.651; .005; .000; .000; .000; .
00550      80; 3; 0; .001; .423; -.651; .005; .000; .000; .000; .
00560      86; 2; 0; .001; .282; -.531; .004; .000; .000; .000; .
00570      88; 16; 0; .004; 2.257; *-1.505; .029; .000; .000; .000; .
00580      89; 9; 2; .002; .420; .649; .016; .004; .001; .001; .
00590      90; 39; 0; .010; 5.501; *-2.357; .071; .000; .000; .000; .
00600      97; 33; 11; .008; 8.650; 2.954; .060; .020; .005; .004; .
00610      98; 17; 2; .004; .066; -.257; .031; .004; .001; .001; .
00620      99; 24; 1; .006; 1.681; *-1.300; .043; .002; .000; .000; .
00630      105; 5; 0; .001; .705; -.840; .009; .000; .000; .000; .
00640      106; 1; 0; .000; .141; -.376; .002; .000; .000; .000; .
00650      107; 3; 0; .001; .423; -.651; .005; .000; .000; .000; .
00660      109; 11; 2; .003; .130; .361; .020; .004; .001; .001; .
00670      110; 25; 0; .006; 3.526; *-1.884; .045; .000; .000; .000; .
00680      111; 104; 3; .027; 9.283; *-3.088; .188; .005; .001; .001; .
00690      112; 54; 2; .014; 4.142; *-2.049; .098; .004; .001; .001; .

```

00700	115,	1,	0,	.000,	.141,	-.376,	.002,	.000,	.000,	.000,	.
00710	116,	11,	0,	.003,	1.552,	*-1.247,	.020,	.000,	.000,	.000,	.
00720	119,	55,	6,	.014,	.398,	-.636,	.099,	.011,	.003,	.002,	.
00730	120,	1,	0,	.000,	.141,	-.376,	.002,	.000,	.000,	.000,	.
00740	121,	66,	42,	.017,	*114.799,	*10.806,	.119,	.076,	.021,	.01	.
00750	124,	73,	0,	.019,	*10.297,	*-3.239,	.132,	.000,	.000,	.000,	.
00760	127,	5,	0,	.001,	.705,	-.840,	.009,	.000,	.000,	.000,	.
00770	130,	5,	1,	.001,	.123,	.351,	.009,	.002,	.000,	.000,	.
00780	131,	47,	11,	.012,	2.882,	1.708,	.085,	.020,	.005,	.004,	.
00790	132,	9,	1,	.002,	.057,	-.239,	.016,	.002,	.000,	.000,	.
00800	135,	8,	0,	.002,	1.128,	*-1.063,	.014,	.000,	.000,	.000,	.
00810	139,	77,	0,	.020,	*10.861,	*-3.328,	.139,	.000,	.000,	.000,	.
00820	141,	18,	0,	.005,	2.539,	*-1.597,	.033,	.000,	.000,	.000,	.
00830	150,	20,	0,	.005,	2.821,	*-1.684,	.036,	.000,	.000,	.000,	.
00840	152,	1,	0,	.000,	.141,	-.376,	.002,	.000,	.000,	.000,	.
00850	201,	39,	4,	.010,	.410,	-.643,	.071,	.007,	.002,	.001,	.
00860	203,	13,	1,	.003,	.379,	-.617,	.024,	.002,	.000,	.000,	.
00870	205,	2,	1,	.001,	1.827,	1.352,	.004,	.002,	.000,	.000,	.
00880	208,	1,	0,	.000,	.141,	-.376,	.002,	.000,	.000,	.000,	.
00890	214,	17,	2,	.004,	.066,	-.257,	.031,	.004,	.001,	.001,	.
00900	223,	10,	0,	.003,	1.410,	*-1.189,	.018,	.000,	.000,	.000,	.
00910	225,	3,	0,	.001,	.423,	-.651,	.005,	.000,	.000,	.000,	.
00920	228,	1,	0,	.000,	.141,	-.376,	.002,	.000,	.000,	.000,	.
00930	230,	21,	12,	.005,	*27.577,	5.266,	.038,	.022,	.006,	.004,	.
00940	232,	2,	0,	.001,	.282,	-.531,	.004,	.000,	.000,	.000,	.
00950	238,	140,	8,	.036,	6.988,	*-2.692,	.253,	.014,	.004,	.003,	.
00960	243,	3,	0,	.001,	.423,	-.651,	.005,	.000,	.000,	.000,	.
00970	247,	1,	0,	.000,	.141,	-.376,	.002,	.000,	.000,	.000,	.
00980	249,	9,	0,	.002,	1.269,	*-1.128,	.016,	.000,	.000,	.000,	.
00990	250,	5,	4,	.001,	*15.392,	3.926,	.009,	.007,	.002,	.001,	.
01000	251,	39,	7,	.010,	.409,	.642,	.071,	.013,	.003,	.002,	.
01010	252,	33,	13,	.008,	*14.963,	3.885,	.060,	.024,	.006,	.005,	.
01020	257,	33,	5,	.008,	.026,	.161,	.060,	.009,	.002,	.002,	.
01030	260,	2,	0,	.001,	.282,	-.531,	.004,	.000,	.000,	.000,	.
01040	261,	227,	24,	.058,	2.008,	*-1.460,	.410,	.043,	.012,	.009,	.
01050	262,	9,	0,	.002,	1.269,	*-1.128,	.016,	.000,	.000,	.000,	.
01060	263,	4,	0,	.001,	.564,	-.752,	.007,	.000,	.000,	.000,	.
01070	264,	12,	1,	.003,	.283,	-.533,	.022,	.002,	.000,	.000,	.
01080	265,	9,	0,	.002,	1.269,	*-1.128,	.016,	.000,	.000,	.000,	.
01090	268,	1,	0,	.000,	.141,	-.376,	.002,	.000,	.000,	.000,	.
01100	270,	10,	1,	.003,	.119,	-.346,	.018,	.002,	.000,	.000,	.
01110	271,	4,	0,	.001,	.564,	-.752,	.007,	.000,	.000,	.000,	.
01120	272,	1,	0,	.000,	.141,	-.376,	.002,	.000,	.000,	.000,	.
01130	276,	61,	11,	.016,	.667,	.823,	.110,	.020,	.005,	.004,	.
01140	277,	4,	4,	.001,	*20.923,	4.577,	.007,	.007,	.002,	.001,	.
01150	301,	1,	0,	.000,	.141,	-.376,	.002,	.000,	.000,	.000,	.
01160	401,	34,	5,	.009,	.009,	.094,	.061,	.009,	.002,	.002,	.
01170	402,	12,	7,	.003,	*16.642,	4.086,	.022,	.013,	.003,	.002,	.
01180	405,	4,	2,	.001,	3.654,	1.913,	.007,	.004,	.001,	.001,	.
01190	408,	4,	3,	.001,	*10.516,	3.245,	.007,	.005,	.001,	.001,	.
01200	409,	4,	1,	.001,	.337,	.580,	.007,	.002,	.000,	.000,	.
01210	411,	1,	0,	.000,	.141,	-.376,	.002,	.000,	.000,	.000,	.
01220	417,	4,	0,	.001,	.564,	-.752,	.007,	.000,	.000,	.000,	.
01230	421,	4,	4,	.001,	*20.923,	4.577,	.007,	.007,	.002,	.001,	.
01240	422,	17,	16,	.004,	*77.161,	8.803,	.031,	.029,	.008,	.006,	.
01250	424,	17,	17,	.004,	*88.923,	9.450,	.031,	.031,	.008,	.006,	.
01260	425,	2,	0,	.001,	.282,	-.531,	.004,	.000,	.000,	.000,	.
01270	428,	4,	3,	.001,	*10.516,	3.245,	.007,	.005,	.001,	.001,	.
01280	429,	8,	3,	.002,	3.104,	1.764,	.014,	.005,	.001,	.001,	.
01290	648,	5,	1,	.001,	.123,	.351,	.009,	.002,	.000,	.000,	.

01300	676,	3,	0,	.001,	.423,	-.651,	.005,	.000,	.000,	.000,	.	
01310				CONCORDS OF THE VARIABLE AND LETTERS								
01320	1,	35,	6,	.0089,	.2290,	.4807,	.0633,	.0108,	.0021,			
01330	2,	122,	10,	.0311,	3.0192,	*-1.7653,	.2206,	.0181,	.0036,			
01340	3,	8,	2,	.0020,	.6733,	.8214,	.0145,	.0036,	.0007,			
01350	4,	39,	0,	.0099,	5.5009,	*-2.3572,	.0705,	.0000,	.0000,			
01360	5,	14,	12,	.0036,	*50.8978,	7.1470,	.0253,	.0217,	.0043,			
01370	7,	4,	0,	.0010,	.5642,	-.7515,	.0072,	.0000,	.0000,			
01380	8,	7,	0,	.0018,	.9873,	-.9945,	.0127,	.0000,	.0000,			
01390	9,	6,	0,	.0015,	.8463,	-.9206,	.0108,	.0000,	.0000,			
01400	10,	50,	5,	.0128,	.5973,	-.7778,	.0904,	.0090,	.0018,			
01410	11,	11,	3,	.0028,	1.3522,	1.1645,	.0199,	.0054,	.0011,			
01420	12,	80,	17,	.0204,	2.8956,	1.7193,	.1447,	.0307,	.0060,			
01430	13,	3,	0,	.0008,	.4231,	-.6507,	.0054,	.0000,	.0000,			
01440	14,	15,	1,	.0038,	.5884,	-.7685,	.0271,	.0018,	.0004,			
01450	15,	29,	6,	.0074,	.8915,	.9477,	.0524,	.0108,	.0021,			
01460	17,	18,	7,	.0046,	7.8387,	2.8062,	.0325,	.0127,	.0025,			
01470	18,	1,	0,	.0003,	.1410,	-.3756,	.0018,	.0000,	.0000,			
01480	19,	7,	0,	.0018,	.9873,	-.9945,	.0127,	.0000,	.0000,			
01490	20,	40,	4,	.0102,	.4779,	-.6948,	.0723,	.0072,	.0014,			
01500				CONCORDS OF THE VARIABLE AND DOUBLE LETTERS								
01510	1,	7,	0,	.0018,	.9873,	-.9945,	.0127,	.0000,	.0000,			
01520	5,	245,	28,	.0625,	1.2441,	*-1.1520,	.4430,	.0506,	.0100,			
01530	6,	13,	5,	.0033,	5.4678,	2.3422,	.0235,	.0090,	.0018,			
01540	7,	11,	1,	.0028,	.1961,	-.4434,	.0199,	.0018,	.0004,			
01550	9,	2,	0,	.0005,	.2821,	-.5313,	.0036,	.0000,	.0000,			
01560	13,	16,	0,	.0041,	2.2568,	*-1.5053,	.0289,	.0000,	.0000,			
01570	14,	31,	0,	.0079,	4.3725,	*-2.0994,	.0561,	.0000,	.0000,			
01580				CONCORDS OF THE VARIABLE AND ASTERISK NUMBERS								
01590	1,	1,	0,	.0003,	.1410,	-.3756,	.0018,	.0000,	.0000,			
01600	2,	13,	0,	.0033,	1.8336,	*-1.3564,	.0235,	.0000,	.0000,			
01610	4,	7,	2,	.0018,	1.0386,	1.0200,	.0127,	.0036,	.0007,			
01620	5,	5,	0,	.0013,	.7052,	-.8403,	.0090,	.0000,	.0000,			
01630	6,	4,	3,	.0010,	*10.5161,	3.2445,	.0072,	.0054,	.0011,			
01640	16,	6,	1,	.0015,	.0279,	.1672,	.0108,	.0018,	.0004,			
01650				CONCORDS OF THE VARIABLE AND SENTANCE TYPE								
01660	1,	98,	14,	.025,	.002,	.048,	.025,	.177,				
01670	2,	11,	3,	.003,	1.352,	1.164,	.005,	.020,				
01680	3,	294,	33,	.075,	1.729,	*-1.367,	.060,	.532,				
01690	5,	132,	20,	.034,	.103,	.326,	.036,	.239,				
01700	6,	5,	2,	.001,	2.377,	1.543,	.004,	.009,				
01710	7,	3,	1,	.001,	.786,	.887,	.002,	.005,				
01720	8,	4,	1,	.001,	.337,	.580,	.002,	.007,				
01730	9,	6,	2,	.002,	1.573,	1.255,	.004,	.011,				
01740				CONCORDS OF VARIABLE AND SENTANCE STRENGTH								
01750	1,	80,	11,	.020,	.007,	-.085,	.145,	.020,				
01760	2,	428,	57,	.109,	.188,	-.459,	.774,	.103,				
01770	3,	45,	8,	.011,	.430,	.660,	.081,	.014,				
01780				CONCORDS OF THE VARIABLE AND CONTEXTS								
01790	4,	26,	10,	.007,	*10.936,	3.318,	.047,	.018,				
01800	28,	12,	1,	.003,	.283,	-.533,	.022,	.002,				
01810	30,	41,	2,	.010,	2.475,	*-1.581,	.074,	.004,				
01820	34,	9,	0,	.002,	1.269,	*-1.128,	.016,	.000,				
01830	97,	257,	27,	.066,	2.360,	*-1.589,	.465,	.049,				
01840	121,	79,	29,	.020,	*28.617,	5.404,	.143,	.052,				
01850	150,	46,	0,	.012,	6.488,	*-2.562,	.083,	.000,				
01860	201,	83,	7,	.021,	1.893,	*-1.391,	.150,	.013,				
01870				CONCORDS OF THE VARIABLE AND SATISFACTION								
01880	1,	58,	17,	.0148,	9.5073,	3.1065,	.1049,	.0307,	.4474,			
01890	2,	211,	16,	.0538,	6.3631,	*-2.5933,	.3816,	.0289,	.4211,			

01900	3;	273;	38;	.0696;	.0067;	-.0846;	.4937;	.0687;	1.0000;
01910	4;	11;	5;	.0028;	7.6646;	2.7724;	.0199;	.0090;	.1316;
01920				CONCORDS OF THE VARIABLE AND TENSE					
01930	1;	260;	35;	.0663;	.0763;	-.2859;	.4702;	.0633;	.7955;
01940	2;	52;	9;	.0133;	.3782;	.6191;	.0940;	.0163;	.2045;
01950	3;	241;	32;	.0615;	.1168;	-.3528;	.4358;	.0579;	.7273;

EXAMPLE MEETING DATA FILE

DA,1,1,B,9,F,131,111,201,9,0,J,DA,Z;
 AB,1,15,B,13,E,201,9,111,110,150,A,Z,Z;
 AB,1,18,B,5,F,238,201,0,0,0,Z,Z,Z;
 AB,1,12,B,5,E,238,77,649,127,0,Z,Z,Z;
 AB,1,18,B,5,F,238,66,6,0,0,Z,Z,Z;
 AB,1,6,B,13,E,208,201,9,150,0,Z,Z,Z;
 AB,1,6,B,6,F,203,3,242,77,0,AB,A,Z;
 AA,1,5,B,6,E,203,3,242,77,0,AA,AB,A;
 AA,1,8,B,12,F,242,276,34,238,0,L,Z,Z;
 AA,1,6,B,2,F,99,18,21,0,0,Z,Z,Z;
 AA,1,20,B,13,E,208,34,242,203,18,AA,Z,Z;
 AB,1,6,B,13,F,111,66,6,0,0,AB,J,Z;
 AB,1,1,B,7,F,66,6,0,0,0,10*,Z,Z;
 AB,1,18,B,5,F,238,9,76,0,0,Z,Z,Z;
 AB,1,21,B,5,F,21,76,6,66,605,Z,Z,Z;
 AB,1,1,B,2,F,18,21,6,66,99,Z,Z,Z;
 AB,1,6,B,6,F,233,77,34,0,0,Z,Z,Z;
 AB,1,1,B,5,F,77,3,649,0,0,CD,4*,Z;
 AB,1,6,B,5,F,34,77,121,649,281,Z,Z,Z;
 AB,1,9,B,5,F,105,649,0,0,0,4*,CD,Z;
 AB,1,7,B,6,E,203,3,77,0,0,AB,Z,Z;
 CA,1,16,B,5,F,238,77,34,0,0,C,Z,Z;
 CA,1,7,B,5,D,52,0,0,0,0,C,CD,4*;
 CA,1,15,B,5,E,281,238,261,0,0,CD,4*,Z;
 CA,1,6,B,5,F,238,281,0,0,0,BD,4*,CA;
 CA,1,7,B,5,D,56,34,131,0,0,4*,CD,Z;
 CA,1,1,A,5,F,238,34,131,276,0,4*,C,Z;
 CA,1,1,A,3,F,618,30,34,121,0,4*,Z,Z;
 AA,1,21,B,5,D,53,34,131,150,110,CD,4*,Z;
 AA,1,1,B,5,F,34,121,99,52,0,4*,CD,Z;
 DA,2,1,B,5,F,276,203,3,0,0,4*,CD,Z;
 CA,1,15,B,7,E,261,111,29,0,0,CD,4*,Z;
 CA,1,7,B,5,E,251,141,0,0,0,4*,Z,Z;
 CA,1,18,B,7,E,131,238,29,0,0,4*,CD,N;
 DA,2,1,B,5,D,52,276,0,0,0,CD,Z,Z;
 CA,1,20,B,5,D,276,52,0,0,0,CD,4*,Z;
 AB,1,7,B,5,E,238,3,77,0,0,4*,CD,Z;
 AB,1,6,B,12,F,121,238,3,77,0,4*,Z,Z;
 CA,1,5,B,12,E,121,238,3,77,0,4*,Z,Z;
 CA,1,7,B,10,E,29,34,121,0,0,C,Z,Z;
 CA,1,6,B,4,F,77,34,29,0,0,C,Z,Z;
 CA,1,6,B,2,F,131,99,77,34,0,I,Z,Z;
 DA,2,1,B,5,F,203,3,99,0,0,CD,A,4*;
 DA,1,16,B,5,E,34,131,0,0,0,1*,4*,CD;
 DA,1,7,B,5,E,238,281,34,261,0,CD,4*,Z;
 DA,1,1,A,5,E,281,34,0,0,0,CD,4*,Z;
 CA,1,5,A,5,E,281,34,0,0,0,CD,4*,CA;
 CA,1,7,B,5,D,131,89,32,0,0,CD,4*,Z;
 CA,1,20,B,3,D,121,32,89,34,150,CD,4*,Z;
 DA,1,16,B,5,D,77,29,131,649,0,Z,Z,Z;
 DA,2,1,B,5,F,77,34,3,0,0,Z,Z,Z;
 CA,1,7,B,7,E,77,242,3,18,0,Z,Z,Z;
 CA,1,1,B,1,Z,238,17,77,0,0,M,C,Z;
 CA,1,1,B,1,Z,238,230,32,17,77,C,M,Z;
 CA,1,1,A,1,Z,277,230,238,17,77,M,Z,Z;
 DA,1,6,B,6,F,34,649,0,0,0,DA,C,Z;
 DA,1,1,B,1,Z,649,32,29,0,0,R,Z,Z;
 DA,1,1,B,1,Z,34,203,3,54,46,CD,Z,Z;
 CA,1,9,B,1,Z,34,203,3,54,46,CD,Z,Z;
 CA,1,9,B,5,F,34,238,121,0,0,CD,Z,Z;

CA,1,1,B,5,F,238,34,45,0,0,Z,Z,Z;
 CA,2,1,B,1,Z,649,648,29,0,0,C,CD,R;
 CA,2,1,B,1,Z,105,34,0,0,0,R,Z,Z;
 DC,1,20,B,1,Z,34,121,105,0,0,R,Z,Z;
 DC,1,1,B,1,Z,55,52,105,0,0,R,I,N;
 CA,1,15,B,7,E,105,648,0,0,0,C,R,Z;
 DA,2,1,B,1,Z,34,121,105,0,0,R,Z,Z;
 AB,1,20,B,1,Z,34,121,105,0,0,R,Z,Z;
 DA,1,7,B,5,D,52,0,0,0,0,C,CD,Z;
 DA,1,5,B,1,Z,52,0,0,0,0,R,DA,Z;
 DA,1,16,B,1,Z,52,121,34,238,131,CD,O,Z;
 CA,1,3,A,5,D,238,52,648,0,0,Z,Z,Z;
 DA,1,5,B,5,D,238,52,648,0,0,Z,Z,Z;
 DA,1,7,B,12,E,230,238,252,257,0,J,Z,Z;
 DA,1,6,B,12,E,223,230,238,252,257,Z,Z,Z;
 DA,1,7,B,12,E,276,109,252,257,0,Z,Z,Z;
 DC,1,16,C,1,Z,238,42,0,0,0,CD,Z,Z;
 CA,1,2,B,2,F,99,34,121,29,131,CD,Z,Z;
 CA,1,19,A,5,F,121,262,105,0,0,CD,4*,Z;
 CA,1,1,B,1,Z,262,105,0,0,0,CD,M,Z;
 CA,1,21,B,5,F,401,77,34,262,105,CD,4*,Z;
 CA,1,16,B,5,F,131,276,77,401,34,C,Z,Z;
 CA,1,1,B,2,F,77,34,99,3,0,C,Z,Z;
 AA,1,21,B,1,Z,9,201,77,0,0,Z,Z,Z;
 AA,1,9,B,5,F,201,9,119,0,0,Z,Z,Z;
 AA,1,19,B,2,D,56,99,150,0,0,Z,Z,Z;
 AA,1,1,A,3,E,66,6,121,34,21,A,Z,Z;
 AA,1,1,B,2,E,21,238,66,6,0,A,Z,Z;
 AA,1,6,B,6,F,29,34,6,66,77,A,Z,Z;
 AA,1,6,B,5,F,6,66,121,18,0,AA,Z,Z;
 DA,1,15,B,5,E,238,261,131,6,66,D,Z,Z;
 CA,1,15,B,12,E,28,9,261,111,201,CA,N,C;
 CA,1,15,B,1,Z,261,111,238,28,99,C,N,Z;
 CA,1,1,B,2,F,99,18,121,37,0,C,Z,Z;
 AB,1,20,B,2,E,264,37,18,0,0,A,Z,Z;
 AB,1,21,B,5,E,56,3,203,0,0,Z,Z,Z;
 AA,1,1,A,3,F,121,34,0,0,0,A,Z,Z;
 AA,1,1,A,3,F,121,18,37,0,0,A,Z,Z;
 DA,1,6,B,7,F,29,105,649,0,0,CD,R,5*;
 DA,2,1,B,7,E,276,649,131,0,0,CD,5*,Z;
 CA,1,3,B,7,E,238,131,649,0,0,CD,5*,Z;
 CA,1,3,A,7,E,121,238,119,649,0,CD,5*,Z;
 CA,1,16,A,7,E,238,131,649,0,0,CD,Z,Z;
 CA,1,16,C,1,Z,131,52,105,29,0,CA,CD,C;
 AA,1,6,B,13,F,131,111,276,264,0,AA,CA,N;
 CA,1,20,C,13,E,131,111,276,264,0,CA,N,CD;
 CA,1,21,B,5,F,264,230,6,66,0,J,Z,Z;
 CA,1,18,B,5,E,276,261,264,66,6,Z,Z,Z;
 DA,1,1,B,5,F,5,99,0,0,0,Z,Z,Z;
 DA,1,1,B,2,F,21,34,99,0,0,Z,Z,Z;
 DA,1,3,B,7,E,276,131,0,0,0,Z,Z,Z;
 DA,1,6,B,5,F,98,77,105,34,0,CD,Z,Z;
 CA,2,1,B,5,F,34,121,0,0,0,4*,Z,Z;
 AB,1,20,B,5,F,34,121,0,0,0,4*,Z,Z;
 AB,1,21,B,5,F,34,121,0,0,0,Z,Z,Z;
 AB,1,15,B,7,E,34,121,261,0,0,CD,4*,Z;
 AB,1,15,B,7,E,77,34,121,261,0,Z,Z,Z;
 AB,1,19,B,2,D,34,121,150,0,0,Z,Z,Z;
 AB,1,15,B,13,E,34,99,276,201,97,A,Z,Z;
 AB,1,18,B,2,D,34,203,99,150,105,Z,Z,Z;

AB,1,19,B,2,D,37,99,17,7,150,Z,Z,Z;
 CA,1,9,C,2,D,119,37,7,17,150,Z,Z,Z;
 CA,1,20,B,5,F,99,37,56,6,131,C,Z,Z;
 DA,1,6,B,9,F,131,90,0,0,0,C,R,Z;
 CA,1,5,B,9,E,131,90,0,0,0,CA,C,R;
 CA,1,6,B,7,F,37,3,105,131,0,CD,Z,Z;
 CA,1,4,B,7,E,131,111,105,3,37,CD,Z,Z;
 AB,1,13,B,13,F,105,110,9,0,0,AB,Z,Z;
 AA,1,7,A,5,E,238,34,121,0,0,Z,Z,Z;
 DA,1,10,B,13,E,124,97,110,111,0,A,C,N;;
 DC,1,6,B,6,F,401,34,131,651,0,C,6*,Z;
 CA,1,5,B,6,E,276,131,401,34,651,6*,Z,Z;
 CA,1,1,B,5,F,34,99,651,0,0,6*,Z,Z;
 CA,1,1,B,2,F,99,28,80,651,0,C,6*,Z;
 CA,1,21,B,1,Z,262,34,651,0,0,6*,Z,Z;
 CA,1,6,B,7,F,262,39,34,651,0,CA,6*,Z;
 CA,1,16,C,7,E,131,29,34,39,262,6*,Z,Z;
 CA,1,16,C,5,F,131,223,34,0,0,6*,C,Z;
 DC,1,5,B,5,E,131,223,34,0,0,6*,C,Z;
 DC,1,6,B,3,F,34,121,3,0,0,6*,Z,Z;
 DA,2,1,B,5,F,34,121,0,0,0,Z,Z,Z;
 AA,1,20,B,5,F,34,121,0,0,0,Z,Z,Z;
 AA,1,22,B,5,F,34,121,105,0,0,AA,CD,4*;
 AA,1,1,B,5,F,34,121,0,0,0,Z,Z,Z;
 AA,1,20,B,2,D,34,150,121,99,261,C,D,Z;
 AA,1,6,B,6,F,37,203,99,131,0,C,Z,Z;
 DC,1,21,B,1,Z,29,89,34,0,0,6*,Z,Z;
 DC,1,6,B,5,F,37,6,34,29,0,6*,Z,Z;
 DC,2,1,B,5,F,37,0,0,0,0,Z,Z,Z;
 AA,1,6,B,7,F,37,105,3,0,0,AA,4*,1*;
 AA,1,6,B,7,F,39,3,37,0,0,1*,4*,AA;
 CA,1,7,B,7,E,6,34,0,0,0,Z,Z,Z;
 CA,1,21,B,5,F,37,3,34,649,0,Z,Z,Z;
 CA,1,6,B,5,F,401,230,34,77,29,Z,Z,Z;
 AA,1,6,B,6,F,401,37,264,0,0,AA,C,Z;
 AA,1,4,B,6,E,401,37,34,131,650,Z,Z,Z;
 CA,1,21,B,8,E,34,650,29,261,0,Z,Z,Z;
 CA,1,3,B,8,E,238,650,34,401,29,C,Z,Z;
 CA,1,15,B,8,E,401,650,34,428,0,R,Z,Z;
 DA,1,5,B,8,E,401,650,34,428,0,R,Z,Z;
 DA,1,7,B,5,D,26,9,0,0,0,Z,Z,Z;
 DA,1,7,B,5,D,62,9,0,0,0,Z,Z,Z;
 CA,1,2,B,2,F,77,3,99,0,0,C,Z,Z;
 CA,1,7,B,2,D,20,53,99,0,0,C,Z,Z;
 CA,1,1,B,2,F,20,99,0,0,0,C,Z,Z;
 CA,1,1,B,5,F,56,131,77,20,0,Z,Z,Z;
 AA,1,21,B,5,F,34,121,0,0,0,1*,Z,Z;
 AA,1,21,B,5,F,34,121,3,0,0,Z,Z,Z;
 AA,1,6,B,5,F,121,34,202,18,0,Z,Z,Z;
 AA,1,21,B,3,F,34,121,0,0,0,1*,Z,Z;
 AA,1,20,B,5,F,34,121,105,0,0,4*,Z,Z;
 CA,1,3,B,5,E,34,121,230,0,0,4*,Z,Z;
 CA,1,2,B,6,F,203,3,39,0,0,4*,Z,Z;
 CA,1,2,B,2,F,34,121,650,29,0,C,Z,Z;
 AB,1,20,B,5,F,34,121,203,39,0,A,Z,Z;
 AB,1,1,A,3,F,121,34,3,56,0,Z,Z,Z;
 CA,1,4,B,7,E,276,131,105,34,121,CD,4*,Z;
 CA,1,4,B,7,E,276,77,131,34,121,Z,Z,Z;
 CA,1,16,B,5,F,276,131,6,0,0,Z,Z,Z;
 CA,1,4,B,7,E,277,276,201,9,0,Z,Z,Z;

CA,1,13,B,13,F,131,111,276,264,0,CA,Z,Z;
 AA,1,1,B,12,F,201,9,54,46,0,AA,L,Z;
 AA,1,1,B,12,F,238,628,0,0,0,4*,Z,Z;
 AA,1,9,B,12,E,131,238,628,0,0,4*,Z,Z;
 AA,1,15,B,13,E,150,201,438,97,9AA,Z,Z;
 AA,1,1,B,5,F,93,201,6,238,0,Z,Z,Z;
 AA,1,1,B,1,Z,131,111,628,0,0,AA,4*,Z;
 AA,2,1,B,5,F,93,29,650,0,0,4*,Z,Z;
 CA,2,1,B,5,F,89,29,93,628,650,4*,Z,Z;
 CA,1,1,B,2,F,121,21,93,99,650,4*,Z,Z;
 AA,2,1,B,5,F,131,56,93,3,628,4*,Z,Z;
 CA,1,20,B,5,E,131,56,93,3,628,4*,Z,Z;
 CA,1,7,B,5,D,56,131,105,17,3,4*,Z,Z;
 AA,1,6,B,13,F,203,121,93,6,34,4*,AA,Z;
 AA,1,16,B,5,F,21,6,131,650,628,4*,Z,Z;
 AA,1,1,B,5,F,34,121,93,628,0,4*,Z,Z;
 AA,1,6,B,13,F,131,110,93,628,0,4*,AA,C;
 CA,1,5,B,13,E,131,110,93,628,0,4*,CA,AA;
 DA,1,9,B,13,E,119,6,34,629,93,CA,4*,Z;
 DA,1,6,B,9,F,93,29,34,131,97,CA,4*,Z;
 DA,1,6,B,12,F,131,124,111,93,0,D,E,4,*;
 DA,1,1,A,3,F,99,121,401,93,66,4*,Z,Z;
 AA,1,6,B,6,F,203,19,93,628,0,AA,4*,Z;
 AA,1,1,B,2,D,238,34,121,651,99,4*,Z,Z;
 AA,1,20,,5,F,238,4,21,259,34,4*,6*,Z;
 AA,1,1,A,10,F,262,651,201,0,0,4*,Z,Z;
 AA,2,1,B,2,D,121,18,99,651,0,4*,Z,Z;
 CA,1,15,B,7,E,261,18,651,0,0,4*,Z,Z;
 CA,1,21,B,7,E,651,18,0,0,0,4*,Z,Z;
 CA,1,6,C,5,F,401,18,276,131,651,CA,4*,Z;
 AA,1,1,B,12,F,201,9,0,0,0,4*,6*,Z;
 AA,1,1,B,5,F,18,0,0,0,0,4*,6*,Z;
 AA,1,6,B,5,F,131,18,651,0,0,4*,AA,Z;
 AA,2,1,B,5,F,131,18,651,0,0,04*,Z,Z;
 AA,1,19,B,2,D,99,18,618,34,150,4*,Z,Z;
 AA,1,20,B,5,F,201,18,34,618,651,4*,Z,Z;
 CA,1,16,C,13,F,131,112,93,6,34,J,4*,Z;
 CA,1,16,C,13,F,131,112,401,34,29,4*,J,E;
 DA,2,1,B,2,D,18,99,150,651,0,4*,Z,Z;
 CA,1,20,B,5,F,18,651,121,56,6,4*,Z,Z;
 DA,1,6,B,9,F,131,11,401,18,93,4*,J,Z;
 AA,1,6,B,6,F,401,18,93,0,0,AA,C,4*;
 DC,1,9,A,6,E,121,401,18,93,0,Z,Z,Z;
 DC,1,1,A,3,F,121,93,18,0,0,Z,Z,Z;
 DC,1,1,A,3,E,18,121,92,238,119,4*,Z,Z;
 DC,2,1,B,5,F,66,6,93,18,0,Z,Z,Z;
 AA,1,20,B,5,E,6,66,93,18,0,Z,Z,Z;
 CA,2,1,B,5,F,66,6,121,93,18,Z,Z,Z;
 AA,1,20,B,5,E,66,6,276,93,18,Z,Z,Z;
 DC,1,7,B,7,E,17,650,93,3,0,4*,Z,Z;
 DC,1,16,B,5,F,29,93,6,131,0,4*,Z,Z;
 DC,2,1,B,5,F,17,93,131,628,0,4*,C,Z;
 CA,1,20,B,5,E,131,17,93,628,0,C,4*,Z;
 CA,1,7,B,7,E,17,29,650,93,131,4*,Z,Z;
 CA,1,2,B,2,F,262,258,39,99,0,4*,Z,Z;
 DC,1,16,C,5,F,675,131,238,93,628,4*,Z,Z;
 DC,1,16,C,5,F,131,606,605,675,0,Z,Z,Z;
 CA,1,6,B,7,F,37,639,131,0,0,4*,Z,Z;
 CA,1,6,B,6,F,203,41,46,93,0,4*,Z,Z;
 CA,1,6,B,7,F,618,28,41,3,93,4*,Z,Z;

AA,1,1,B,1,Z,131,111,41,18,0,4*,Z,Z;
AA,1,19,B,2,D,41,150,99,18,0,4*,Z,Z;
AA,2,1,B,2,D,121,41,18,0,0,4*,Z,Z;
AA,1,16,B,5,F,203,3,41,121,651,A,4*,Z;
AA,2,1,B,5,F,41,18,276,131,0,Z,Z,Z;
CA,1,6,B,5,F,41,18,650,277,276,Z,Z,Z;
CA,1,1,B,2,F,41,18,99,6,37,Z,Z,Z;
AA,1,6,B,6,E,203,41,46,0,0,AA,Z,Z;
AA,1,1,B,5,F,93,41,18,0,0,Z,Z,Z;
AA,1,1,B,5,E,41,18,93,0,0,Z,Z,Z;
AA,1,21,B,2,D,41,18,3,0,0,4*,6*,Z;
AA,1,15,B,7,E,663,265,54,201,261,AA,Z,Z;
AA,1,6,B,7,E,663,54,0,0,0,Z,Z,Z;
AA,1,6,B,7,F,651,46,54,663,3,AA,4*,Z;
AA,1,4,B,7,E,276,131,651,663,46,4*,Z,Z;
AA,1,21,B,3,F,18,34,99,121,651,4*,Z,Z;
AA,1,6,B,7,7F,6,131,651,663,0,4*,10*,Z;
AA,1,6,B,7,F,6,37,663,651,0,4*,10*,Z;
DA,1,4,B,7,E,285,277,264,663,651,4*,Z,Z;
DA,2,1,B,5,F,265,264,663,651,46,4*,Z,Z;
AA,1,20,C,5,E,131,265,651,633,46,4*,Z,Z;
AA,1,6,B,7,F,661,41,131,3,0,Z,Z,Z;
AA,1,16,B,5,F,131,121,18,651,99,4*,A,Z;
AA,1,16,C,5,E,131,121,18,99,651,4*,A,Z;
AA,1,16,B,12,F,131,29,34,651,663,4*,Z,Z;
AA,1,20,B,5,F,41,18,46,651,0,4*,Z,Z;
AA,1,19,B,2,D,99,41,18,623,0,C,4*,Z;
CA,1,20,B,2,D,261,99,41,18,0,4*,C,Z;
CA,1,3,B,7,E,651,93,3,238,0,4*,CA,Z;
AA,1,4,B,7,E,276,3,651,0,0,4*,AA,Z;
AA,1,13,B,13,F,131,110,201,0,0,AA,4*,CA;
DC,1,6,B,13,F,628,111,0,0,0,4*,Z,Z;
DC,2,1,B,5,F,37,121,21,93,6,CA,4*,Z;
DC,2,1,B,5,F,21,93,6,650,0,4*,Z,Z;
CA,1,1,B,5,E,111,21,6,93,628,4*,Z,Z;
CA,1,20,B,2,F,21,99,93,628,0,4*,Z,Z;
CA,1,2,B,2,F,53,37,21,93,628,4*,CA,Z;
DC,1,1,A,10,F,131,111,66,6,93,J,4*,Z;
DC,1,20,B,3,F,18,66,6,37,53,4*,Z,Z;
DC,2,1,B,5,F,53,37,66,0,0,Z,Z,Z;
AA,1,1,B,2,F,66,34,99,0,0,4*,Z,Z;
AA,1,1,B,2,F,99,37,66,93,9,4*,Z,Z;
AA,1,5,B,7,E,276,201,242,0,0,AA,Z,Z;
AA,1,6,B,12,F,131,201,203,242,131,Z,Z,Z;
AA,1,6,B,1,Z,228,252,131,208,0,L,Z,Z;
CA,2,1,B,12,F,403,34,202,121,131,J,Z,Z;
DA,1,11,B,12,E,131,403,203,34,121,DA,J,Z;
AA,1,16,B,12,F,131,34,29,203,121,C,Z,Z;
AA,1,16,C,12,E,131,34,121,203,6,C,Z,Z;
DA,1,5,B,12,E,131,34,121,203,6,C,J,Z;
DA,1,20,B,12,F,34,121,122,131,401,C,Z,Z;
DA,1,2,B,12,E,34,121,122,131,401,Z,Z,Z;
DA,1,5,B,12,F,131,111,403,34,121,DA,E,Z;
DA,1,19,B,12,F,131,111,203,4,34,E,J,Z;
DA,1,7,A,3,E,34,121,4,0,0,E,Z,Z;
DA,1,6,B,12,E,10,34,121,276,238,Z,Z,Z;
AA,1,15,B,13,E,150,97,201,110,0,A,Z,Z;
AA,1,15,B,13,E,99,242,201,0,0,A,Z,Z;
AA,1,15,A,13,E,242,99,653,654,0,A,4*,Z;
AA,1,1,B,1,Z,280,201,0,0,0,A,L,Z;

AA,1,1,B,12,F,214,264,208,0,0,L,Z,Z;
AA,1,1,B,7,F,214,34,30,0,0,Z,Z,Z;
AA,1,1,B,7,F,214,30,265,270,0,Z,Z,Z;
AA,1,20,B,7,D,262,252,628,0,0,4*,Z,Z;
AA,1,1,B,7,F,48,41,18,0,0,L,Z,Z;
AA,1,1,B,7,F,279,39,48,0,0,L,Z,Z;
DA,2,1,B,5,F,201,0,0,0,0,12*,Z,Z;
DA,1,19,B,13,E,111,3,0,0,0,DB,12*,Z;
DA,1,19,B,13,E,111,3,0,0,0,DB,12*,Z;
AA,1,15,B,13,E,203,201,0,0,0,A,12*,Z;
AA,1,6,B,5,F,3,131,99,0,0,13*,12*,10*;
AA,1,1,B,1,Z,242,262,650,34,0,4*,6*,Z;
AA,1,1,A,5,F,262,18,0,0,0,4*,6*,Z;
AA,1,7,B,3,D,262,121,0,0,0,4*,Z,Z;
AA,1,1,B,5,F,34,6,0,0,0,Z,Z,Z;
AA,1,1,B,7,F,34,29,18,0,0,Z,Z,Z;
DA,1,19,B,13,E,112,238,21,6,0,DB,12*,Z;
DC,1,21,B,7,E,268,258,3,0,0,12*,A,Z;
DC,2,1,B,5,F,6,258,268,0,0,12*,Z,Z;
AA,1,20,B,7,F,6,258,268,0,0,12*,Z,Z;
AA,1,1,B,5,E,252,3,0,0,0,L,Z,Z;
AA,1,1,B,2,F,258,99,131,0,0,L,Z,Z;
AA,1,16,B,2,E,131,121,6,0,0,L,Z,Z;
CA,1,16,B,1,Z,131,112,260,0,0,CA,C,N;
CA,1,16,B,5,F,131,111,56,6,238,4*,C,N;
CA,1,6,B,4,F,276,131,6,56,0,CA,4*,Z;
CA,2,1,B,5,F,276,6,5,238,131,4*,Z,Z;
AA,2,1,B,5,E,5,651,0,0,0,4*,Z,Z;
AA,1,18,B,5,E,131,276,6,0,0,4*,Z,Z;
AA,1,1,B,5,F,18,121,37,6,651,4*,Z,Z,0,0;
CA,1,20,B,2,D,18,99,56,6,0,4*,Z,Z;
CA,1,7,B,2,D,99,56,6,0,0,C,4*,Z;
CA,1,16,C,1,Z,131,56,9,99,0,4*,Z,Z;
CA,1,16,C,1,Z,131,112,56,6,0,CA,C,N;
CA,1,19,B,2,D,56,6,150,99,0,C,Z,Z;
CA,1,1,A,3,F,89,56,6,121,0,4*,Z,Z;
CA,1,6,B,5,F,99,131,0,0,0,4*,Z,Z;
AA,1,13,B,13,F,131,264,208,37,6,AA,4*,Z;
AA,1,20,A,5,E,131,276,56,6,651,4*,Z,Z;
DA,1,10,B,2,E,56,6,276,99,0,CA,Z,Z;
CA,1,20,B,2,E,276,6,56,99,0,4*,CA,Z;
DC,2,1,B,5,F,265,270,0,0,0,L,Z,Z;
AA,1,20,B,7,F,270,265,258,0,0,L,Z,Z;
AA,1,15,B,13,E,265,270,225,4,424,AA,L,Z;
AA,1,7,B,12,E,252,264,111,0,0,L,AA,Z;
AA,1,8,B,12,F,131,262,5,0,0,L,AA,Z;
CA,1,19,B,5,E,261,111,625,0,0,AA,4*,Z;
CA,2,1,B,5,E,238,625,0,0,0,4*,Z,Z;
AA,1,20,B,5,E,276,625,0,0,0,4*,Z,Z;
CA,1,1,A,5,F,625,37,6,121,46,4*,Z,Z;
CA,1,6,B,5,F,122,605,37,6,625,4*,Z,Z;
CA,1,16,B,5,E,131,121,626,638,0,4*,Z,Z;
AA,1,20,B,5,F,276,9,242,3,0,4*,Z,Z;
AA,1,1,B,5,F,230,18,214,205,3,4*,Z,Z;
CA,1,7,B,5,D,651,56,58,0,0,4*,Z,Z;
CA,1,7,B,2,D,41,34,651,0,0,4*,Z,Z;
AA,1,6,B,6,F,203,3,37,0,0,4*,AA,C;
AA,2,1,B,5,F,623,203,3,276,131,4*,Z,Z;
CA,1,20,B,5,E,131,276,623,37,203,4*,Z,Z;
AA,1,13,B,13,F,131,264,208,0,0,4*,AA,Z;

AA,1,1,B,5,F,651,34,0,0,0,4*,Z,Z;
AA,1,20,B,2,D,34,121,150,99,0,4*,Z,Z;
AA,1,21,B,2,D,56,41,3,651,0,4*,Z,Z;
CA,1,1,B,2,D,651,39,0,0,0,4*,Z,Z;
CA,1,16,C,1,Z,131,203,39,260,0,C,4*,Z;
CA,1,16,C,1,Z,131,276,203,3,39,4*,Z,Z;
AA,1,20,B,5,F,34,80,0,0,0,4*,Z,Z;
AA,1,20,B,5,F,258,38,203,3,0,4*,Z,Z;
AA,1,20,B,5,F,203,3,39,0,0,4*,Z,Z;
AA,1,6,B,7,F,39,214,258,30,0,Z,Z,Z;
DA,1,9,B,5,E,28,80,121,0,0,4*,Z,Z;
AA,1,5,B,5,E,121,28,80,0,0,4*,Z,Z;
AA,1,16,C,5,F,131,21,34,214,0,4*,Z,Z;
AA,1,16,C,5,F,131,68,34,0,0,4*,Z,Z;
CA,1,20,B,5,F,131,276,29,263,401,C,Z,Z;
CA,1,6,B,4,F,263,28,276,121,0,C,Z,Z;
CA,1,6,B,7,F,610,258,3,0,0,4*,Z,Z;
CA,1,6,B,7,F,610,639,34,0,0,4*,Z,Z;
CA,1,16,B,5,F,56,13,1,3,642,28,4*,Z,Z;
AA,2,1,B,5,F,28,252,3,0,0,L,Z,Z;
AA,1,6,B,7,F,618,3,28,0,0,L,AA,Z;
AA,1,16,B,5,E,131,276,651,3,0,4*,Z,Z;
AA,1,4,B,7,E,276,401,263,28,73,Z,Z,Z;
DC,1,3,B,7,E,238,119,618,3,0,DC,Z,Z;
DC,1,7,B,5,E,83,238,618,0,0,Z,Z,Z;
DC,1,7,B,5,E,238,83,618,0,0,Z,Z,Z;
DC,1,16,B,5,F,73,238,618,131,0,Z,Z,Z;
DC,1,3,B,7,E,238,73,131,618,0,Z,Z,Z;
DC,1,6,B,4,F,611,610,252,0,0,DC,4*,L;
CA,1,5,B,4,E,276,618,252,3,0,CA,L,Z;
CA,1,6,B,4,F,46,3,258,618,28,CA,Z,Z;
CA,1,4,B,4,E,56,3,121,618,258,Z,Z,Z;
DA,2,1,B,3,D,261,201,34,121,6,AA,Z,Z;
AA,1,8,B,1,Z,208,201,34,121,6,Z,Z,Z;
AA,1,6,B,12,F,34,263,401,201,208,Z,Z,Z;
DA,2,1,B,5,F,34,121,0,0,0,Z,Z,Z;
AA,1,11,B,5,E,34,121,110,0,0,AA,Z,Z;
AA,1,13,B,13,F,131,424,4,121,32,AA,Z,Z;
AA,1,21,B,5,F,34,121,6,0,0,L,Z,Z;
AA,1,1,A,5,F,34,121,238,0,0,L,Z,Z;
AA,1,1,B,5,F,424,4,34,28,0,L,Z,Z;
AA,1,18,B,5,E,34,121,238,28,0,16*,Z,Z;
AA,1,1,B,1,Z,34,121,28,252,0,16*,Z,Z;
AA,1,16,B,5,F,131,34,28,651,203,4*,Z,Z;
AA,1,16,B,5,F,131,238,651,34,6,4*,Z,Z;
DC,1,8,B,13,F,131,111,34,28,121,16*,J,Z;
DC,1,16,B,12,F,403,34,121,28,0,D,Z,Z;
DC,1,16,B,12,F,34,131,260,403,0,Z,Z,Z;
DA,2,1,B,12,F,610,0,0,0,0,Z,Z,Z;
DC,1,20,B,12,F,421,4,28,610,0,Z,Z,Z;
DC,1,20,B,12,F,614,611,421,610,0,Z,Z,Z;
DA,1,13,B,13,F,131,90,111,0,0,DA,E,Z;
DA,1,13,B,13,F,110,28,0,0,0,L,DA,Z;
DA,1,16,B,12,F,131,110,105,28,0,Z,Z,Z;
DA,1,6,B,12,F,34,121,28,0,0,16*,Z,Z;
CA,2,1,B,12,F,131,201,28,31,90,AA,J,Z;
DA,1,20,B,12,E,131,201,28,31,90,J,Z,Z;
DA,1,20,B,12,F,131,110,105,28,99,Z,Z,Z;
DC,1,16,B,12,F,424,4,28,111,0,Z,Z,Z;
DC,1,16,C,12,F,131,424,4,609,113,0,D,Z;

DA,1,5,B,12,E,131,424,4,609,113,O,D,Z;
 DA,1,2,B,9,F,131,97,139,112,251,J,B,Z;
 DA,1,15,B,1,Z,431,98,112,201,251,6*,B,Z;
 AA,1,6,B,1,Z,261,112,42,251,0,B,AA,Z;
 AA,1,15,B,1,Z,252,201,249,261,0,A,Z,Z;
 DA,1,13,B,13,F,131,111,0,0,0,1*,I,Z;
 DA,1,21,B,7,F,46,54,3,0,0,1*,Z,Z;
 CA,1,20,B,5,F,54,46,3,0,0,1*,Z,Z;
 AA,1,9,B,2,D,52,0,0,0,0,1*,Z,Z;
 AA,2,1,B,5,F,99,54,46,3,0,CA,1*,Z;
 CA,1,1,B,2,F,54,46,99,0,0,C,I,Z;
 CA,1,20,B,5,F,276,131,54,46,3,1*,CA,Z;
 CA,1,7,B,5,E,276,131,54,46,3,1*,Z,Z;
 CA,1,16,B,1,Z,55,649,131,0,0,4*,I,Z;
 AA,2,1,B,5,F,99,34,0,0,0,C,12*,Z;
 CA,1,20,B,3,D,4,121,34,0,0,12*,C,Z;
 CA,1,20,B,2,F,99,0,0,0,0,12*,C,Z;
 DA,1,1,B,2,F,6,0,0,0,0,12*,Z,Z;
 AA,2,1,B,5,F,6,0,0,0,0,12*,14*,Z;
 AA,1,1,B,7,F,78,252,3,0,0,AA,L,Z;
 AA,1,20,B,5,F,3,264,0,0,0,AA,16*,L;
 AA,1,20,B,5,F,201,98,44,3,0,AA,Z,Z;
 AA,1,7,B,7,E,28,618,3,44,0,Z,Z,Z;
 AA,1,1,B,7,F,28,6,663,46,0,L,Z,Z;
 AA,1,20,B,3,D,56,0,0,0,0,Z,Z,Z;
 AA,1,4,B,3,D,131,276,58,56,0,Z,Z,Z;
 AA,1,16,B,1,Z,56,77,276,131,0,Z,Z,Z;
 AA,1,15,B,6,F,242,0,0,0,0,1*,AA,Z;
 AA,1,20,B,2,D,62,225,0,0,0,1*,14*,Z;
 AA,1,1,B,5,F,46,18,0,0,0,L,Z,Z;
 AA,1,10,B,7,E,6,34,0,0,0,12*,Z,Z;
 AA,1,16,C,1,Z,46,276,131,0,0,L,Z,Z;
 AA,1,20,B,5,F,46,131,18,0,0,L,Z,Z;
 AA,1,15,B,6,E,203,34,261,0,0,AA,3*,Z;
 AA,1,7,B,5,E,55,131,32,281,0,I,3*,Z;
 AA,1,7,B,5,E,238,131,281,44,89,CA,I,Z;
 AA,1,2,B,9,F,131,111,281,0,0,Z,Z,Z;
 AA,1,15,B,13,E,201,34,57,0,0,AA,Z,Z;
 AA,1,16,C,1,Z,131,223,34,57,0,AA,Z,Z;
 AA,1,20,B,5,F,6,99,131,56,77,AA,Z,Z;
 AA,1,1,B,7,F,264,0,0,0,0,1*,10*,AA;
 AA,1,15,B,6,E,77,3,0,0,0,AA,1*,10*;
 AA,1,6,B,7,F,34,0,0,0,0,12*,AA,Z;
 AA,1,6,B,7,F,41,18,0,0,0,12*,Z,Z;
 AA,1,21,B,5,F,27,9,0,0,0,12*,Z,Z;
 AA,1,16,B,1,Z,131,0,0,0,0,12*,Z,Z;
 AA,1,1,B,7,E,264,9,0,0,0,1*,AA,Z;
 CA,2,1,B,5,D,27,238,261,0,0,AA,1*,Z;
 AA,1,20,B,5,D,261,111,27,238,0,AA,1*,A;
 AA,1,18,C,5,F,238,27,131,9,0,1*,Z,Z;
 AA,1,3,B,7,E,238,62,37,9,0,1*,Z,Z;
 AA,2,1,B,5,E,238,27,0,0,0,Z,Z,Z;
 CA,1,20,B,1,Z,238,27,0,0,0,M,Z,Z;
 CA,1,12,B,1,Z,238,27,0,0,0,CA,1*,M;
 DA,1,21,B,2,D,201,0,0,0,0,CB,1*,AA;
 DA,2,1,B,1,Z,131,55,0,0,0,CB,C,L;
 CA,1,20,B,1,Z,131,55,0,0,0,CB,C,L;
 CA,1,20,B,1,Z,131,260,55,0,0,C,CB,Z;
 AA,1,6,B,7,F,650,57,29,0,0,Z,Z,Z;
 AA,1,1,B,7,E,650,57,29,0,0,Z,Z,Z;

AA,1,6,B,7,F,203,3,57,129,650,AA,C,Z;
CA,1,21,B,5,F,257,57,34,0,0,Z,Z,Z;
AA,1,7,B,7,E,239,78,28,0,0,L,Z,Z;
AA,1,6,B,7,F,93,3,0,0,0,Z,Z,Z;
AA,1,20,B,2,D,242,78,150,0,0,Z,Z,Z;
AA,1,3,B,7,E,93,238,121,0,0,Z,Z,Z;
AA,1,15,B,6,E,203,3,242,0,0,4*,AA,Z;
AA,1,13,B,13,F,131,208,201,242,0,AA,4*,Z;
DA,2,1,B,1,Z,111,0,0,0,0,Z,Z,Z;
CA,1,21,B,5,F,230,52,0,0,0,1*,Z,Z;
CA,1,20,B,2,D,261,90,150,0,0,C,1*,Z;
CA,2,1,B,5,F,46,54,3,0,0,A,1*,Z;
CA,1,6,B,4,F,46,54,3,0,0,C,1*,Z;
AA,1,20,B,4,E,131,276,54,46,3,1*,Z,Z;
AA,1,1,A,5,F,3,93,121,54,46,1*,Z,Z;
AA,1,16,B,5,F,131,238,32,0,0,1*,Z,Z;
AA,1,1,B,1,Z,663,3,0,0,0,Z,Z,Z;
AA,1,7,B,5,E,238,131,62,0,0,1*,Z,Z;
AA,1,16,B,5,F,131,112,238,62,0,N,1*,Z;
AA,2,1,A,4,E,99,54,46,3,0,CA,1*,Z;
CA,1,2,B,2,F,99,54,46,3,0,1*,CA,Z;
AA,1,7,B,4,E,131,276,54,46,3,1*,Z,Z;
AA,1,1,B,3,D,238,4,121,3,0,1*,Z,Z;
AA,1,1,B,1,Z,29,34,41,203,0,L,Z,Z;
DA,1,5,B,1,Z,29,34,41,203,0,L,Z,Z;
DA,1,21,B,7,E,203,41,18,0,0,L,Z,Z;
DA,1,6,B,1,Z,41,203,401,276,131,Z,Z,Z;
DA,1,2,B,9,F,131,111,54,46,3,CA,N,1*;
DA,1,13,B,13,F,131,111,3,0,0,CA,1*,N;
DA,1,1,A,10,F,111,201,131,208,0,Z,Z,Z;
DA,2,1,B,12,F,131,120,111,0,0,AA,C,1*;
AA,1,20,C,12,E,131,120,111,0,0,AA,1*,C;
AA,1,1,B,12,F,201,208,124,116,0,AA,L,Z;
AA,1,20,B,12,F,131,90,32,0,0,AA,Z,Z;
DA,1,10,B,1,Z,131,111,0,0,0,J,Z,Z;
DA,1,1,B,9,F,131,111,651,0,0,4*,J,Z;
DA,1,20,B,9,E,131,111,623,105,0,4*,1*,Z;
DA,1,6,B,12,F,131,111,651,0,0,4*,Z,Z;
DC,1,21,B,7,E,54,46,3,77,60,AA,Z,Z;
DC,1,6,B,4,F,54,46,77,3,60,D,Z,Z;
DC,1,6,B,1,Z,238,60,6,0,0,D,Z,Z;
AA,1,15,B,6,E,201,77,3,60,0,AA,Z,Z;
AA,1,20,B,7,F,78,34,60,54,0,Z,Z,Z;
DC,1,13,B,13,F,131,111,0,0,0,16*,J,Z;
DC,2,1,B,5,F,28,0,0,0,0,16*,Z,Z;
AA,1,11,B,5,E,28,0,0,0,0,AA,16*,Z;
AA,1,8,B,12,F,131,111,201,9,0,A,16*,Z;
AA,1,8,B,12,F,131,111,201,9,0,A,16*,3*;
DC,1,6,B,12,F,17,201,0,0,0,A,16*,Z;
DC,1,6,B,12,F,17,201,611,105,0,A,Z,Z;
DC,1,1,A,10,F,131,111,33,7,0,J,Z,Z;
DC,1,1,A,10,F,131,111,33,7,0,J,Z,Z;
DC,1,4,B,7,E,56,131,276,0,0,Z,Z,Z;
DC,1,7,A,10,E,17,7,33,131,56,J,16*,Z;
DC,1,6,A,6,F,203,3,131,0,0,DC,A,16*;
DC,1,16,C,1,Z,238,258,131,260,0,16*,Z,Z;
DC,1,15,B,1,Z,251,141,261,258,0,D,16*,Z;
DC,1,15,B,1,Z,19,7,251,141,261,16*,Z,Z;
DC,1,12,B,1,Z,262,252,251,0,0,16*,B,Z;
DC,1,18,B,1,Z,121,262,252,0,0,L,DC,16*;

DC,1,7,B,6,E,203,3,0,0,0,16*,A,DC;
 DC,1,6,B,6,F,203,3,22,0,0,16*,Z,Z;
 DC,1,6,B,1,Z,3,0,0,0,0,168,Z,Z;
 DC,1,6,B,6,F,262,28,0,0,0,DC,A,Z;
 DC,1,6,B,7,F,262,28,3,634,611,DC,Z,Z;
 AA,1,11,B,5,E,34,0,0,0,0,AA,16*,Z;
 AA,2,1,B,5,F,56,121,258,0,0,Z,Z,Z;
 DC,1,6,B,4,F,56,3,258,0,0,Z,Z,Z;
 DC,1,7,B,5,E,41,18,44,28,0,Z,Z,Z;
 DA,1,7,B,1,Z,41,44,18,251,0,R,Z,Z;
 DA,1,1,B,1,Z,41,44,18,251,0,R,Z,Z;
 AA,1,20,B,3,D,41,44,18,6,61,AA,Z,Z;
 AA,2,1,B,5,F,66,6,44,41,18,Z,Z,Z;
 DA,1,11,B,5,E,66,6,44,41,18,DA,Z,Z;
 DA,1,6,B,13,F,431,201,131,111,0,DA,A,Z;
 DC,1,1,B,1,Z,56,77,0,0,0,Z,Z,Z;
 DC,2,1,B,7,E,121,663,46,56,77,Z,Z,Z;
 AA,1,20,B,7,E,121,663,46,56,77,Z,Z,Z;
 AA,1,20,B,5,F,203,3,56,77,0,Z,Z,Z;
 AA,1,15,B,13,E,3,34,56,77,663,AA,Z,Z;
 CA,1,6,B,5,F,46,628,77,56,0,Z,Z,Z;
 CA,1,16,B,1,Z,99,56,19,56,77,Z,Z,Z;
 CA,1,13,B,13,F,131,264,111,56,77,CA,Z,Z;
 AA,1,7,B,5,E,203,3,56,77,0,Z,Z,Z;
 AA,1,6,B,6,F,46,401,3,56,77,AA,Z,Z;
 AA,1,6,B,7,F,618,56,28,0,0,L,Z,Z;
 AA,1,1,B,5,F,80,121,56,77,0,Z,Z,Z;
 DC,1,6,B,5,F,676,56,618,28,0,Z,Z,Z;
 DC,1,1,B,1,Z,676,89,29,618,0,Z,Z,Z;
 DC,1,7,B,2,D,6,99,261,271,57,D,C,Z;
 DC,2,1,B,2,D,89,29,6,57,271,Z,Z,Z;
 CA,1,20,B,2,D,89,29,57,271,6,Z,Z,Z;
 CA,1,20,B,2,D,6,276,6,57,271,Z,Z,Z;
 DC,1,13,B,13,F,56,6,0,0,0,Z,Z,Z;
 DC,2,1,B,5,F,83,56,6,131,0,Z,Z,Z;
 AA,1,6,B,5,E,238,131,56,6,83,Z,Z,Z;
 AA,1,16,B,12,F,131,110,56,6,34,Z,Z,Z;
 AA,1,6,B,12,E,230,34,56,6,0,Z,Z,Z;
 AA,1,6,B,11,F,29,34,56,6,0,L,AA,Z;
 AA,1,6,B,12,E,230,34,56,6,29,Z,Z,Z;
 DA,2,1,Z,1,Z,111,0,0,0,0,Z,Z,Z;
 DA,1,13,B,13,F,131,111,90,0,0,J,Z,Z;
 DA,1,13,B,13,F,131,111,32,121,0,CA,C,N;
 DA,1,7,B,9,E,99,120,111,0,0,CA,Z,Z;
 DA,1,7,B,13,E,131,111,32,0,0,C,N,Z;

EXAMPLE MEETING RESULTS PRINT OUT

Analysis of the example meeting data file for
references to cost using program 6.

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00100      RESULTS OF NUMBER/CHARACTER (PROG6) ANALYSIS
00110      FILE.....
00120      DCE7
00130      NUMERIC VARIABLE.....
00140      4,
00150      ANALYSIS OF RECORDS
00160 583,   12,   .0206,
00170      ANALYSIS OF INPUTS/OUTPUTS
00180 527,   12,   .0228,
00190  12,    0,   .0000,
00200      CONCORDANCE ANALYSIS SECTION
00210      CONCORDS OF NUMERIC VARIABLE AND CONTRIBUTORS
00220  1,  231,  5,  .3962,  .0082,  .0086,  .0127,  .1129,  .4167,
00230  2,   32,  0,  .0549,  .0011,  .0000,  .6587,  -.8120,  .0000,
00240  3,    0,  0,  .0000,  .0000,  .0000,  .0001,  -.0072,  .0000,
00250  4,    0,  0,  .0000,  .0000,  .0000,  .0001,  -.0072,  .0000,
00260  5,    0,  0,  .0000,  .0000,  .0000,  .0001,  -.0072,  .0000,
00270  6,    0,  0,  .0000,  .0000,  .0000,  .0001,  -.0072,  .0000,
00280  7,    0,  0,  .0000,  .0000,  .0000,  .0001,  -.0072,  .0000,
00290  8,    0,  0,  .0000,  .0000,  .0000,  .0001,  -.0072,  .0000,
00300  9,  157,  1,  .2693,  .0055,  .0017,  1.5410, *-1.2448,  .0833
00310 10,    0,  0,  .0000,  .0000,  .0000,  .0001,  -.0072,  .0000,
00320 11,    0,  0,  .0000,  .0000,  .0000,  .0001,  -.0072,  .0000,
00330 12,    0,  0,  .0000,  .0000,  .0000,  .0001,  -.0072,  .0000,
00340 13,   92,  3,  .1578,  .0032,  .0051,  .6464,  .8053,  .2500,
00350 14,    0,  0,  .0000,  .0000,  .0000,  .0001,  -.0072,  .0000,
00360 15,   71,  3,  .1218,  .0025,  .0051,  1.6199,  1.2743,  .2500,
00370 16,    0,  0,  .0000,  .0000,  .0000,  .0001,  -.0072,  .0000,
00380      CONCORDS OF VARIABLE AND ALL CONTRIBUTIONS
00390  1,  147,  2,  .2521,  .0052,  .0034,  .3477,  -.5912,  .1667,
00400  2,   11,  0,  .0189,  .0004,  .0000,  .2264,  -.4759,  .0000,
00410  3,   11,  0,  .0189,  .0004,  .0000,  .2264,  -.4759,  .0000,
00420  4,   12,  0,  .0206,  .0004,  .0000,  .2470,  -.4971,  .0000,
00430  5,   17,  1,  .0292,  .0006,  .0017,  1.2078,  1.0993,  .0833,
00440  6,   94,  0,  .1612,  .0033,  .0000,  1.9348, *-1.3933,  .0000
00450  7,   43,  1,  .0738,  .0015,  .0017,  .0149,  .1222,  .0833,
00460  8,    6,  0,  .0103,  .0002,  .0000,  .1235,  -.3515,  .0000,
00470  9,   10,  0,  .0172,  .0004,  .0000,  .2058,  -.4538,  .0000,
00480 10,    4,  0,  .0069,  .0001,  .0000,  .0823,  -.2870,  .0000,
00490 11,    5,  0,  .0086,  .0002,  .0000,  .1029,  -.3208,  .0000,
00500 12,    3,  0,  .0051,  .0001,  .0000,  .0617,  -.2485,  .0000,
00510 13,   16,  1,  .0274,  .0006,  .0017,  1.3658,  1.1690,  .0833,
00520 14,    0,  0,  .0000,  .0000,  .0000,  .0000,  -.0023,  .0000,
00530 15,   30,  1,  .0515,  .0011,  .0017,  .2369,  .4870,  .0833,
00540 16,   53,  2,  .0909,  .0019,  .0034,  .7576,  .8712,  .1667,
00550 17,    0,  0,  .0000,  .0000,  .0000,  .0000,  -.0023,  .0000,
00560 18,   10,  0,  .0172,  .0004,  .0000,  .2058,  -.4538,  .0000,
00570 19,   12,  1,  .0206,  .0004,  .0017,  2.2956,  1.5154,  .0833,
00580 20,   70,  3,  .1201,  .0025,  .0051,  1.6873,  1.3006,  .2500,
00590 21,   27,  0,  .0463,  .0010,  .0000,  .5557,  -.7458,  .0000,
00600 22,    1,  0,  .0017,  .0000,  .0000,  .0206,  -.1435,  .0000,
00610 23,    0,  0,  .0000,  .0000,  .0000,  .0000,  -.0023,  .0000,
00620 24,    0,  0,  .0000,  .0000,  .0000,  .0000,  -.0023,  .0000,
00630      CONCORDS OF VARIABLE AND STRONG CONTRIBS
00640  1,   21,  0,  .0360,  .0007,  .0000,  .4322,  -.6577,  .0000,
00650  2,    0,  0,  .0000,  .0000,  .0000,  .0000,  -.0007,  .0000,
00660  3,    2,  0,  .0034,  .0001,  .0000,  .0412,  -.2029,  .0000,
00670  4,    0,  0,  .0000,  .0000,  .0000,  .0000,  -.0007,  .0000,
00680  5,    1,  0,  .0017,  .0000,  .0000,  .0206,  -.1435,  .0000,
00690  6,    1,  0,  .0017,  .0000,  .0000,  .0206,  -.1435,  .0000,

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00700	7,	3,	1,	.0051,	.0001,	.0017,	*14.2562,	3.7759,	.0833
00710	8,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0007,	.0000,
00720	9,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,
00730	10,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0007,	.0000,
00740	11,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0007,	.0000,
00750	12,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0007,	.0000,
00760	13,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0007,	.0000,
00770	14,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0007,	.0000,
00780	15,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,
00790	16,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,
00800	17,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0007,	.0000,
00810	18,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0007,	.0000,
00820	19,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,
00830	20,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,
00840	21,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0007,	.0000,
00850	22,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0007,	.0000,
00860	23,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0007,	.0000,
00870	24,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0007,	.0000,
00880	CONCORDS OF VARIABLE AND MEDIUM CONTRIBS								
00890	1,	126,	2,	.2161,	.0044,	.0034,	.1358,	-.3693,	.1667,
00900	2,	11,	0,	.0189,	.0004,	.0000,	.2264,	-.4759,	.0000,
00910	3,	9,	0,	.0154,	.0003,	.0000,	.1852,	-.4305,	.0000,
00920	4,	12,	0,	.0206,	.0004,	.0000,	.2470,	-.4971,	.0000,
00930	5,	16,	1,	.0274,	.0006,	.0017,	1.3658,	1.1690,	.0833,
00940	6,	92,	0,	.1578,	.0032,	.0000,	1.8937,	*-1.3783,	.0000
00950	7,	40,	0,	.0686,	.0014,	.0000,	.8233,	-.9080,	.0000,
00960	8,	6,	0,	.0103,	.0002,	.0000,	.1235,	-.3515,	.0000,
00970	9,	8,	0,	.0137,	.0003,	.0000,	.1647,	-.4058,	.0000,
00980	10,	4,	0,	.0069,	.0001,	.0000,	.0823,	-.2870,	.0000,
00990	11,	5,	0,	.0086,	.0002,	.0000,	.1029,	-.3208,	.0000,
01000	12,	3,	0,	.0051,	.0001,	.0000,	.0617,	-.2485,	.0000,
01010	13,	16,	1,	.0274,	.0006,	.0017,	1.3658,	1.1690,	.0833,
01020	14,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0007,	.0000,
01030	15,	29,	1,	.0497,	.0010,	.0017,	.2722,	.5220,	.0833,
01040	16,	32,	1,	.0549,	.0011,	.0017,	.1769,	.4208,	.0833,
01050	17,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0007,	.0000,
01060	18,	9,	0,	.0154,	.0003,	.0000,	.1852,	-.4305,	.0000,
01070	19,	11,	1,	.0189,	.0004,	.0017,	2.6431,	1.6261,	.0833,
01080	20,	66,	3,	.1132,	.0023,	.0051,	1.9835,	1.4100,	.2500,
01090	21,	27,	0,	.0463,	.0010,	.0000,	.5557,	-.7458,	.0000,
01100	22,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,
01110	23,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0007,	.0000,
01120	24,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0007,	.0000,
01130	CONCORDS OF VARIABLE AND WEAK CONTRIBS								
01140	1,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0023,	.0000,
01150	2,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0023,	.0000,
01160	3,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0023,	.0000,
01170	4,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0023,	.0000,
01180	5,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0023,	.0000,
01190	6,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,
01200	7,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0023,	.0000,
01210	8,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0023,	.0000,
01220	9,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,
01230	10,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0023,	.0000,
01240	11,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0023,	.0000,
01250	12,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0023,	.0000,
01260	13,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0023,	.0000,
01270	14,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0023,	.0000,
01280	15,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0023,	.0000,
01290	16,	20,	1,	.0343,	.0007,	.0017,	.8408,	.9173,	.0017,

01300	17	0	0	.0000	.0000	.0000	.0000	-.0023	.0000		
01310	18	1	0	.0017	.0000	.0000	.0206	-.1435	.0000		
01320	19	0	0	.0000	.0000	.0000	.0000	-.0023	.0000		
01330	20	3	0	.0051	.0001	.0000	.0617	-.2485	.0000		
01340	21	0	0	.0000	.0000	.0000	.0000	-.0023	.0000		
01350	22	0	0	.0000	.0000	.0000	.0000	-.0023	.0000		
01360	23	0	0	.0000	.0000	.0000	.0000	-.0023	.0000		
01370	24	0	0	.0000	.0000	.0000	.0000	-.0023	.0000		
01380				CONCORDS OF VARIABLE AND ALL SUBJECTS							
01390	1	0	0	.0000	.0000	.0000	.0000	-.0007	.0000		
01400	2	60	0	.1029	.0021	.0000	1.2350	*-1.1125	.0000		
01410	3	22	3	.0377	.0008	.0051	*14.3278	3.7867	.2500		
01420	4	13	0	.0223	.0005	.0000	.2676	-.5174	.0000		
01430	5	196	2	.3362	.0069	.0034	1.0258	*-1.0163	.1667		
01440	6	28	0	.0480	.0010	.0000	.5763	-.7595	.0000		
01450	7	79	0	.1355	.0028	.0000	1.6261	*-1.2770	.0000		
01460	8	4	0	.0069	.0001	.0000	.0823	-.2870	.0000		
01470	9	11	0	.0189	.0004	.0000	.2264	-.4759	.0000		
01480	10	6	0	.0103	.0002	.0000	.1235	-.3515	.0000		
01490	11	1	0	.0017	.0000	.0000	.0206	-.1435	.0000		
01500	12	53	5	.0909	.0019	.0086	*14.0076	3.7462	.4167		
01510	13	44	2	.0755	.0016	.0034	1.3223	1.1508	.1667		
01520	14	0	0	.0000	.0000	.0000	.0000	-.0007	.0000		
01530	15	0	0	.0000	.0000	.0000	.0000	-.0007	.0000		
01540				CONCORDS OF VARIABLE AND BRIEFED SUBJECTS							
01550	1	0	0	.0000	.0000	.0000	.0000	-.0023	.0000		
01560	2	32	0	.0549	.0011	.0000	.6587	-.8120	.0000		
01570	3	8	2	.0137	.0003	.0034	*20.4563	4.5235	.1667		
01580	4	0	0	.0000	.0000	.0000	.0000	-.0023	.0000		
01590	5	16	0	.0274	.0006	.0000	.3293	-.5740	.0000		
01600	6	0	0	.0000	.0000	.0000	.0000	-.0023	.0000		
01610	7	1	0	.0017	.0000	.0000	.0206	-.1435	.0000		
01620	8	0	0	.0000	.0000	.0000	.0000	-.0023	.0000		
01630	9	0	0	.0000	.0000	.0000	.0000	-.0023	.0000		
01640	10	0	0	.0000	.0000	.0000	.0000	-.0023	.0000		
01650	11	0	0	.0000	.0000	.0000	.0000	-.0023	.0000		
01660	12	0	0	.0000	.0000	.0000	.0000	-.0023	.0000		
01670	13	0	0	.0000	.0000	.0000	.0000	-.0023	.0000		
01680	14	0	0	.0000	.0000	.0000	.0000	-.0023	.0000		
01690	15	0	0	.0000	.0000	.0000	.0000	-.0023	.0000		
01700				CONCORDS OF VARIABLE AND DISCOVERED SUBJECTS							
01710	1	0	0	.0000	.0000	.0000	.0000	-.0001	.0000		
01720	2	5	0	.0086	.0002	.0000	.1029	-.3208	.0000		
01730	3	3	1	.0051	.0001	.0017	*14.2562	3.7759	.0833		
01740	4	5	0	.0086	.0002	.0000	.1029	-.3208	.0000		
01750	5	49	0	.0840	.0017	.0000	1.0086	*-1.0051	.0000		
01760	6	11	0	.0189	.0004	.0000	.2264	-.4759	.0000		
01770	7	44	0	.0755	.0016	.0000	.9057	-.9524	.0000		
01780	8	4	0	.0069	.0001	.0000	.0823	-.2870	.0000		
01790	9	3	0	.0051	.0001	.0000	.0617	-.2485	.0000		
01800	10	2	0	.0034	.0001	.0000	.0412	-.2029	.0000		
01810	11	0	0	.0000	.0000	.0000	.0000	-.0001	.0000		
01820	12	17	1	.0292	.0006	.0017	1.2078	1.0993	.0833		
01830	13	19	1	.0326	.0007	.0017	.9481	.9740	.0833		
01840	14	0	0	.0000	.0000	.0000	.0000	-.0001	.0000		
01850	15	0	0	.0000	.0000	.0000	.0000	-.0001	.0000		
01860				CONCORDS OF VARIABLE AND NEW SUBJECTS							
01870	1	0	0	.0000	.0000	.0000	.0000	-.0001	.0000		
01880	2	23	0	.0395	.0008	.0000	.4734	-.6883	.0000		
01890	3	11	0	.0189	.0004	.0000	.2264	-.4759	.0000		

01900	4,	8,	0,	.0137,	.0003,	.0000,	.1647,	-.4058,	.0000,		
01910	5,	131,	2,	.2247,	.0046,	.0034,	.1799,	-.4251,	.1667,		
01920	6,	17,	0,	.0292,	.0006,	.0000,	.3499,	-.5917,	.0000,		
01930	7,	34,	0,	.0583,	.0012,	.0000,	.6998,	-.8371,	.0000,		
01940	8,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0001,	.0000,		
01950	9,	8,	0,	.0137,	.0003,	.0000,	.1647,	-.4058,	.0000,		
01960	10,	4,	0,	.0069,	.0001,	.0000,	.0823,	-.2870,	.0000,		
01970	11,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
01980	12,	36,	4,	.0617,	.0013,	.0069,	*14.3336,	3.7884,	.3333		
01990	13,	25,	1,	.0429,	.0009,	.0017,	.4579,	.6770,	.0833,		
02000	14,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0001,	.0000,		
02010	15,	0,	0,	.0000,	.0000,	.0000,	.0000,	-.0001,	.0000,		
02020				CONCORDS OF VARIABLE AND NUMBERS							
02030	1,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
02040	3,	94,	1,	.1612,	.0033,	.0017,	.4517,	-.6732,	.0833,		
02050	4,	12,	12,	.0206,	.0004,	.0206,	*559.2470,	*23.6534,	1.0		
02060	5,	4,	0,	.0069,	.0001,	.0000,	.0823,	-.2870,	.0000,		
02070	6,	83,	0,	.1424,	.0029,	.0000,	1.7084,	*-1.3090,	.0000		
02080	7,	5,	0,	.0086,	.0002,	.0000,	.1029,	-.3208,	.0000,		
02090	9,	23,	0,	.0395,	.0008,	.0000,	.4734,	-.6883,	.0000,		
02100	10,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
02110	11,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
02120	13,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
02130	17,	13,	0,	.0223,	.0005,	.0000,	.2676,	-.5174,	.0000,		
02140	18,	61,	0,	.1046,	.0022,	.0000,	1.2556,	*-1.1217,	.0000		
02150	19,	3,	0,	.0051,	.0001,	.0000,	.0617,	-.2485,	.0000,		
02160	20,	3,	0,	.0051,	.0001,	.0000,	.0617,	-.2485,	.0000,		
02170	21,	16,	1,	.0274,	.0006,	.0017,	1.3658,	1.1690,	.0833,		
02180	22,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
02190	26,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
02200	27,	7,	0,	.0120,	.0002,	.0000,	.1441,	-.3796,	.0000,		
02210	28,	35,	3,	.0600,	.0012,	.0051,	7.2133,	2.6874,	.2500,		
02220	29,	37,	0,	.0635,	.0013,	.0000,	.7616,	-.8733,	.0000,		
02230	30,	4,	0,	.0069,	.0001,	.0000,	.0823,	-.2870,	.0000,		
02240	31,	2,	0,	.0034,	.0001,	.0000,	.0412,	-.2029,	.0000,		
02250	32,	10,	1,	.0172,	.0004,	.0017,	3.0642,	1.7508,	.0833,		
02260	33,	2,	0,	.0034,	.0001,	.0000,	.0412,	-.2029,	.0000,		
02270	34,	150,	5,	.2573,	.0053,	.0086,	1.1847,	1.0913,	.4167,		
02280	37,	31,	0,	.0532,	.0011,	.0000,	.6381,	-.7992,	.0000,		
02290	38,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
02300	39,	12,	0,	.0206,	.0004,	.0000,	.2470,	-.4971,	.0000,		
02310	41,	31,	0,	.0532,	.0011,	.0000,	.6381,	-.7992,	.0000,		
02320	42,	2,	0,	.0034,	.0001,	.0000,	.0412,	-.2029,	.0000,		
02330	44,	9,	0,	.0154,	.0003,	.0000,	.1852,	-.4305,	.0000,		
02340	45,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
02350	46,	36,	0,	.0617,	.0013,	.0000,	.7410,	-.8614,	.0000,		
02360	48,	2,	0,	.0034,	.0001,	.0000,	.0412,	-.2029,	.0000,		
02370	52,	13,	0,	.0223,	.0005,	.0000,	.2676,	-.5174,	.0000,		
02380	53,	5,	0,	.0086,	.0002,	.0000,	.1029,	-.3208,	.0000,		
02390	54,	23,	0,	.0395,	.0008,	.0000,	.4734,	-.6883,	.0000,		
02400	55,	6,	0,	.0103,	.0002,	.0000,	.1235,	-.3515,	.0000,		
02410	56,	54,	0,	.0926,	.0019,	.0000,	1.1115,	*-1.0553,	.0000		
02420	57,	10,	0,	.0172,	.0004,	.0000,	.2058,	-.4538,	.0000,		
02430	58,	2,	0,	.0034,	.0001,	.0000,	.0412,	-.2029,	.0000,		
02440	60,	5,	0,	.0086,	.0002,	.0000,	.1029,	-.3208,	.0000,		
02450	61,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
02460	62,	5,	0,	.0086,	.0002,	.0000,	.1029,	-.3208,	.0000,		
02470	66,	24,	0,	.0412,	.0008,	.0000,	.4940,	-.7031,	.0000,		
02480	68,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
02490	73,	3,	0,	.0051,	.0001,	.0000,	.0617,	-.2485,	.0000,		

02500	76	2	0	.0034	.0001	.0000	.0412	-.2029	.0000
02510	77	47	0	.0806	.0017	.0000	.9674	-.9844	.0000
02520	78	4	0	.0069	.0001	.0000	.0823	-.2870	.0000
02530	80	5	0	.0086	.0002	.0000	.1029	-.3208	.0000
02540	83	4	0	.0069	.0001	.0000	.0823	-.2870	.0000
02550	89	9	0	.0154	.0003	.0000	.1852	-.4305	.0000
02560	90	8	0	.0137	.0003	.0000	.1647	-.4058	.0000
02570	92	1	0	.0017	.0000	.0000	.0206	-.1435	.0000
02580	93	45	0	.0772	.0016	.0000	.9262	-.9632	.0000
02590	97	6	0	.0103	.0002	.0000	.1235	-.3515	.0000
02600	98	3	0	.0051	.0001	.0000	.0617	-.2485	.0000
02610	99	63	0	.1081	.0022	.0000	1.2967	*-1.1400	.0000
02620	105	26	0	.0446	.0009	.0000	.5352	-.7319	.0000
02630	109	1	0	.0017	.0000	.0000	.0206	-.1435	.0000
02640	110	13	0	.0223	.0005	.0000	.2676	-.5174	.0000
02650	111	50	2	.0858	.0018	.0034	.9158	.9578	.1667
02660	112	9	0	.0154	.0003	.0000	.1852	-.4305	.0000
02670	113	2	2	.0034	.0001	.0034	*93.2078	9.6548	.1667
02680	116	1	0	.0017	.0000	.0000	.0206	-.1435	.0000
02690	119	6	0	.0103	.0002	.0000	.1235	-.3515	.0000
02700	120	3	0	.0051	.0001	.0000	.0617	-.2485	.0000
02710	121	104	4	.1784	.0037	.0069	1.6150	1.2732	.3333
02720	122	3	0	.0051	.0001	.0000	.0617	-.2485	.0000
02730	124	3	0	.0051	.0001	.0000	.0617	-.2485	.0000
02740	127	1	0	.0017	.0000	.0000	.0206	-.1435	.0000
02750	129	1	0	.0017	.0000	.0000	.0206	-.1435	.0000
02760	131	173	4	.2967	.0061	.0069	.0541	.2334	.3333
02770	139	1	0	.0017	.0000	.0000	.0206	-.1435	.0000
02780	141	3	0	.0051	.0001	.0000	.0617	-.2485	.0000
02790	150	19	0	.0326	.0007	.0000	.3911	-.6256	.0000
02800	201	43	0	.0738	.0015	.0000	.8851	-.9415	.0000
02810	202	2	0	.0034	.0001	.0000	.0412	-.2029	.0000
02820	203	45	1	.0772	.0016	.0017	.0059	.0767	.0833
02830	205	1	0	.0017	.0000	.0000	.0206	-.1435	.0000
02840	208	11	0	.0189	.0004	.0000	.2264	-.4759	.0000
02850	214	6	0	.0103	.0002	.0000	.1235	-.3515	.0000
02860	223	4	0	.0069	.0001	.0000	.0823	-.2870	.0000
02870	225	2	1	.0034	.0001	.0017	*22.3328	4.7259	.0833
02880	228	1	0	.0017	.0000	.0000	.0206	-.1435	.0000
02890	230	11	0	.0189	.0004	.0000	.2264	-.4759	.0000
02900	233	1	0	.0017	.0000	.0000	.0206	-.1435	.0000
02910	238	70	2	.1201	.0025	.0034	.2170	.4664	.1667
02920	239	1	0	.0017	.0000	.0000	.0206	-.1435	.0000
02930	242	15	0	.0257	.0005	.0000	.3087	-.5558	.0000
02940	249	1	0	.0017	.0000	.0000	.0206	-.1435	.0000
02950	251	9	0	.0154	.0003	.0000	.1852	-.4305	.0000
02960	252	15	0	.0257	.0005	.0000	.3087	-.5558	.0000
02970	257	4	0	.0069	.0001	.0000	.0823	-.2870	.0000
02980	258	15	0	.0257	.0005	.0000	.3087	-.5558	.0000
02990	259	1	1	.0017	.0000	.0017	*46.6039	6.8268	.0833
03000	260	5	0	.0086	.0002	.0000	.1029	-.3208	.0000
03010	261	25	0	.0429	.0009	.0000	.5146	-.7177	.0000
03020	262	17	0	.0292	.0006	.0000	.3499	-.5917	.0000
03030	263	4	0	.0069	.0001	.0000	.0823	-.2870	.0000
03040	264	17	0	.0292	.0006	.0000	.3499	-.5917	.0000
03050	265	7	1	.0120	.0002	.0017	5.0846	2.2552	.0833
03060	268	3	0	.0051	.0001	.0000	.0617	-.2485	.0000
03070	270	4	1	.0069	.0001	.0017	*10.2282	3.1984	.0833
03080	271	4	0	.0069	.0001	.0000	.0823	-.2870	.0000
03090	276	53	0	.0909	.0019	.0000	1.0909	*-1.0454	.0000

03100	277,	4,	0,	.0069,	.0001,	.0000,	.0823,	-.2870,	.0000,		
03110	279,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
03120	280,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
03130	281,	9,	0,	.0154,	.0003,	.0000,	.1852,	-.4305,	.0000,		
03140	285,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
03150	401,	23,	0,	.0395,	.0008,	.0000,	.4734,	-.6883,	.0000,		
03160	403,	5,	0,	.0086,	.0002,	.0000,	.1029,	-.3208,	.0000,		
03170	421,	2,	1,	.0034,	.0001,	.0017,	*22.3328,	4.7259,	.0833		
03180	424,	6,	6,	.0103,	.0002,	.0103,	*279.6235,	*16.7237,	.5		
03190	428,	2,	0,	.0034,	.0001,	.0000,	.0412,	-.2029,	.0000,		
03200	431,	2,	0,	.0034,	.0001,	.0000,	.0412,	-.2029,	.0000,		
03210	438,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
03220	605,	3,	0,	.0051,	.0001,	.0000,	.0617,	-.2485,	.0000,		
03230	606,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
03240	609,	2,	2,	.0034,	.0001,	.0034,	*93.2078,	9.6548,	.1667		
03250	610,	6,	1,	.0103,	.0002,	.0017,	6.2207,	2.4944,	.0833,		
03260	611,	4,	0,	.0069,	.0001,	.0000,	.0823,	-.2870,	.0000,		
03270	614,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
03280	618,	17,	0,	.0292,	.0006,	.0000,	.3499,	-.5917,	.0000,		
03290	623,	4,	0,	.0069,	.0001,	.0000,	.0823,	-.2870,	.0000,		
03300	625,	5,	0,	.0086,	.0002,	.0000,	.1029,	-.3208,	.0000,		
03310	626,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
03320	628,	20,	0,	.0343,	.0007,	.0000,	.4117,	-.6418,	.0000,		
03330	629,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
03340	633,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
03350	634,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
03360	638,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
03370	639,	2,	0,	.0034,	.0001,	.0000,	.0412,	-.2029,	.0000,		
03380	642,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
03390	648,	4,	0,	.0069,	.0001,	.0000,	.0823,	-.2870,	.0000,		
03400	649,	15,	0,	.0257,	.0005,	.0000,	.3087,	-.5558,	.0000,		
03410	650,	18,	0,	.0309,	.0006,	.0000,	.3705,	-.6089,	.0000,		
03420	651,	45,	0,	.0772,	.0016,	.0000,	.9262,	-.9632,	.0000,		
03430	653,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
03440	654,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
03450	661,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
03460	663,	14,	0,	.0240,	.0005,	.0000,	.2882,	-.5369,	.0000,		
03470	675,	2,	0,	.0034,	.0001,	.0000,	.0412,	-.2029,	.0000,		
03480	676,	2,	0,	.0034,	.0001,	.0000,	.0412,	-.2029,	.0000,		
03490				CONCORDS OF VARIABLE AND CHARACTERS							
03500	1,	26,	0,	.0446,	.0009,	.0000,	.5352,	-.7319,	.0000,		
03510	2,	3,	0,	.0051,	.0001,	.0000,	.0617,	-.2485,	.0000,		
03520	3,	48,	1,	.0823,	.0017,	.0017,	.0001,	.0121,	.0833,		
03530	4,	7,	2,	.0120,	.0002,	.0034,	*23.9060,	4.8900,	.1667		
03540	5,	2,	2,	.0034,	.0001,	.0034,	*93.2078,	9.6548,	.1667		
03550	9,	4,	0,	.0069,	.0001,	.0000,	.0823,	-.2870,	.0000,		
03560	10,	17,	1,	.0292,	.0006,	.0017,	1.2078,	1.0993,	.0833,		
03570	12,	29,	2,	.0497,	.0010,	.0034,	3.2981,	1.8170,	.1667,		
03580	13,	3,	0,	.0051,	.0001,	.0000,	.0617,	-.2485,	.0000,		
03590	14,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
03600	15,	2,	2,	.0034,	.0001,	.0034,	*93.2078,	9.6548,	.1667		
03610	18,	11,	0,	.0189,	.0004,	.0000,	.2264,	-.4759,	.0000,		
03620	21,	59,	2,	.1012,	.0021,	.0034,	.5082,	.7136,	.1667,		
03630	22,	4,	0,	.0069,	.0001,	.0000,	.0823,	-.2870,	.0000,		
03640	28,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,		
03650	29,	31,	0,	.0532,	.0011,	.0000,	.6381,	-.7992,	.0000,		
03660	30,	3,	0,	.0051,	.0001,	.0000,	.0617,	-.2485,	.0000,		
03670	32,	38,	0,	.0652,	.0013,	.0000,	.7822,	-.8850,	.0000,		
03680	33,	6,	0,	.0103,	.0002,	.0000,	.1235,	-.3515,	.0000,		
03690	34,	2,	0,	.0034,	.0001,	.0000,	.0412,	-.2029,	.0000,		

03700	35,	5,	0,	.0086,	.0002,	.0000,	.1029,	-.3208,	.0000,
03710	37,	25,	1,	.0429,	.0009,	.0017,	.4579,	.6770,	.0833,
03720	40,	133,	1,	.2281,	.0047,	.0017,	1.1029,	*-1.0526,	.0833
03730	42,	16,	1,	.0274,	.0006,	.0017,	1.3658,	1.1690,	.0833,
03740	46,	5,	0,	.0086,	.0002,	.0000,	.1029,	-.3208,	.0000,
03750	48,	14,	1,	.0240,	.0005,	.0017,	1.7584,	1.3264,	.0833,
03760	49,	1,	0,	.0017,	.0000,	.0000,	.0206,	-.1435,	.0000,
03770	50,	2,	0,	.0034,	.0001,	.0000,	.0412,	-.2029,	.0000,
03780	52,	11,	0,	.0189,	.0004,	.0000,	.2264,	-.4759,	.0000,

APPENDIX FOUR.

THE R.I.B.A. PLAN OF WORK.

The R.I.B.A. Plan of work.

The research was standardised against the R.I.B.A. plan of work. This design process time scale is widely recognised throughout the construction industry and was adhered to by all the design teams used as data sources in this research. The plan of work may be summarised as follows;

A. Inception.

Purpose: To prepare a general outline of the requirements and plan future actions.

Tasks: To set up the Client organisation for briefing, consider requirements and to appoint the Architect.

Involvement: Client and Architect.

B. Feasibility.

Purpose: To provide the Client with an appraisal and recommendation in order that he may determine the form in which the project is to proceed, ensuring that it is feasible, functionally, technically and financially.

Tasks: To carry out studies of user requirements, site conditions, planning, design and cost etc as necessary to reach decisions.

Involvement: Client, Architect, Engineers, and Q.S.
according to the nature of the project.

C. Outline Proposals.

Purpose: To determine a general approach to layout, design and construction in order to obtain authoratative approval of the Client on the outline proposals and the accompanying report.

Tasks: To develop the brief further and carry out studies on user requirements, technical problems, planning, design and costs as necessary to reach decisions.

Involvement: Client, Architect, Engineers and Q.S.

D. Scheme Design.

Purpose: To complete the brief and deicide upon particular proposals, including planning arrangement appearance, constructional method, outline specification, and cost and to obtain all approvals.

Tasks: Final development of the brief, full design of the project by the Architect, preliminary design by the Engineers, preparation of cost plan and full explanatory report. Submission of proposals for all approvals.

Involvement: Client, Architect, Engineers, Q.S. and all statutory and other approving Authorities.

Brief should not be modified after this point.

E. Detailed Design.

Purpose: To obtain final decisions on everything related to the design, specification, construction and cost.

Tasks: Full design of every part and component of the building by the collaboration of all concerned. Complete cost checking of the designs.

Involvement: Architect, Engineers and Q.S.

Any further changes in location, size, shape or cost after this time will result in abortive work.

F. Production Information.

Purpose: To prepare production information and make final detailed decisions in order to be able to carry out the work.

Tasks: Preparation of final production information drawings i.e. drawings, schedules and specifications.

Involvement: Architect and Engineers.

G. Bills of Quantities.

H. Tender Action.

J. Project Planning.

K. Operations on Site.

L. Completion.

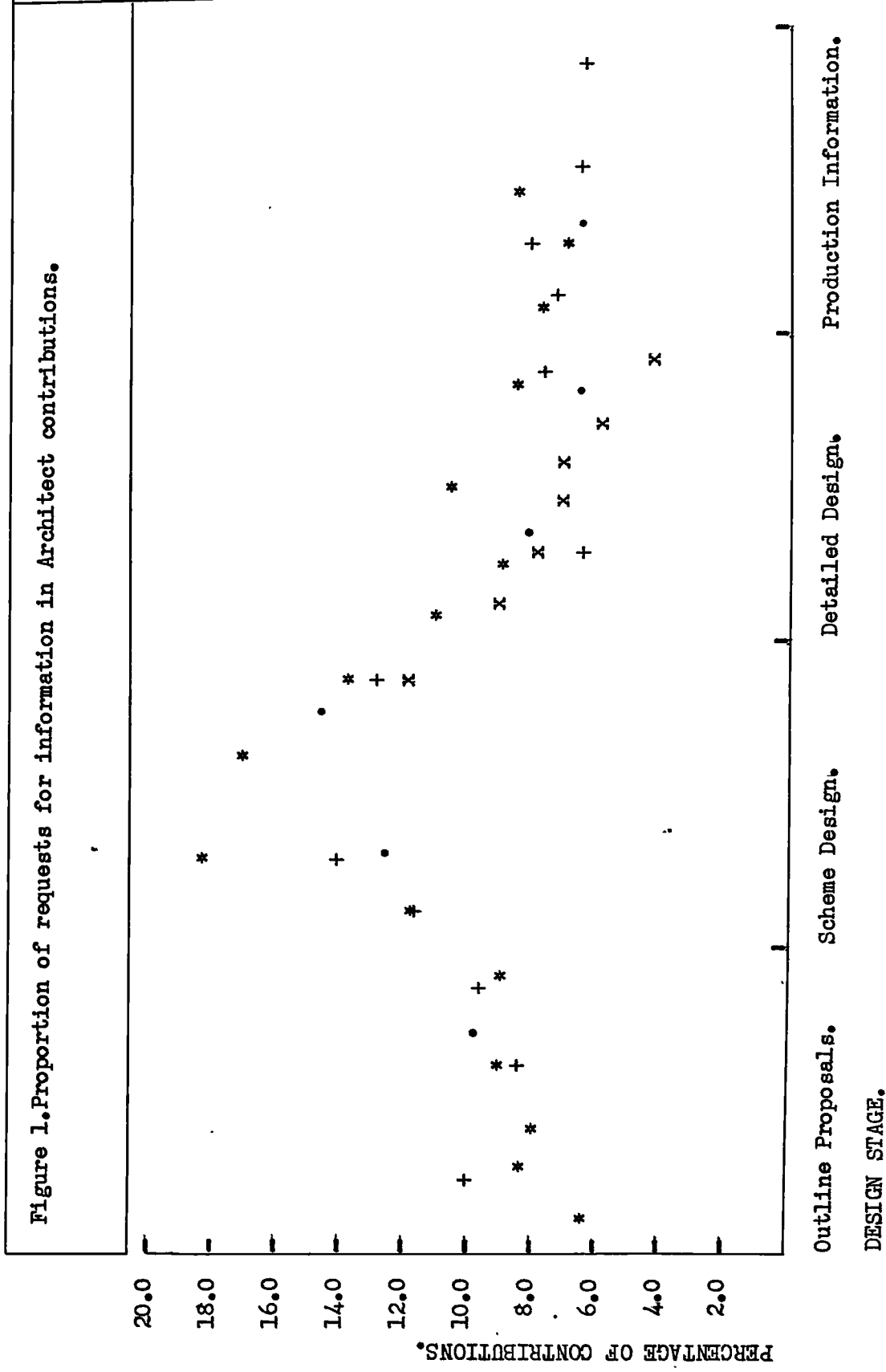
M. Feedback.

The durations of the research involvement in each subject design team were standardised according to this scale. Interviews shown on the graphs correspond to proportional locations within the design stages contained in the plan of work.

APPENDIX FIVE.

FIGURES.

Figure 1. Proportion of requests for information in Architect contributions.

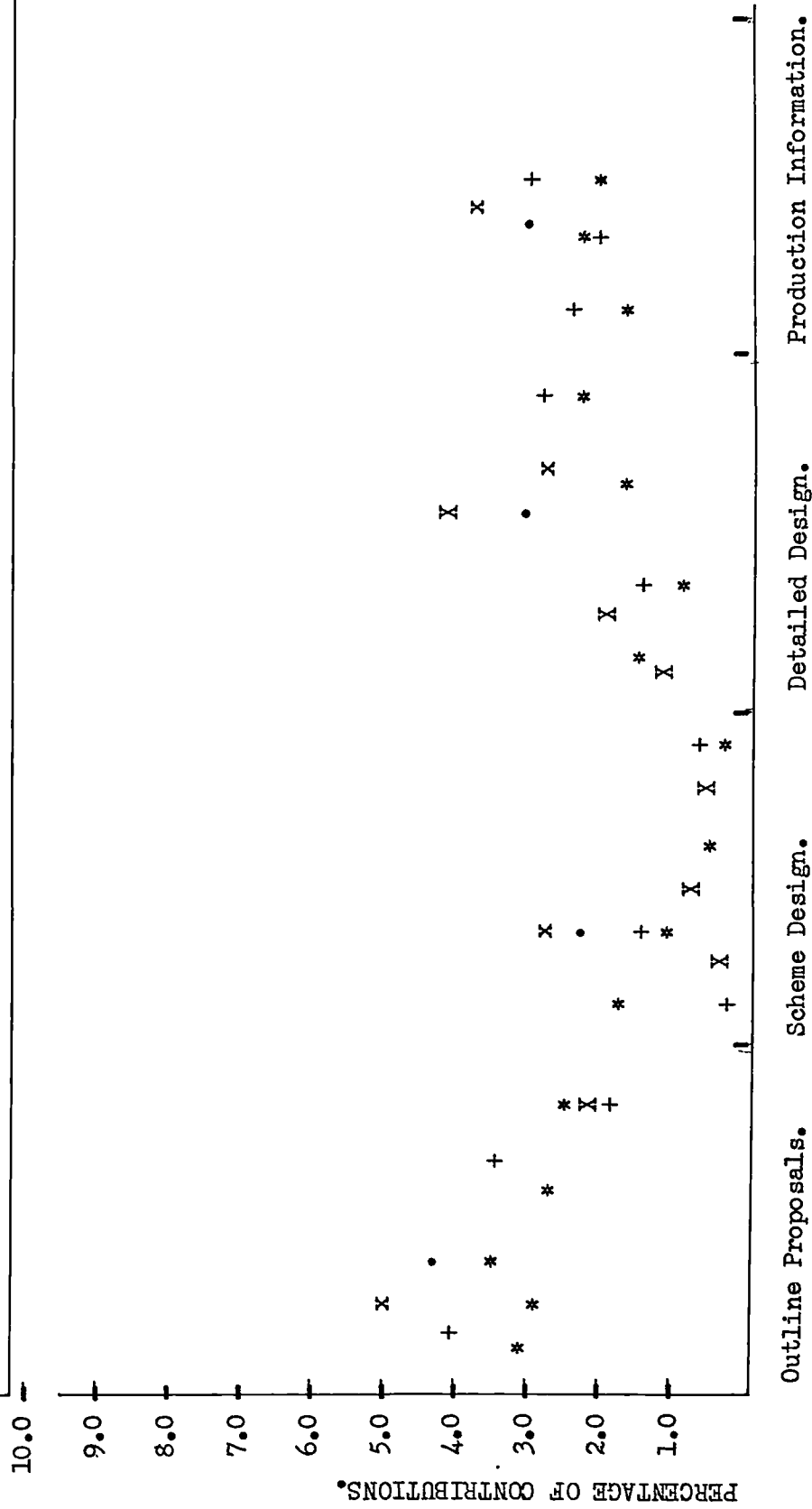


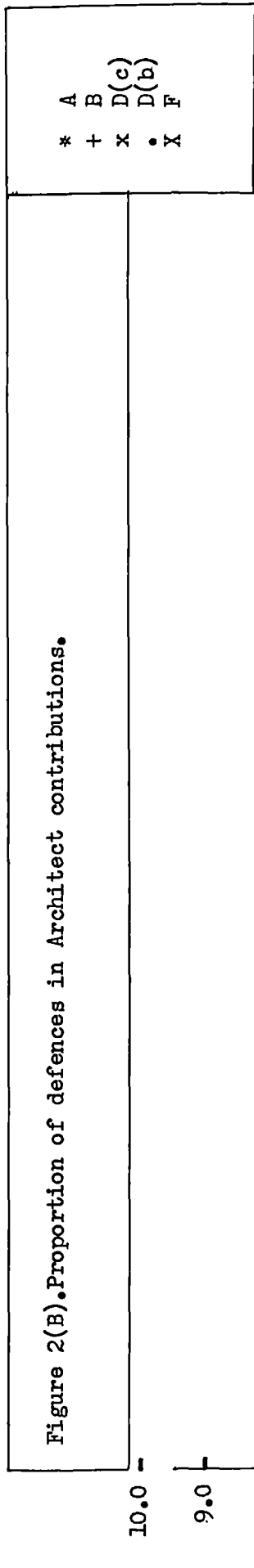
Outline Proposals. Scheme Design. Detailed Design. Production Information.
 DESIGN STAGE.

A
B
C
D(b)
F

* + x • X

Figure 2(A). Proportion of attacks in Architect contributions.

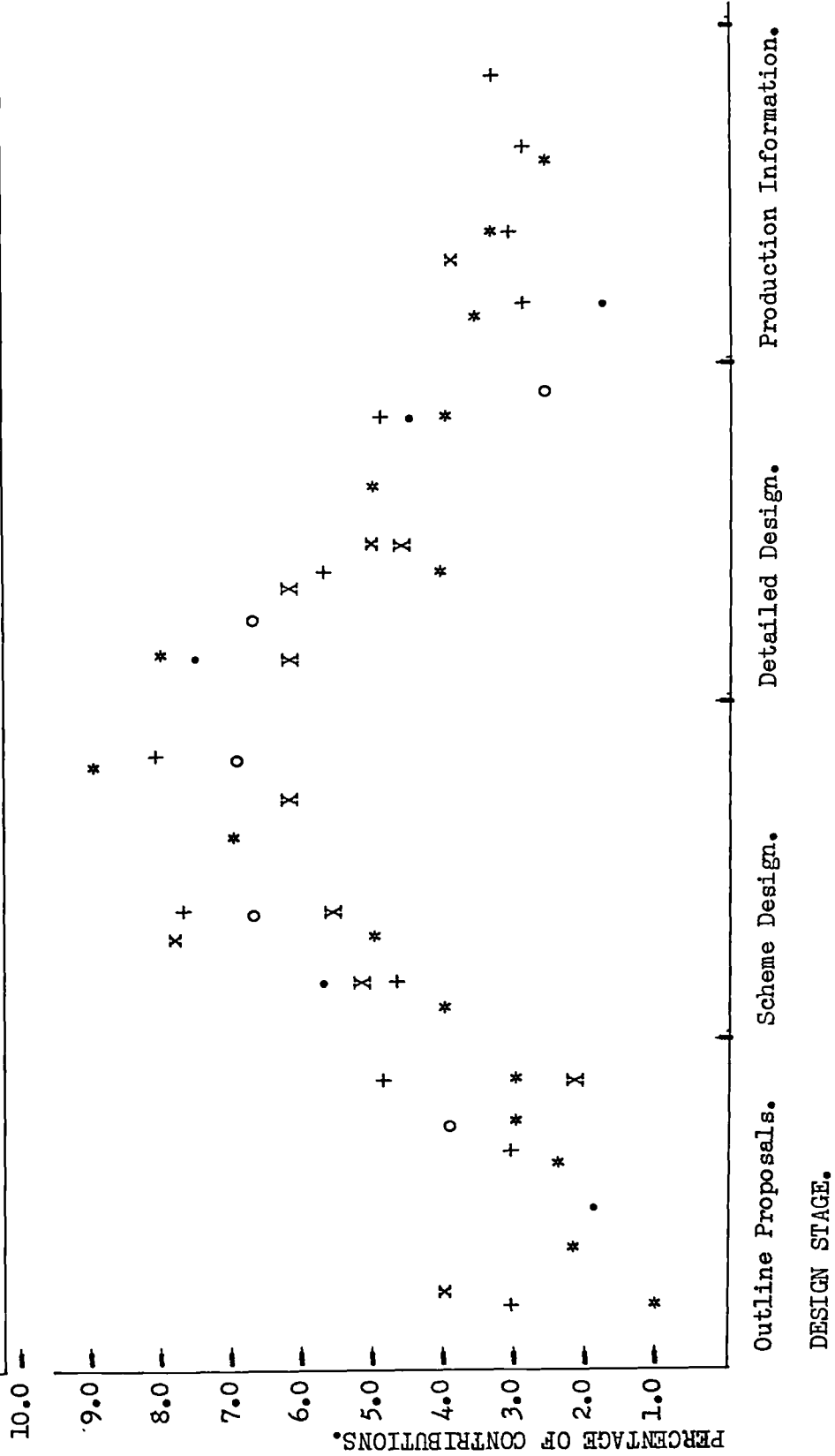




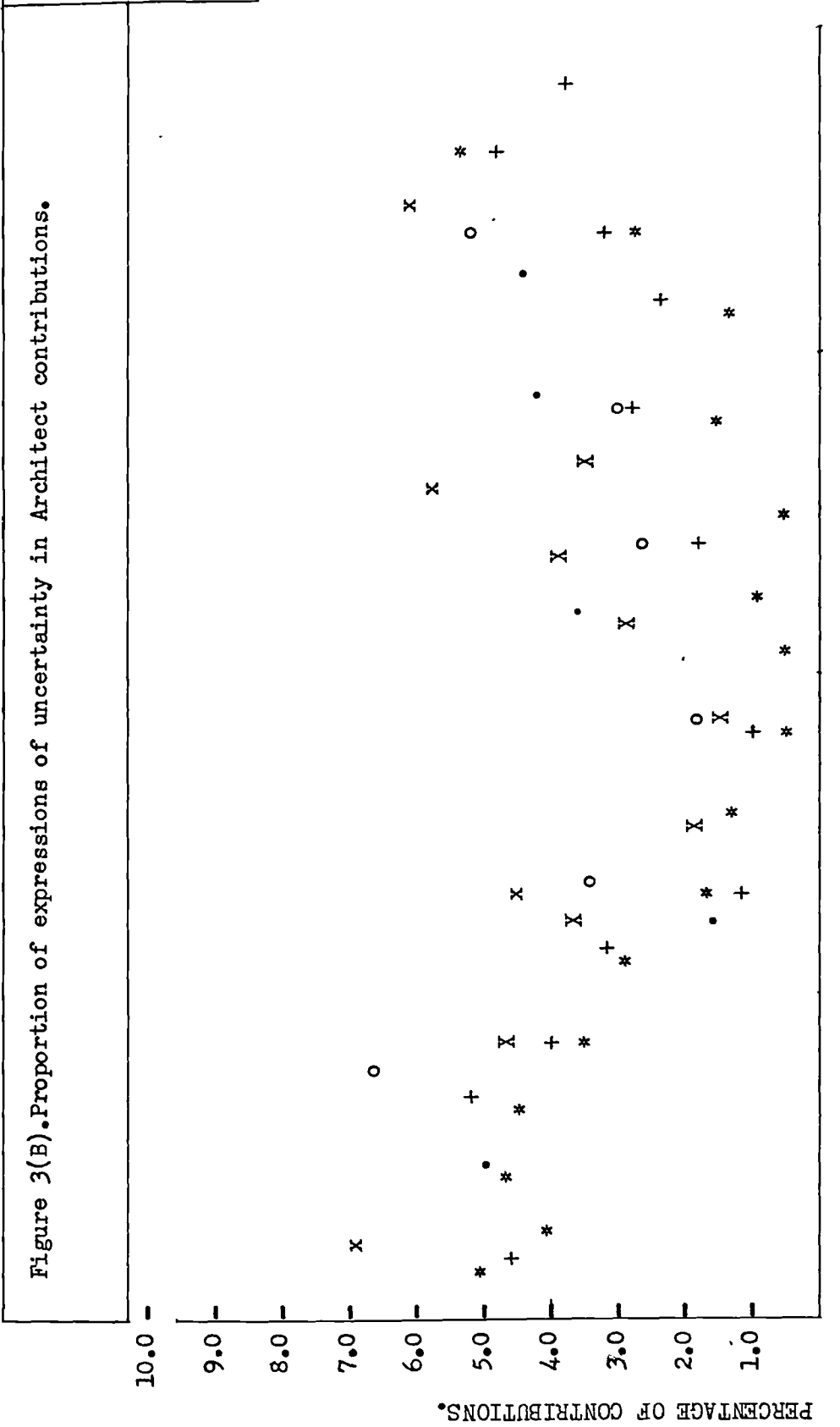
Outline Proposals. Scheme Design. Detailed Design. Production Information.
 DESIGN STAGE.

Figure 3(A). Proportion of opinions in Architect contributions.

A	B	C	D(b)
*	+	x	•
X	o		



A	B	C	D(b)
*	+	x	•
X	o		

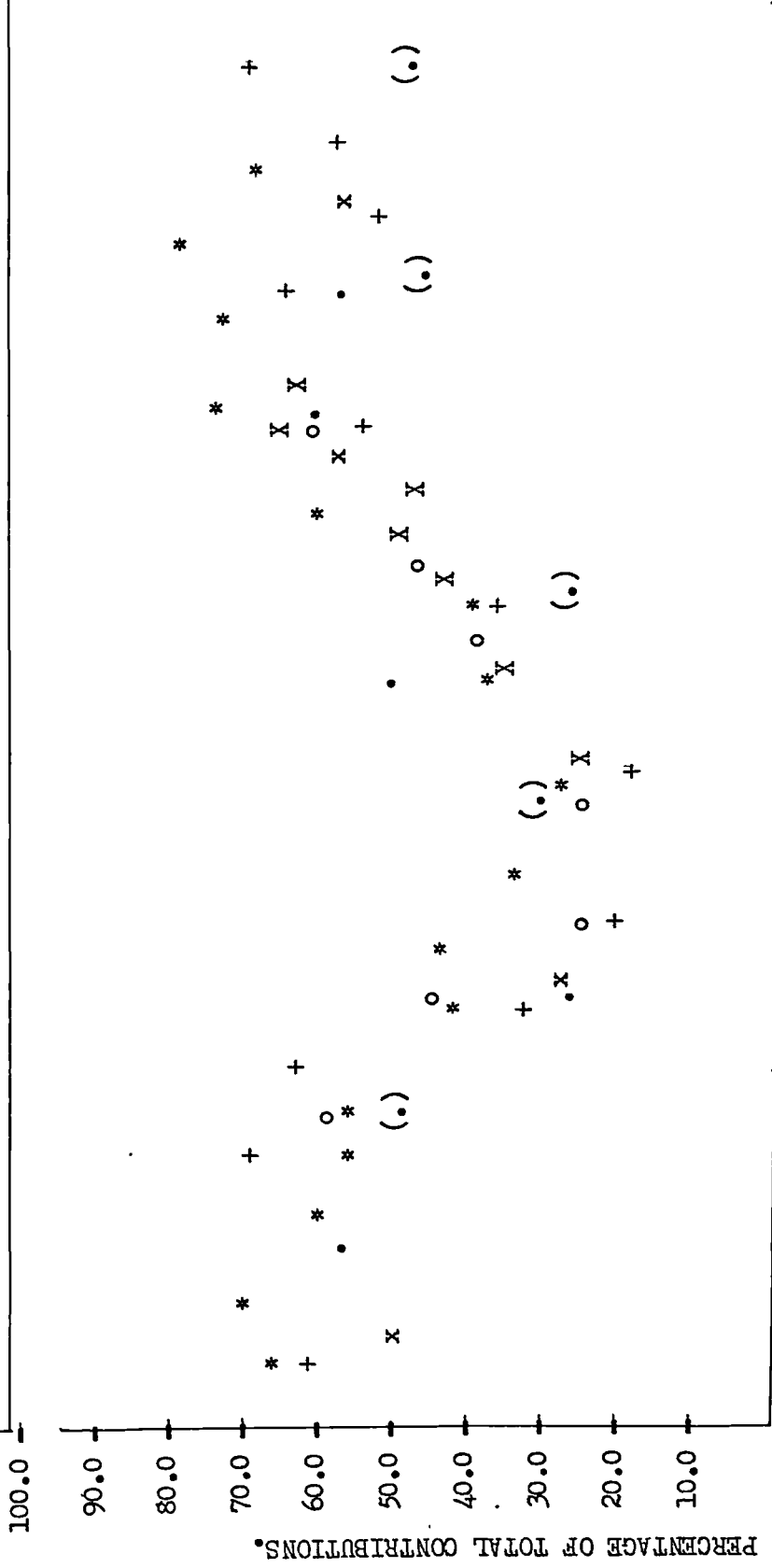


Outline Proposals. Scheme Design. Detailed Design. Production Information.

DESIGN STAGE.

Figure 4. Proportion of Architect contributions in total design team contributions.

*	A
+	B
x	C
.	D(b)
o	E
(.)	F
	G

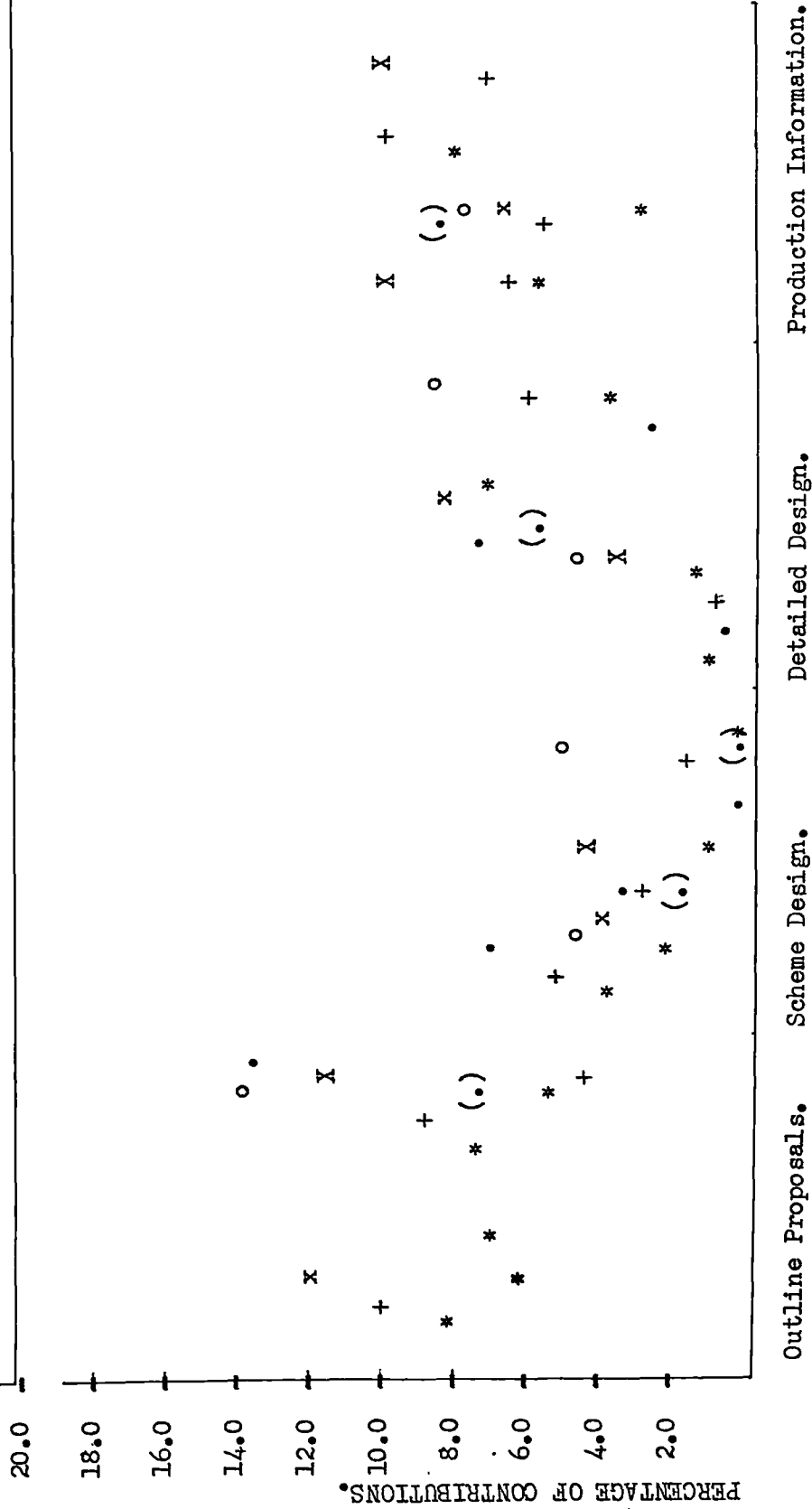


Outline Proposals. Scheme Design. Detailed Design. Production Information.

DESIGN STAGE.

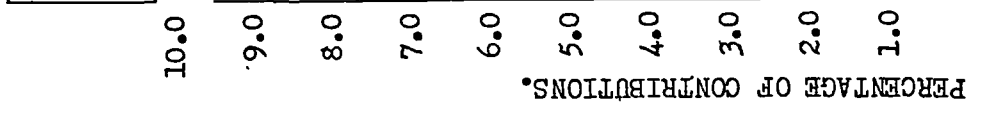
A
B
C
F
G
H
I
*
+
x
o
(.)

Figure 5(A). Proportion of new goals in Architect contributions.



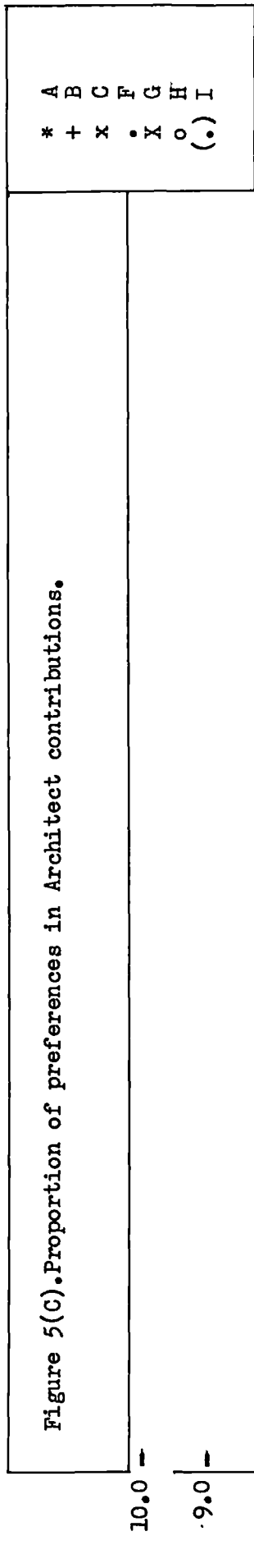
Outline Proposals. Scheme Design. Detailed Design. Production Information.
 DESIGN STAGE.

Figure 5(B). Proportion of new constraints in Architect contributions.



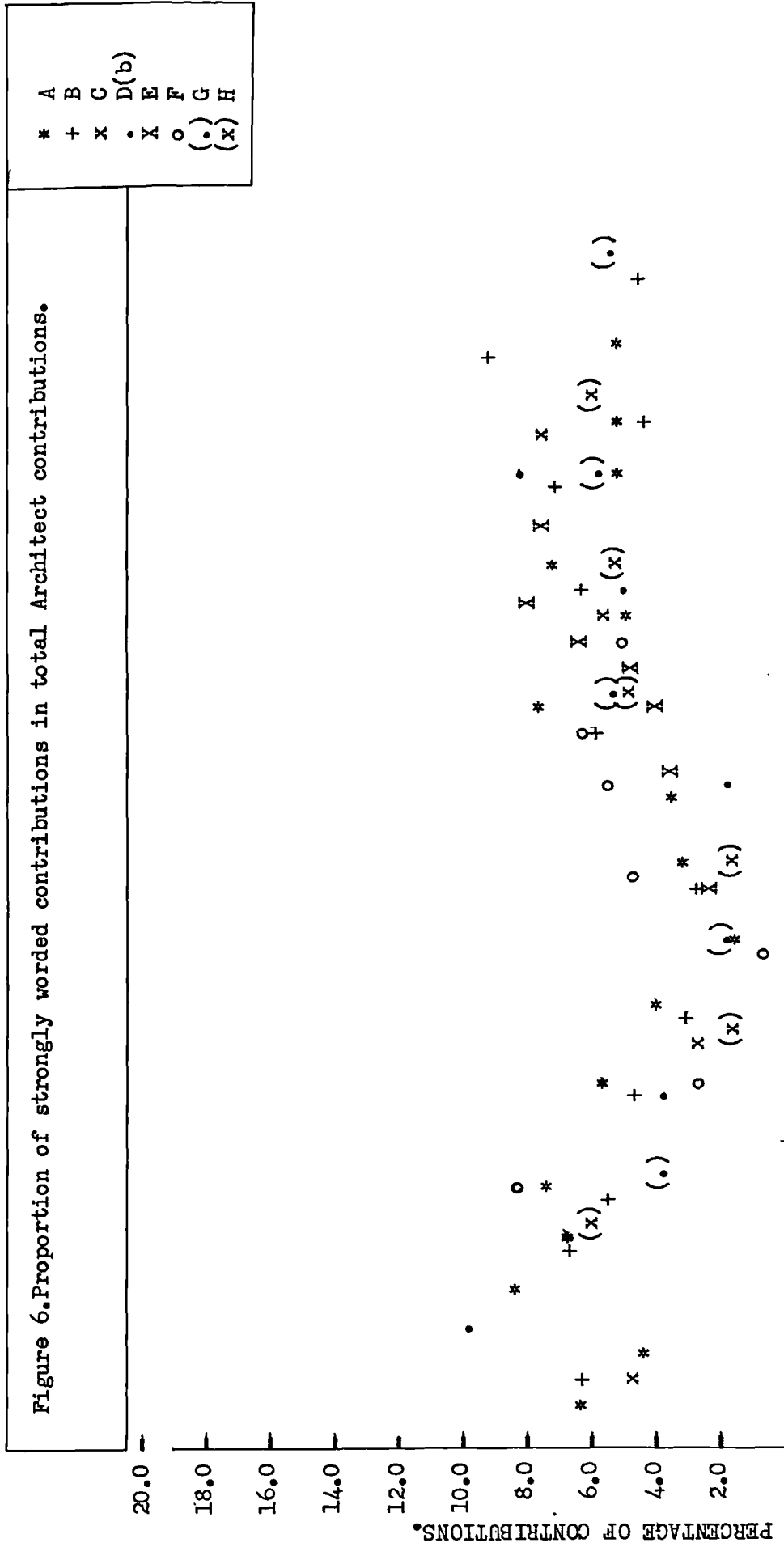
Outline Proposals. Scheme Design. Detailed Design. Production Information.

DESIGN STAGE.



Outline Proposals. Scheme Design. Detailed Design. Production Information.

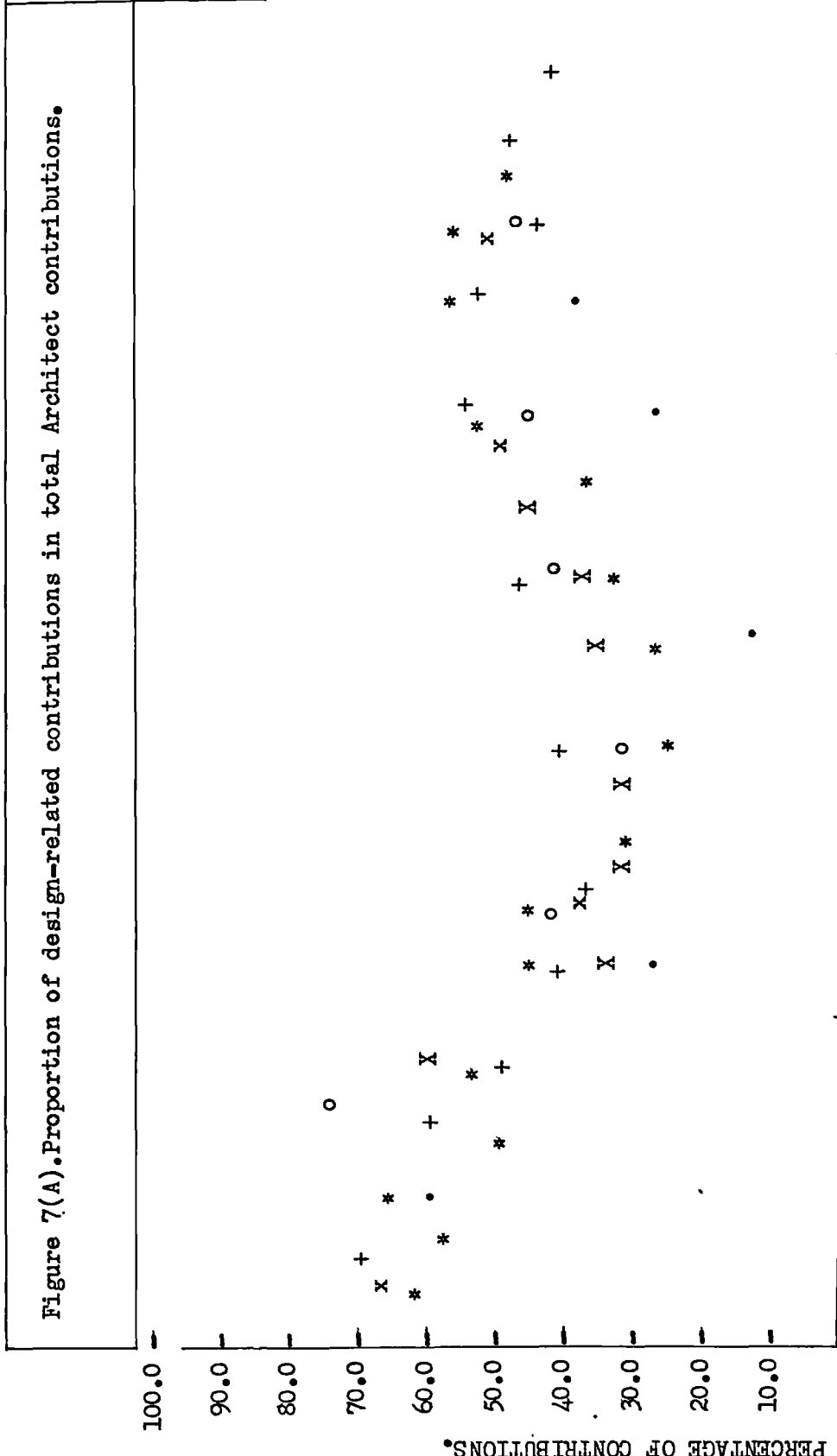
DESIGN STAGE.



Outline Proposals. Scheme Design. Detailed Design. Production information.

DESIGN STAGE.

A
B
C
D
F
H

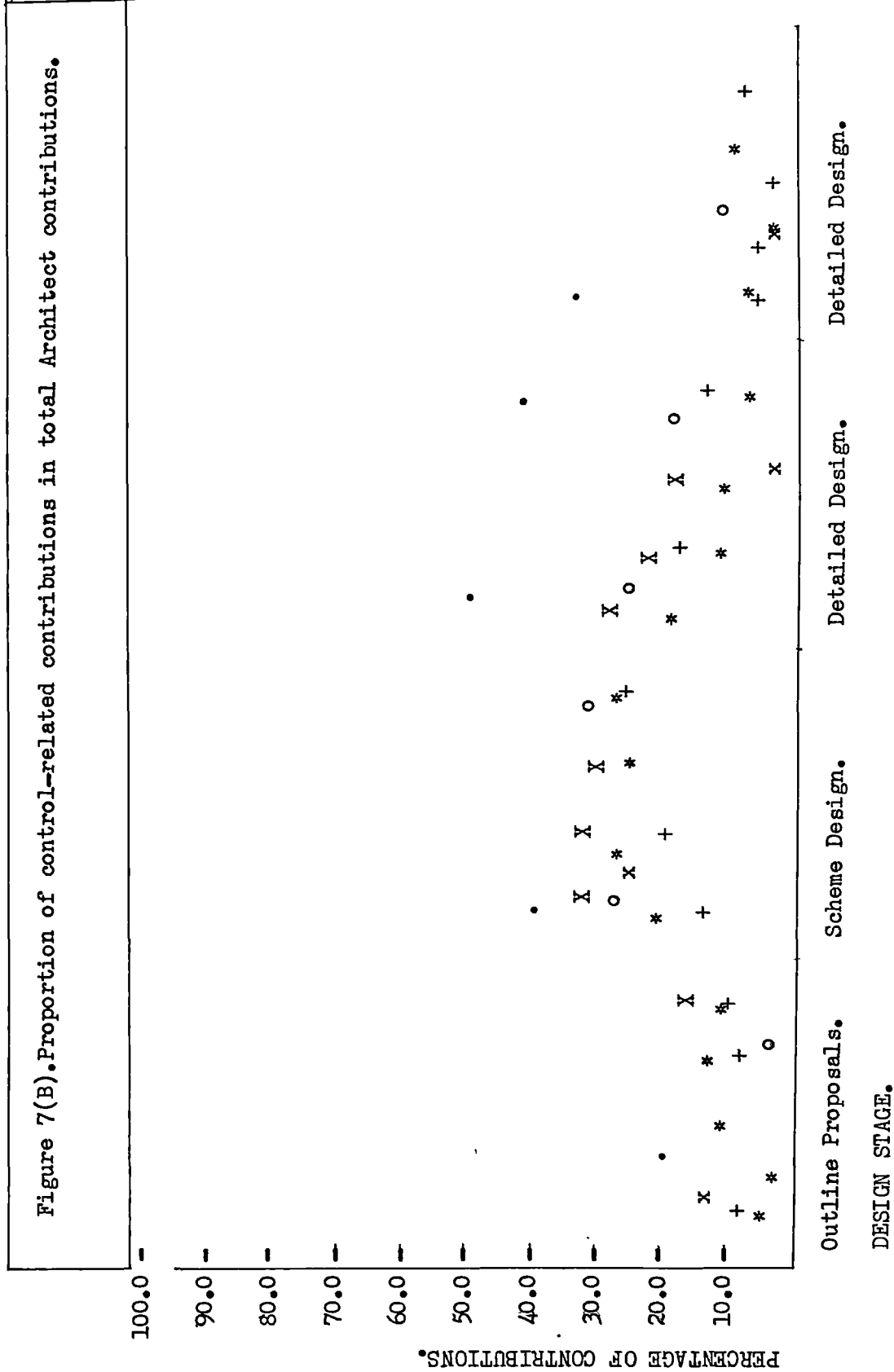


Outline Proposals. Scheme Design. Detailed Design. Production Information.

DESIGN STAGE.

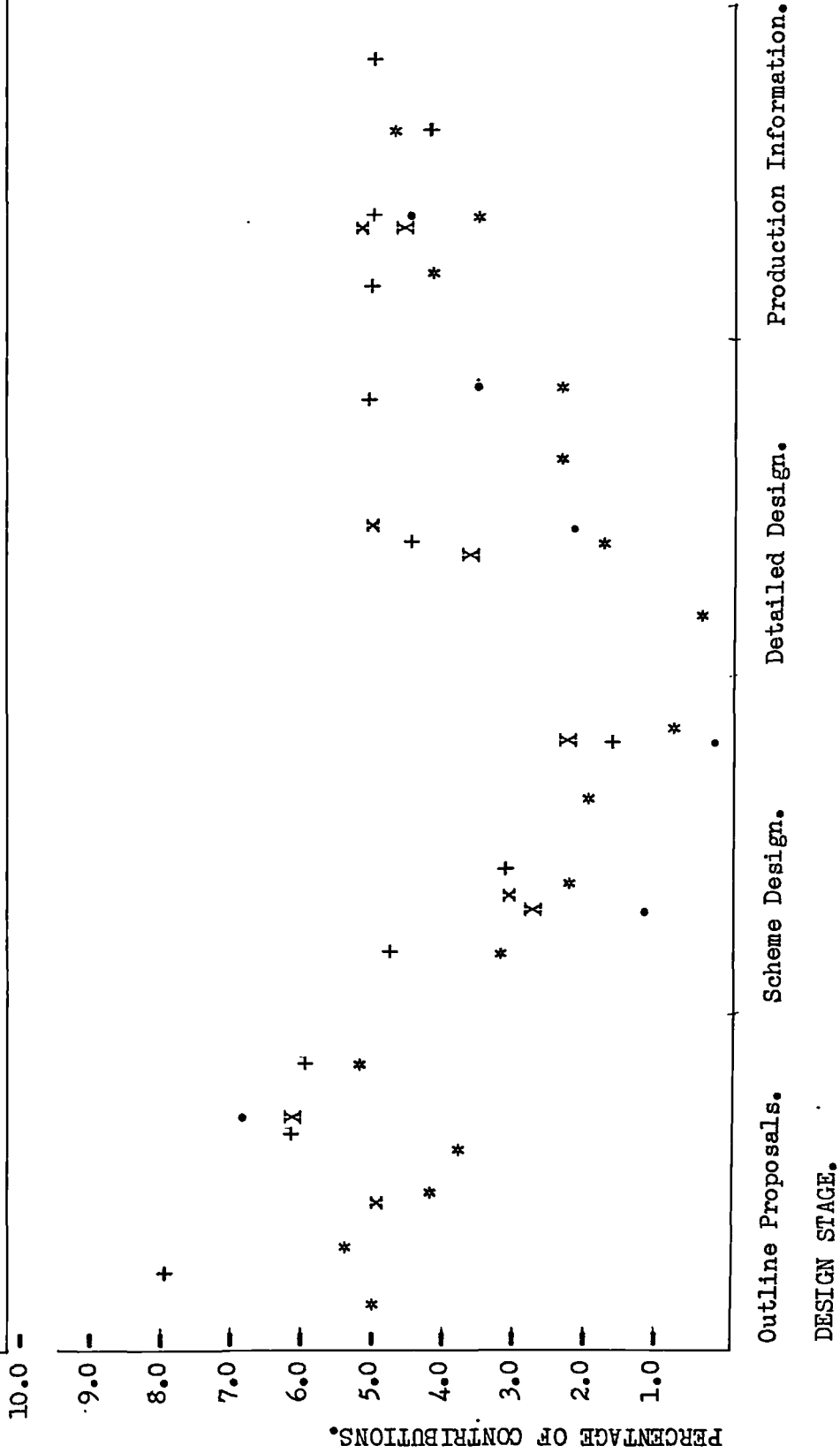
PERCENTAGE OF CONTRIBUTIONS.

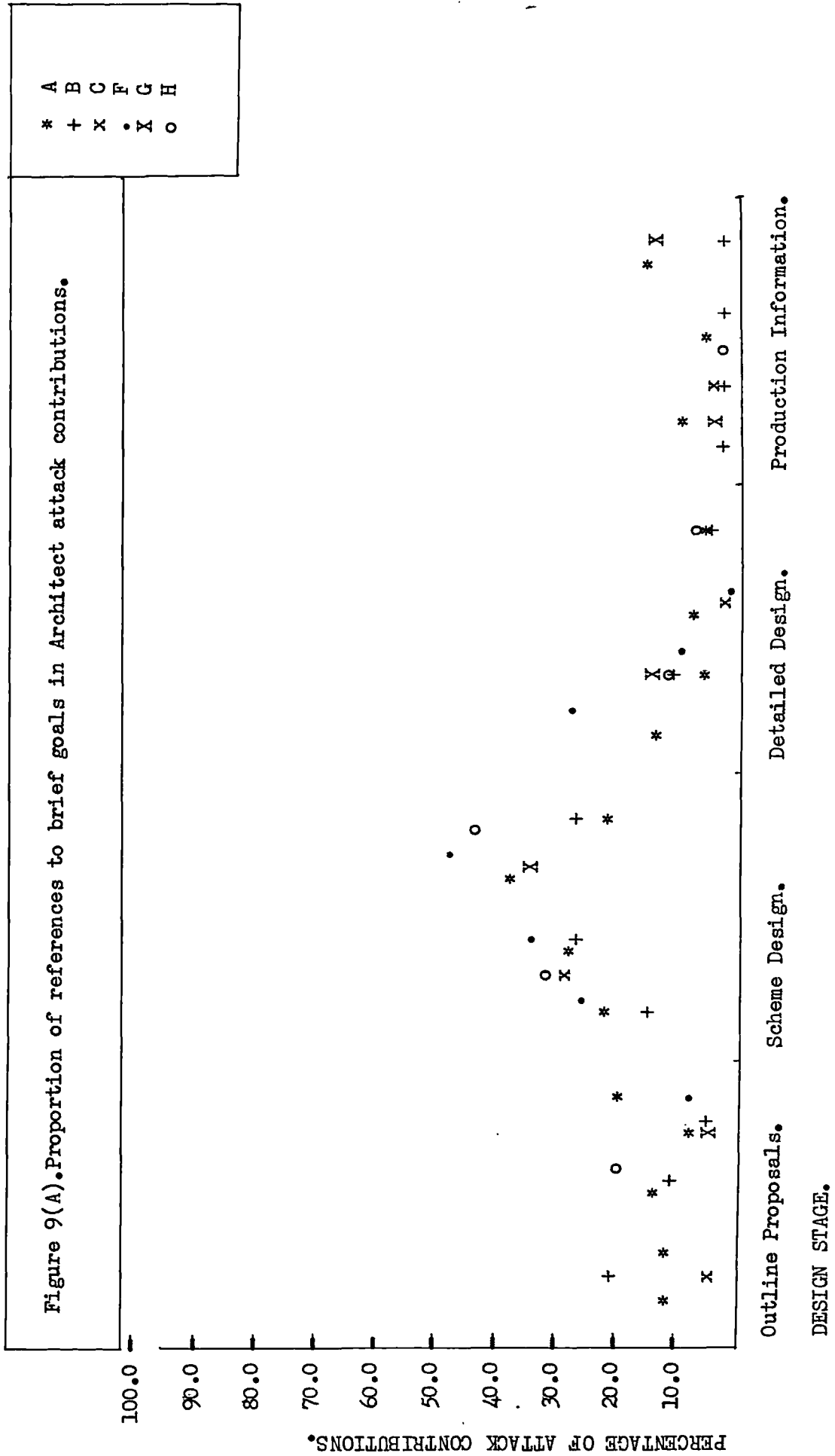
A
B
C
D
F
H

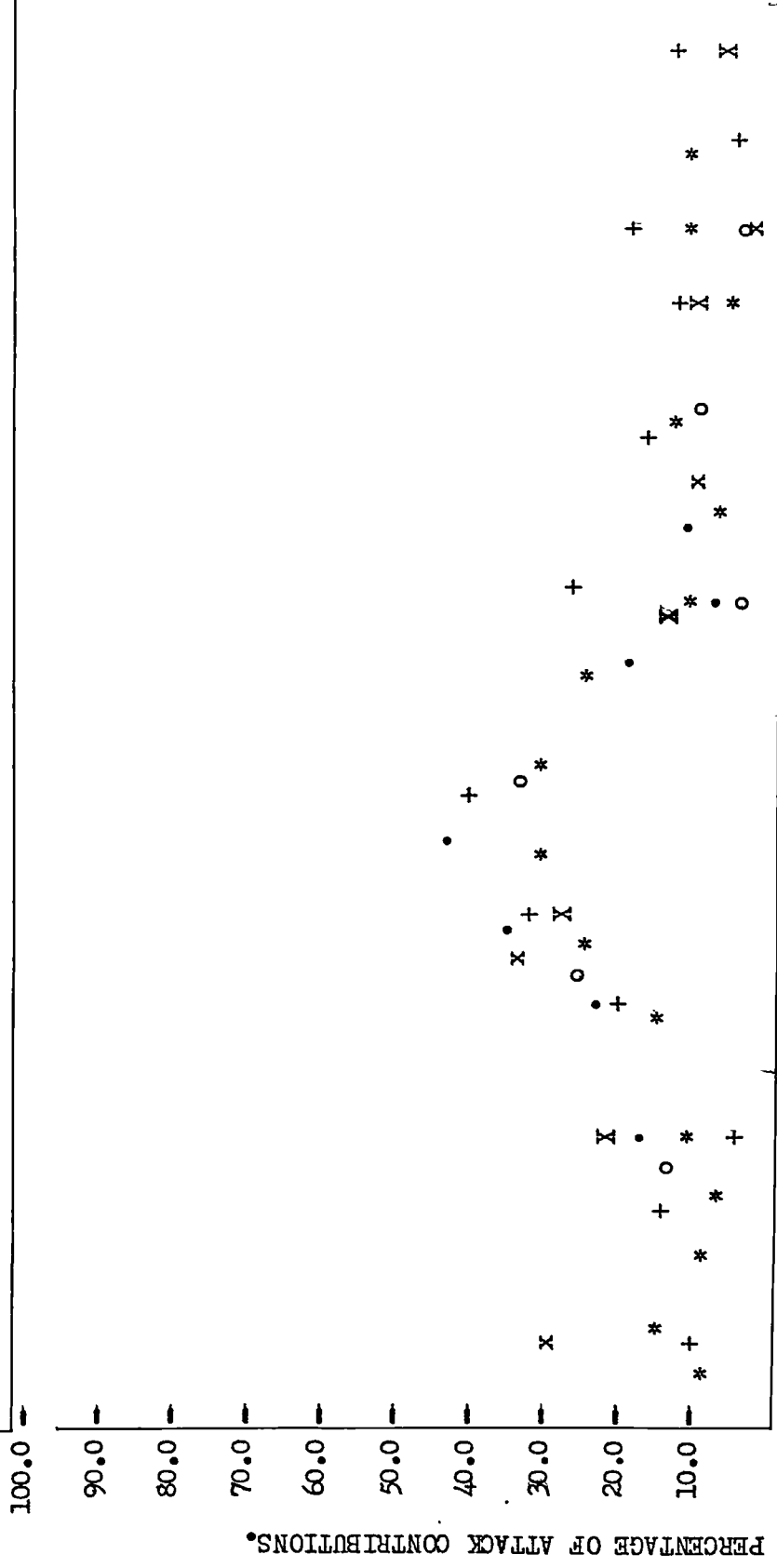
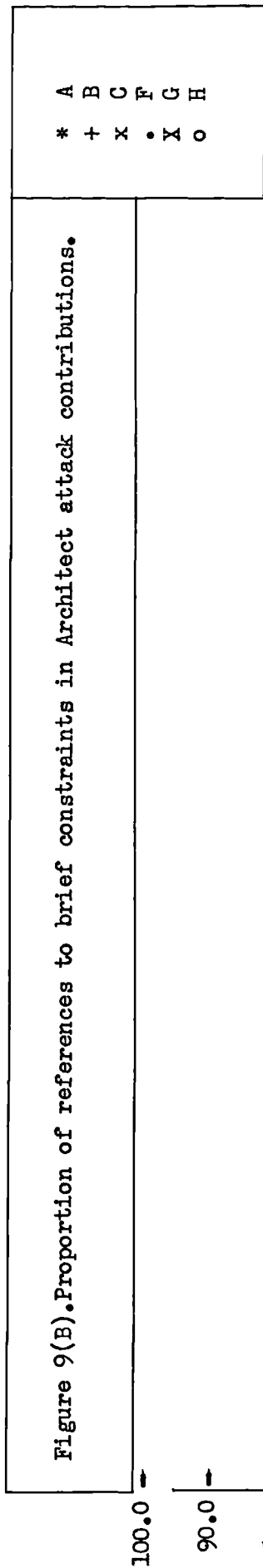


A
B
D(c)
H
I

Figure 8. Proportion of references to the brief in Architect contributions.





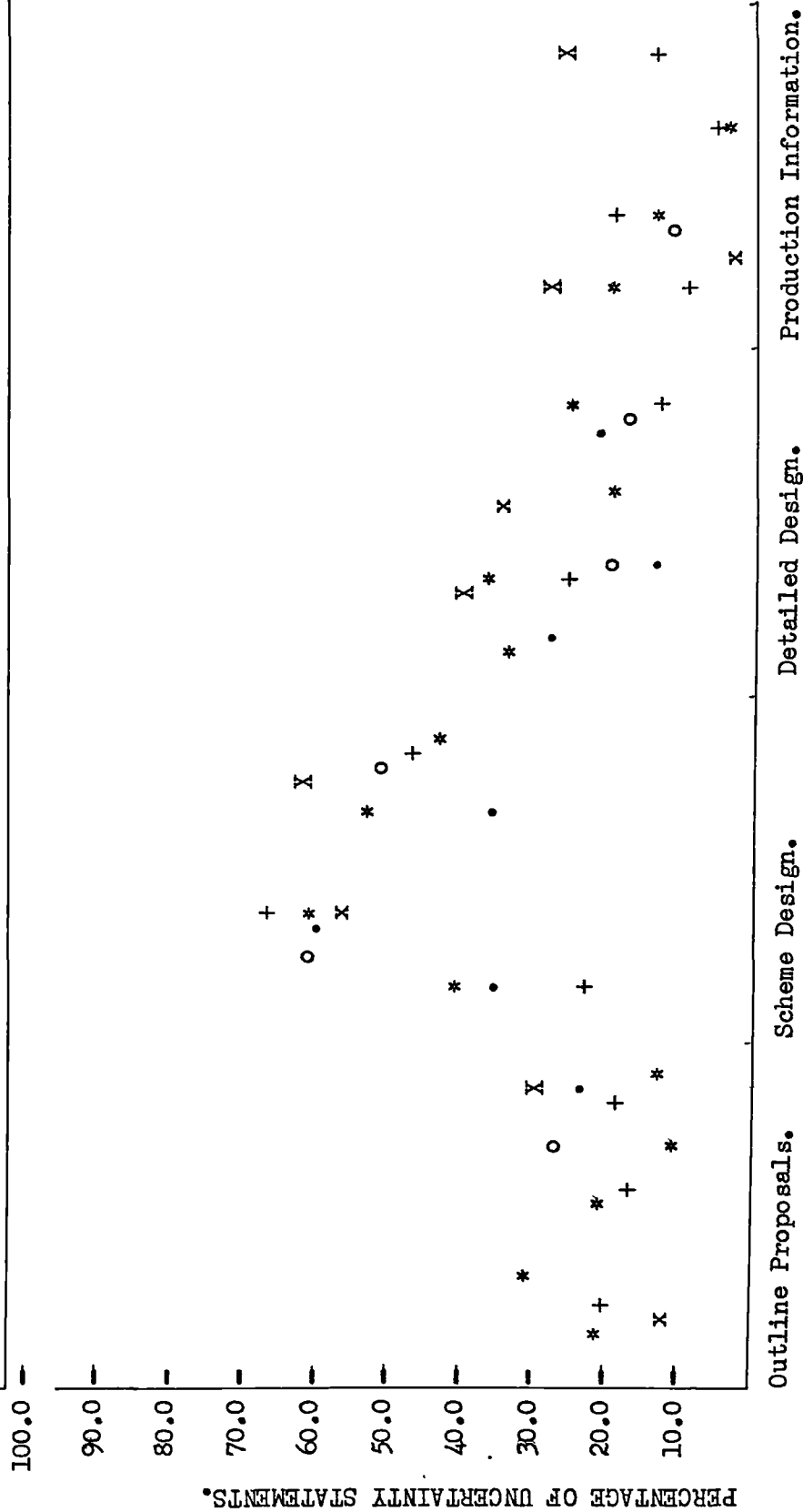


Outline Proposals. Scheme Design. Detailed Design. Production Information.

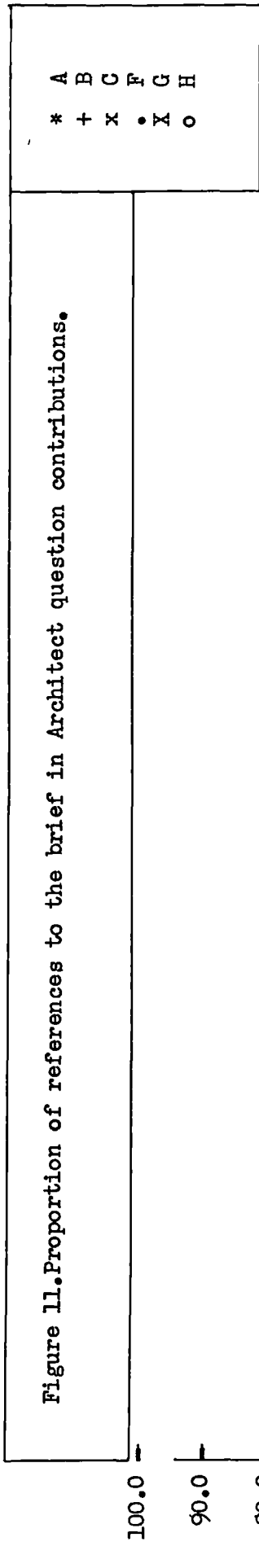
DESIGN STAGE.

Figure 10. Proportion of references to the brief in Architect uncertainty contributions.

* A
+ B
x C
• F
X G
o H



DESIGN STAGE.



Outline Proposals. Scheme Design. Detailed Design. Production Information.
 DESIGN STAGE.

Figure 12(B). Variations in the significance of association between Client and design in Architect contributions.

*	A
+	B
x	C
•	D(b)
X	G
o	H

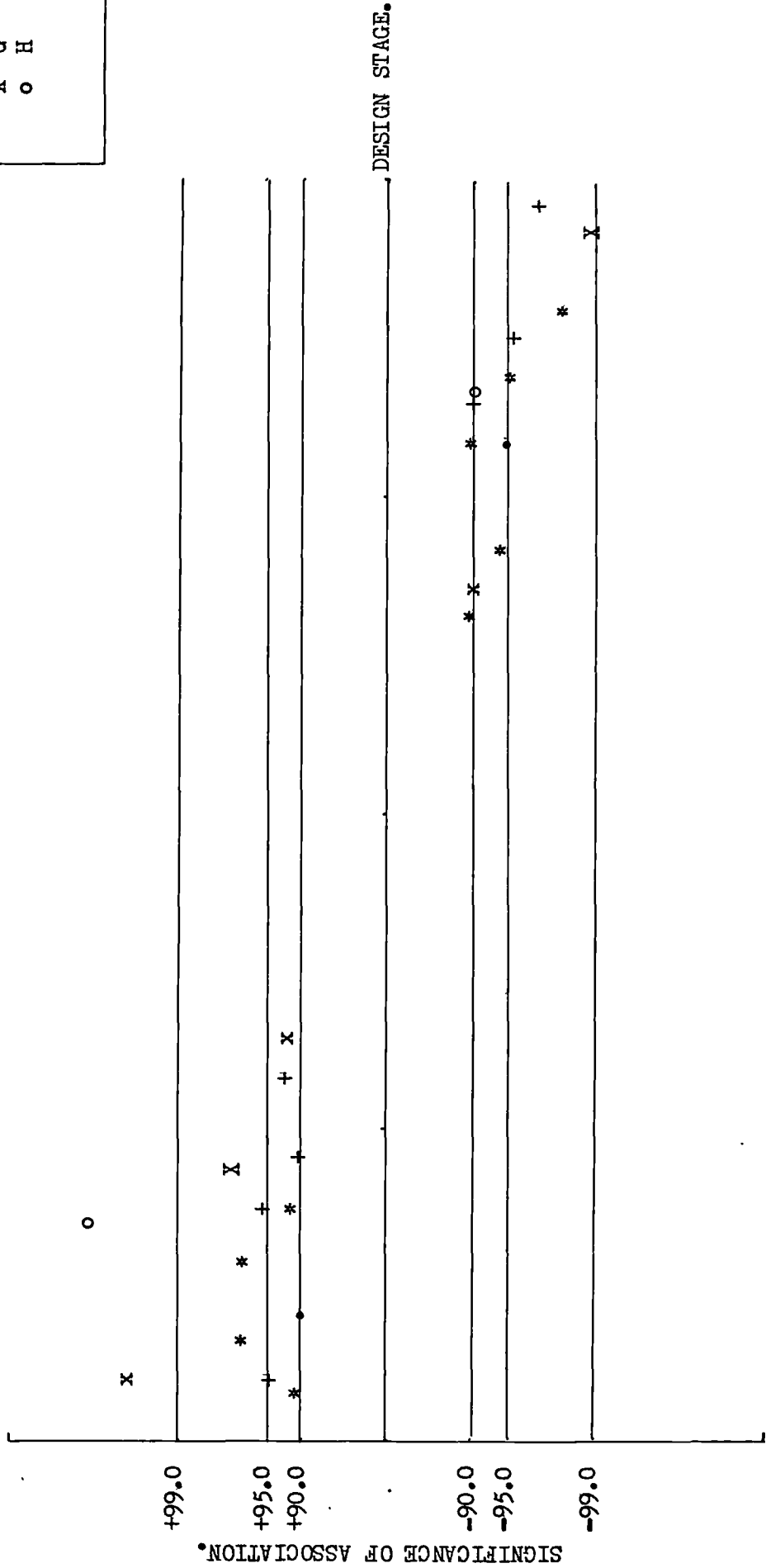


Figure 12(C). Variations in the significance of association between Architect-produced reports and design in Architect contributions.

*	A
+	B
x	C
•	D(b)
X	G
o	H

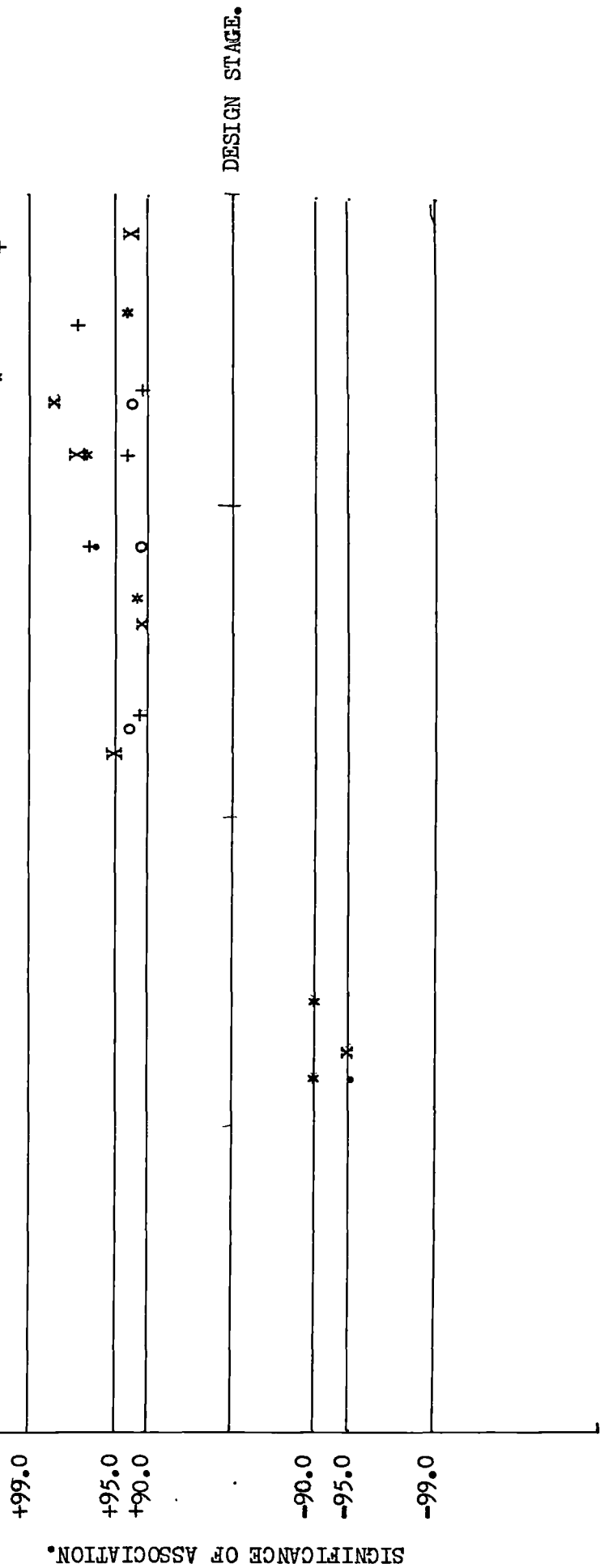
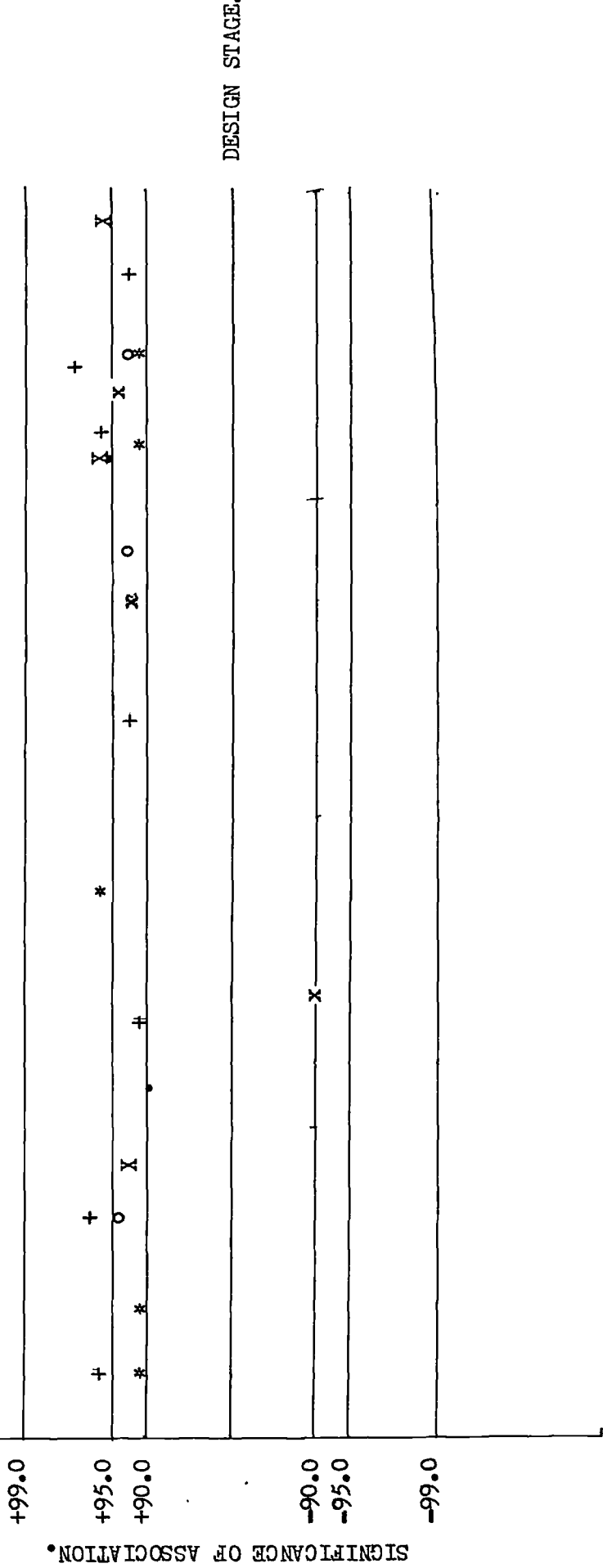


Figure 13(A). Variations in the significance of association between Brief and Design in Client Representative contributions.

*	A
+	B
x	C
•	D(b)
X	G
o	H



* A
+ B
x C
• D(b)
X G
o H

Figure 13(B). Variations in the significance of association between Self(Client) and design in Client Representative contributions.

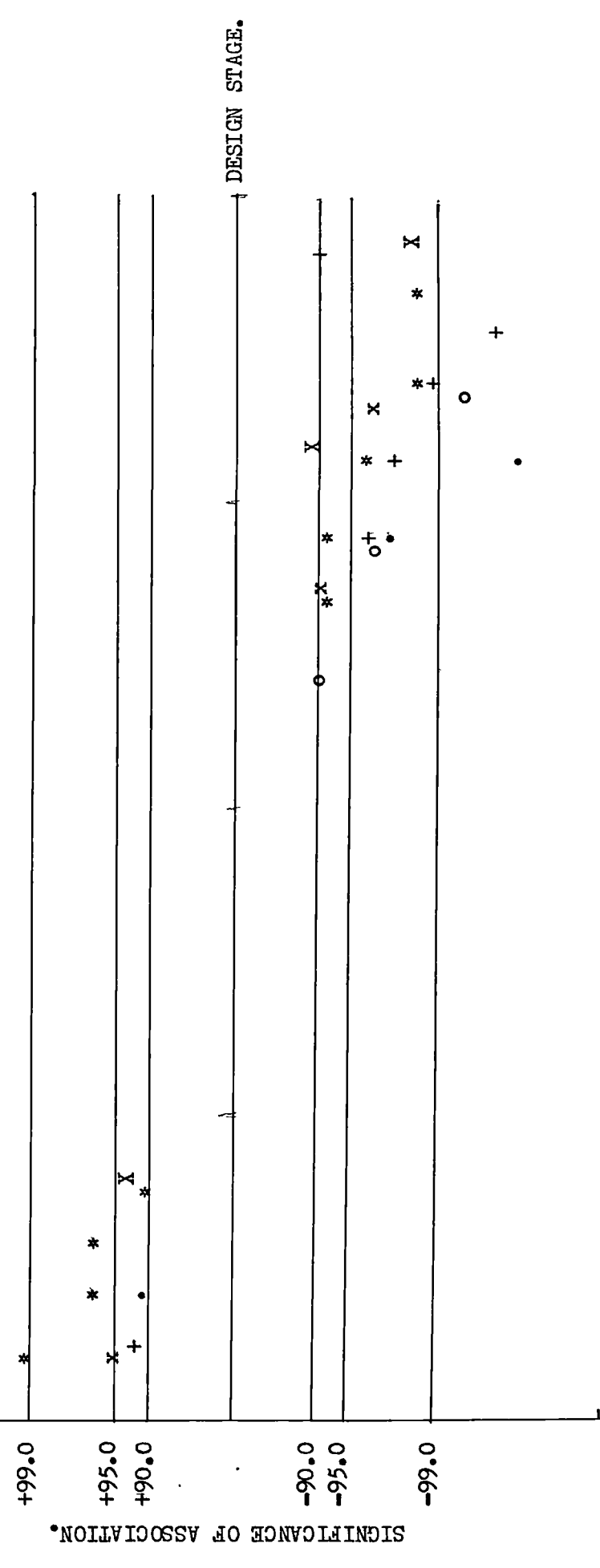


Figure 13(C). Variations in the significance of association between Architect-produced reports and Design in Client Representative contributions.

*	A
+	B
x	C
.	D(b)
X	G
o	H

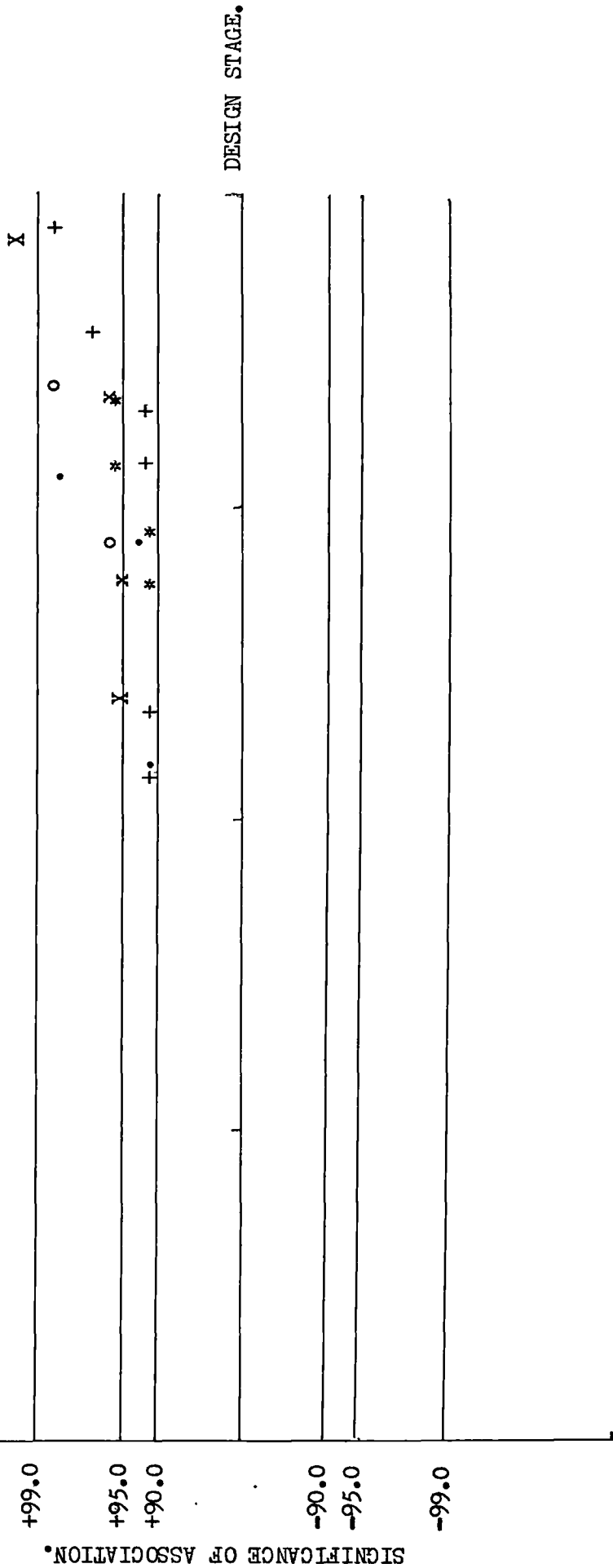


Figure 13(D). Variations in the significance of association between Architect and Design in Client Representative contributions.

*	A
+	B
x	C
.	D(b)
X	G
o	H

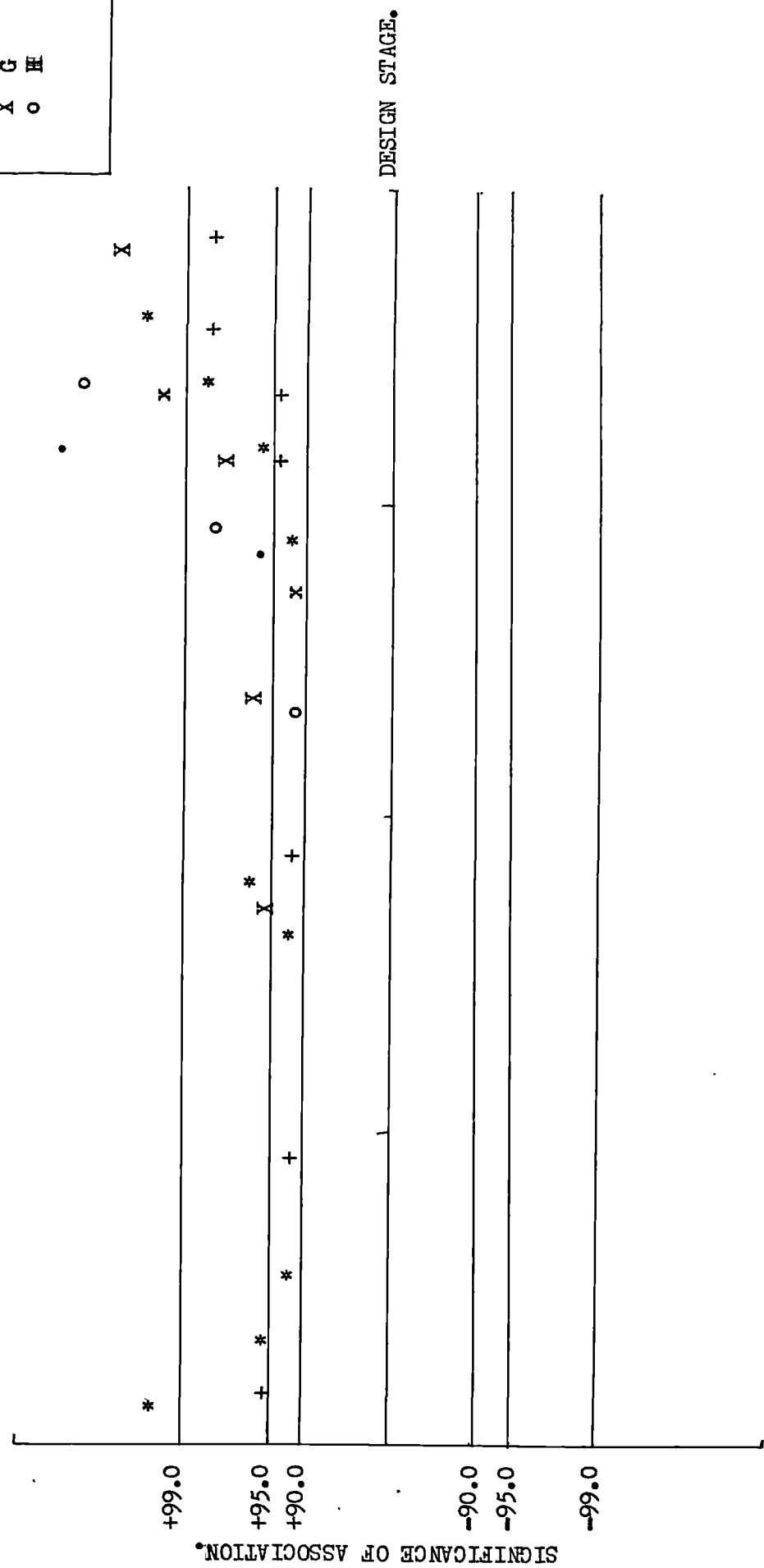
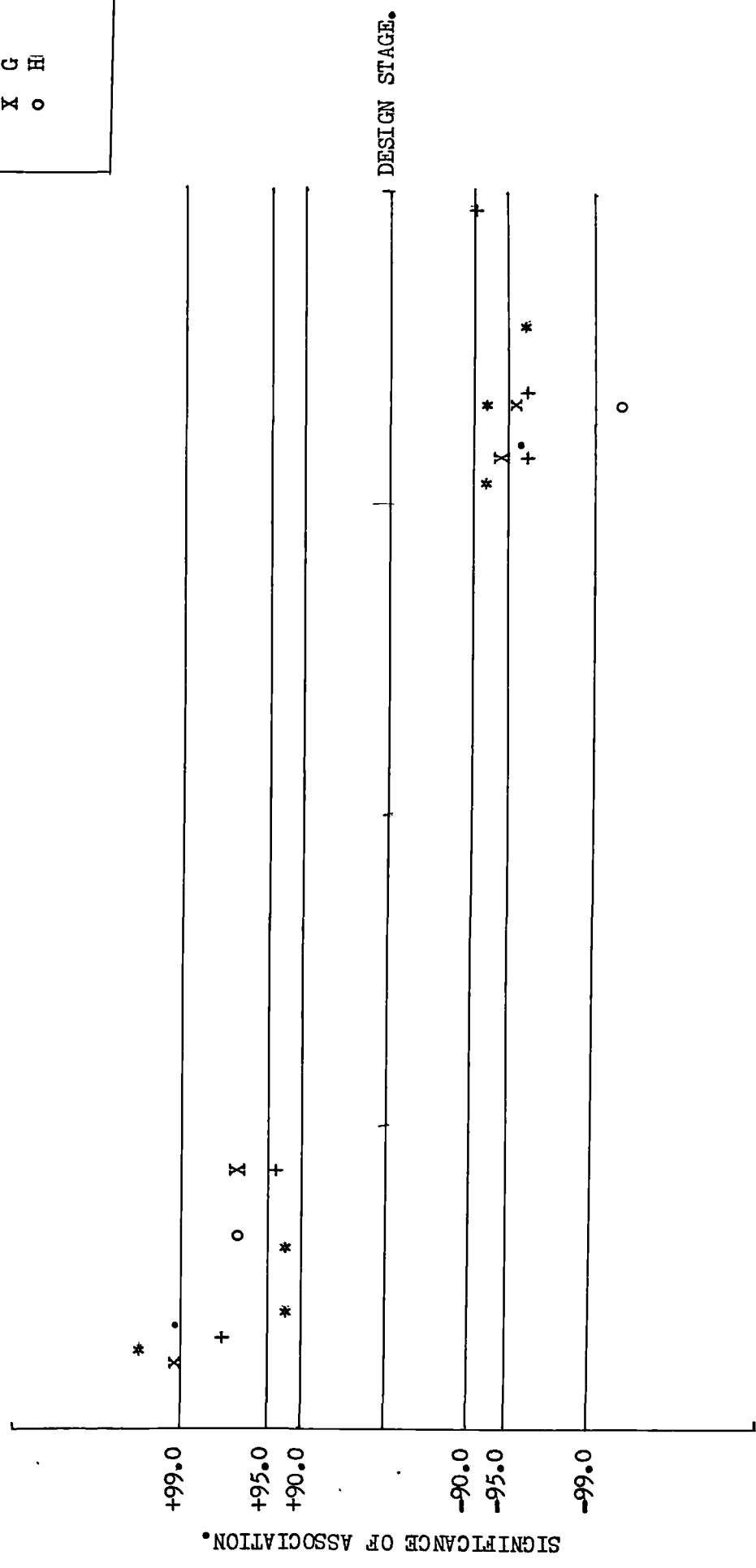


Figure 14(A). Variations in the significance of association between Brief and Design in Quantity Surveyor contributions.

*	A
+	B
x	C
•	D(b)
X	G
o	H



SIGNIFICANCE OF ASSOCIATION.

*	A
+	B
x	C
•	D(b)
x	G
o	H

Figure 14(C). Variations in the significance of association between Architect-produced reports and Design.

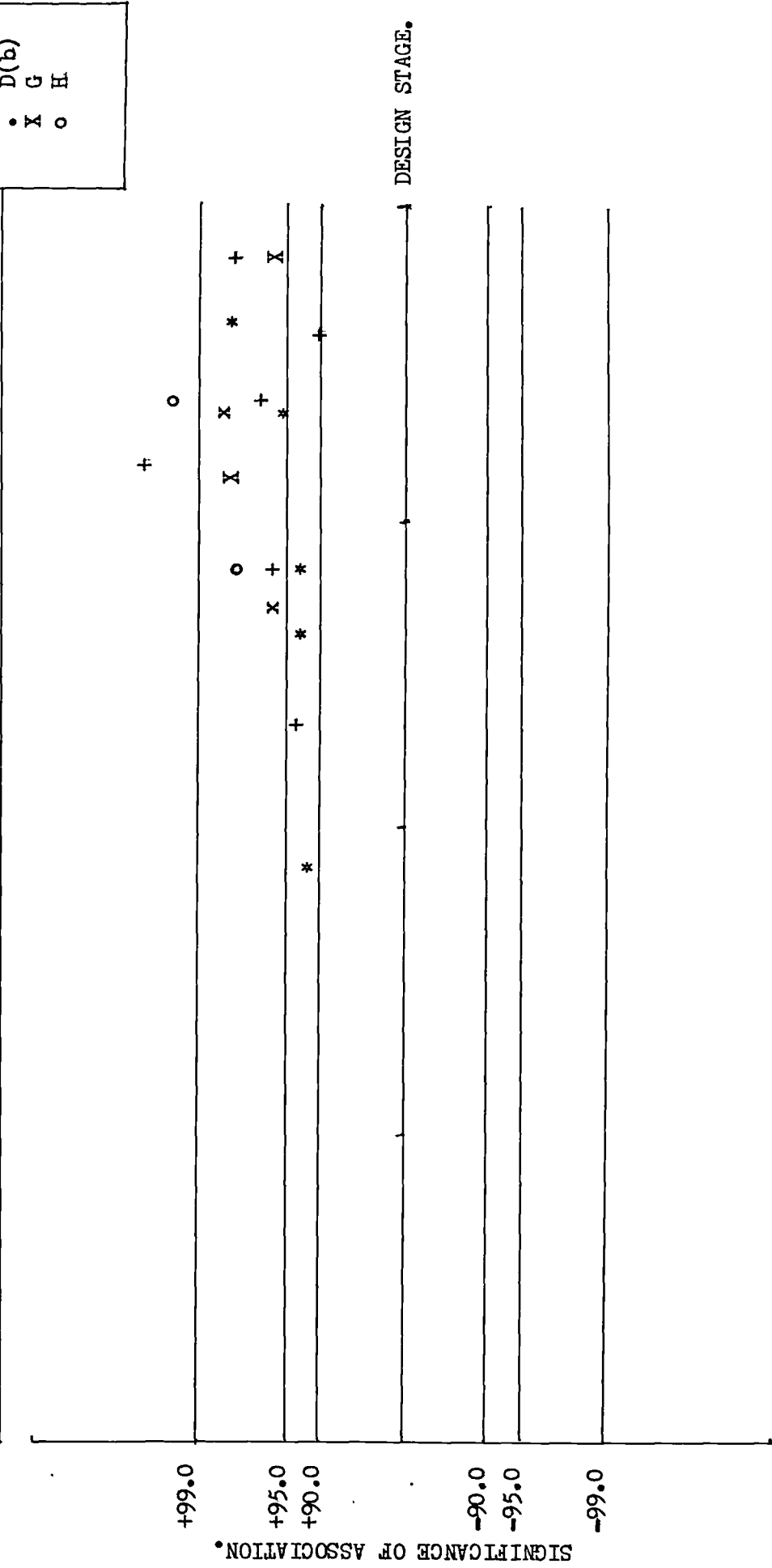
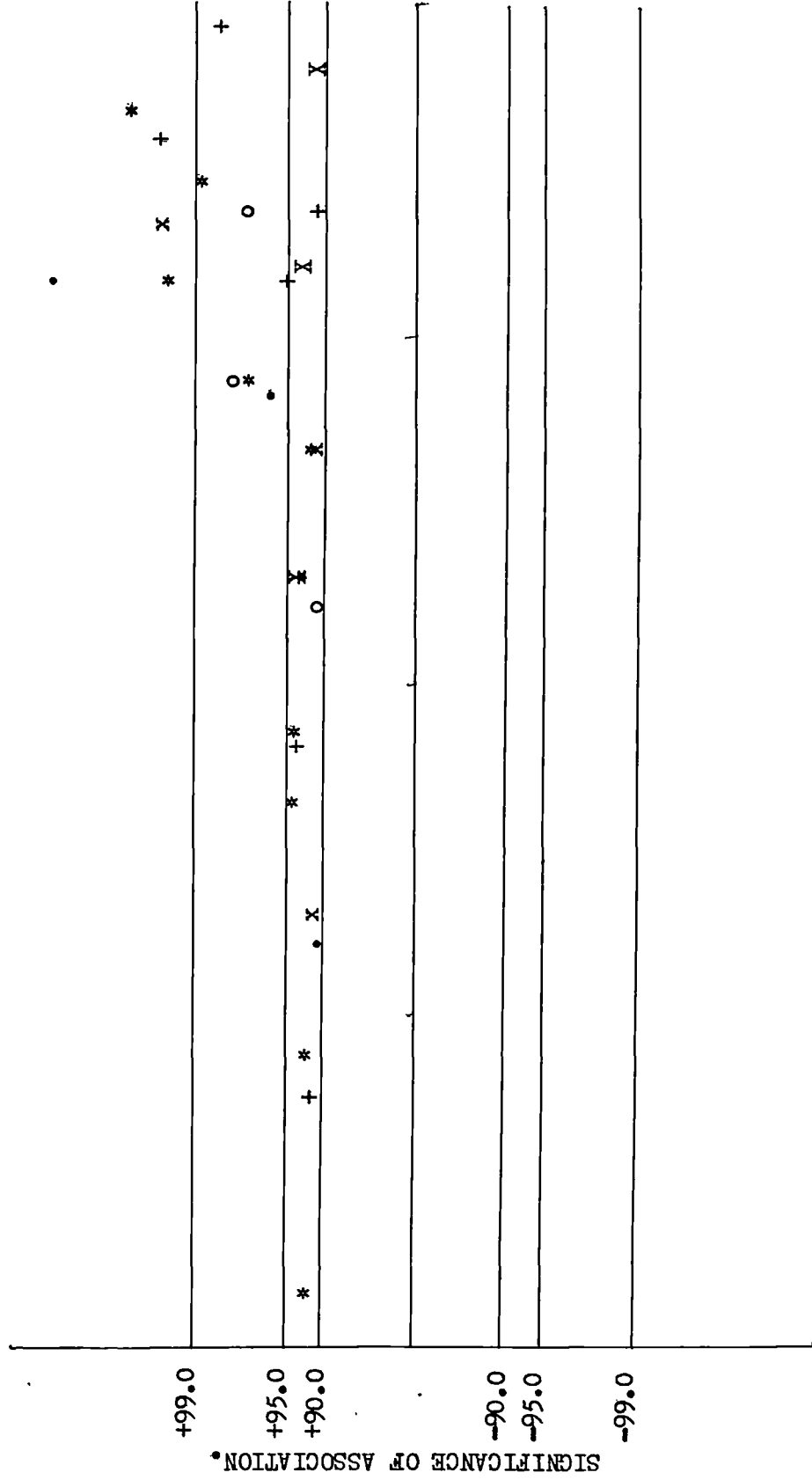


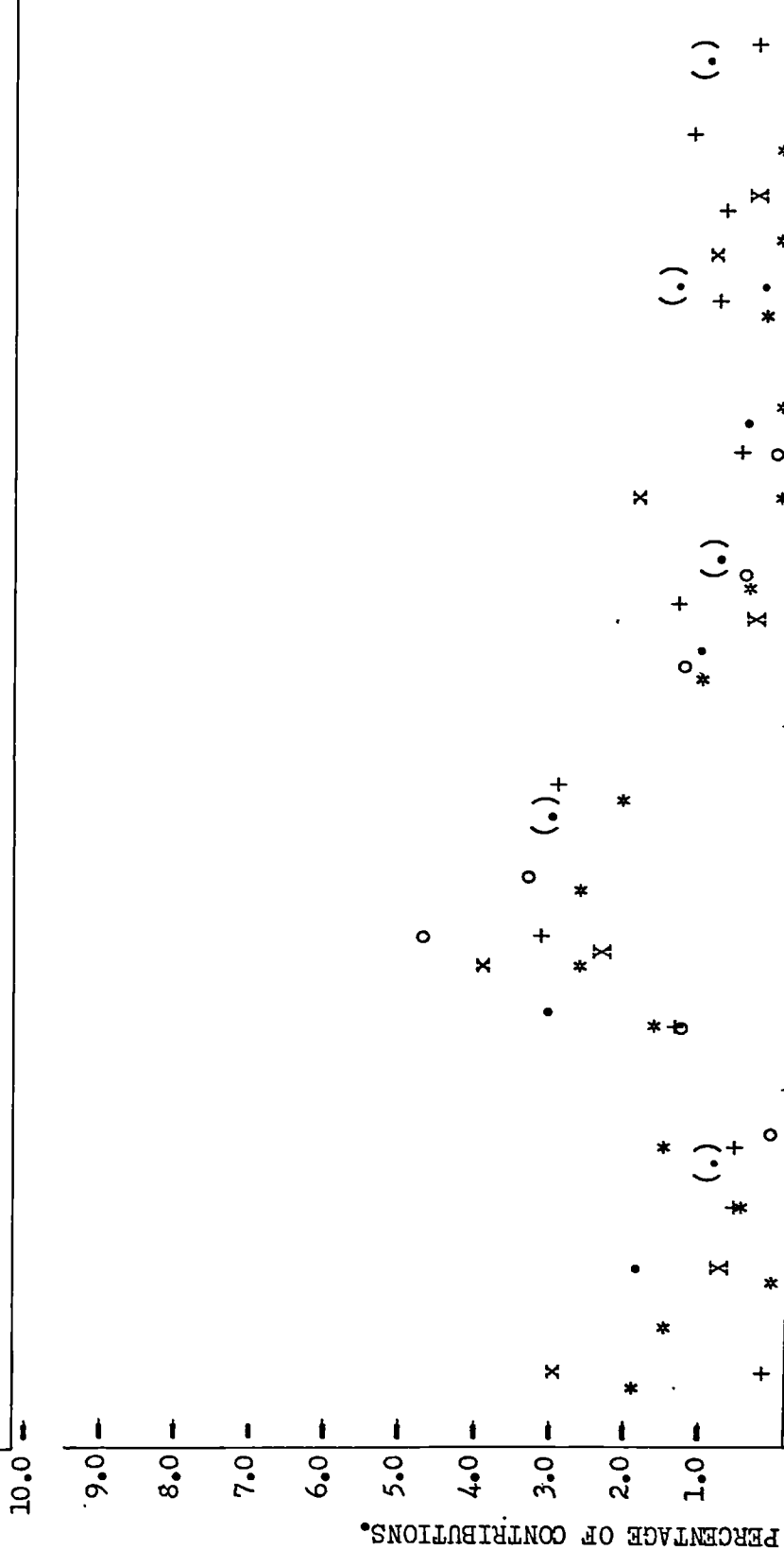
Figure 14(D). Variations in the significance of association between Architect and Design in Quantity Surveyor contributions.

*	A
+	B
x	C
o	D(b)
.	G
o	H



A
B
C
D(b)
D(c)
F
G

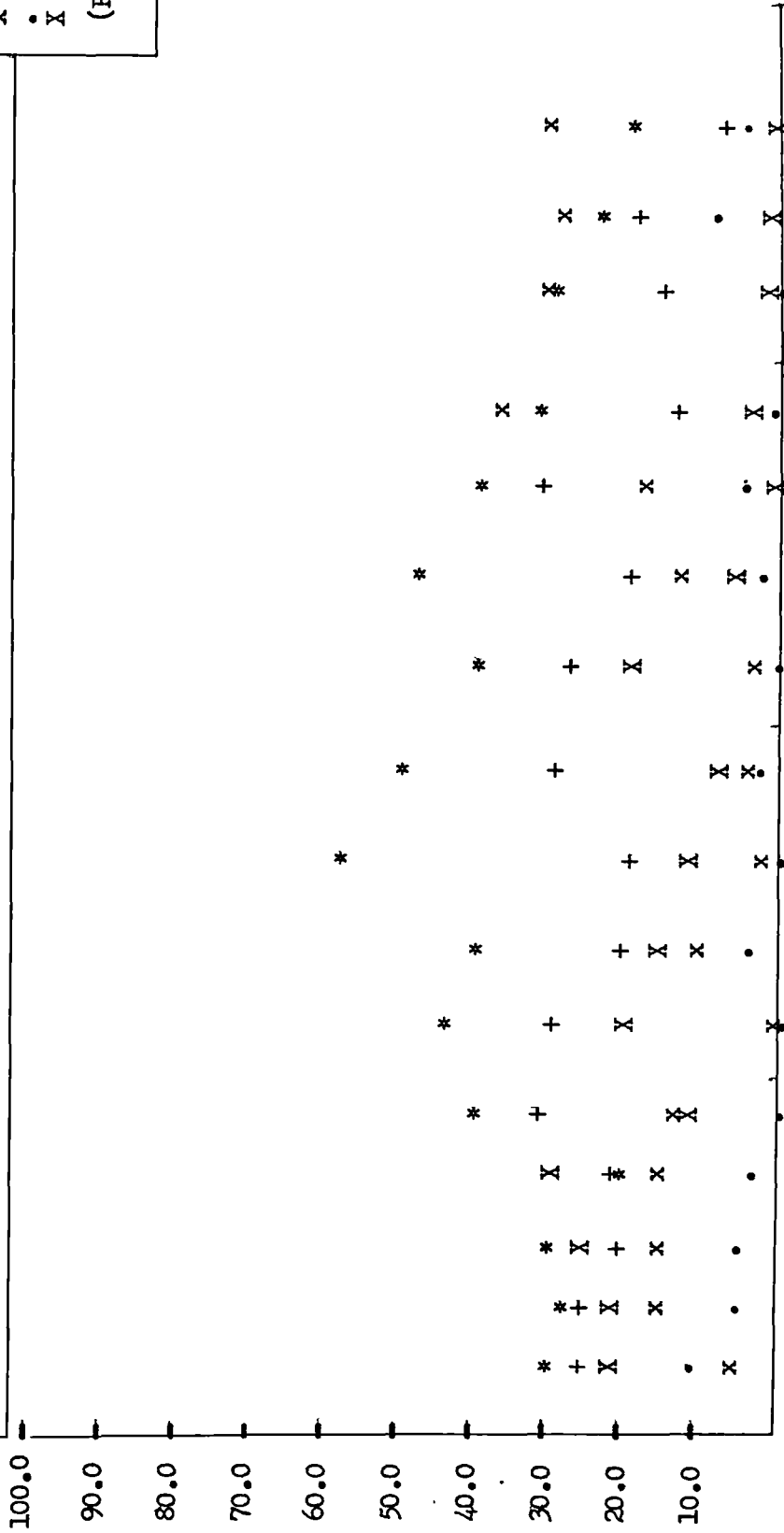
Figure 15. Proportion of references to previous designs in Architect contributions.



Outline Proposals. Scheme Design. Detailed Design. Production Information.
DESIGN STAGE.

Figure 16(A). Distribution of design consideration references made in conjunction with a reference to past experience in total design team contributions.

* MATERIALS.
 + MAINTAINANCE.
 x PRACTICALITY.
 • LIFESPAN.
 X AESTHETICS.
 (Project A)

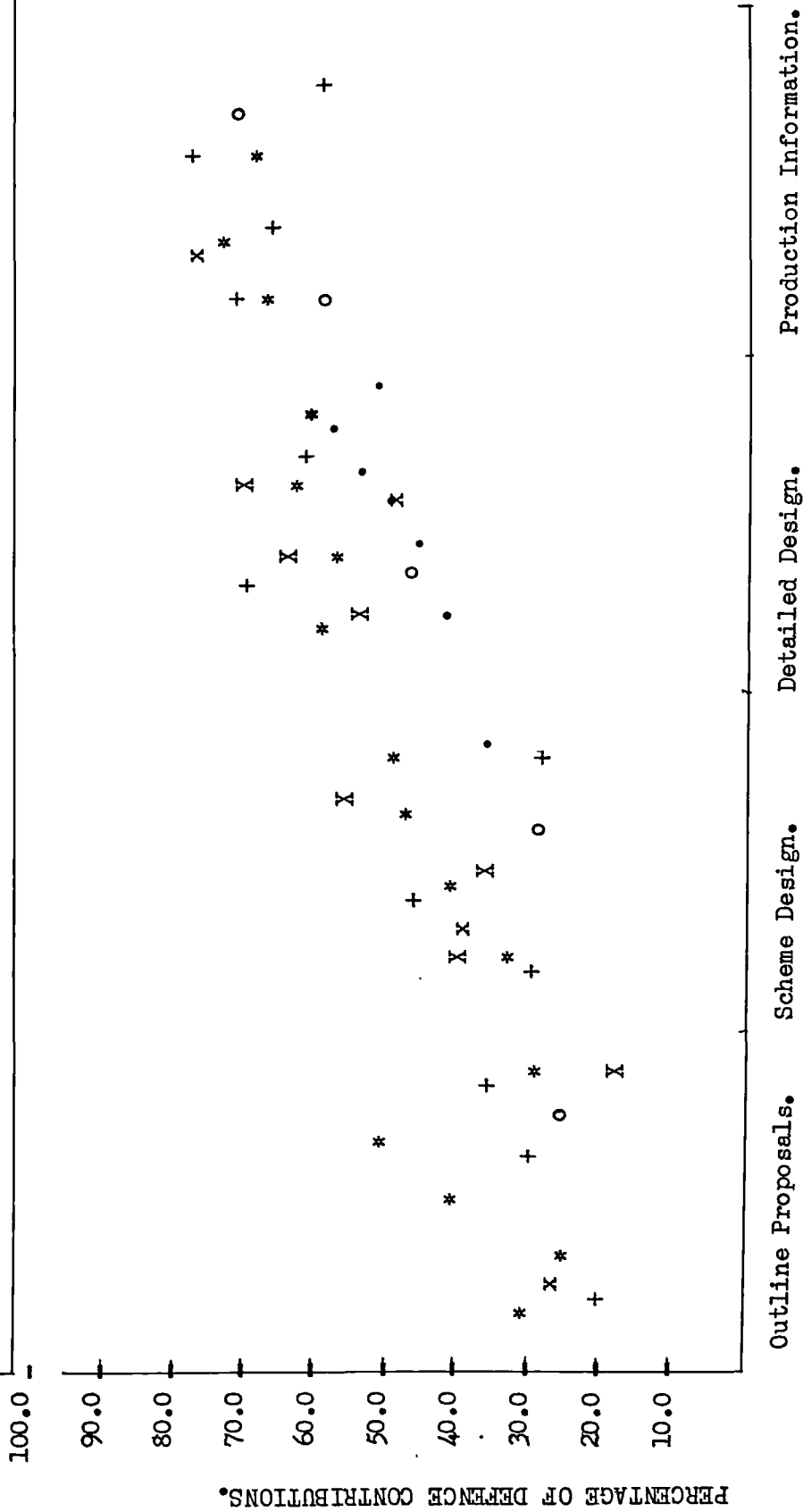


Outline Proposals. Scheme Design. Detailed Design. Production Information.
 DESIGN STAGE.

Figure 17. Proportion of references to previous designs in Architect defence contributions made in response to a Client Representative attack contribution.

A
B
C
E
F
G

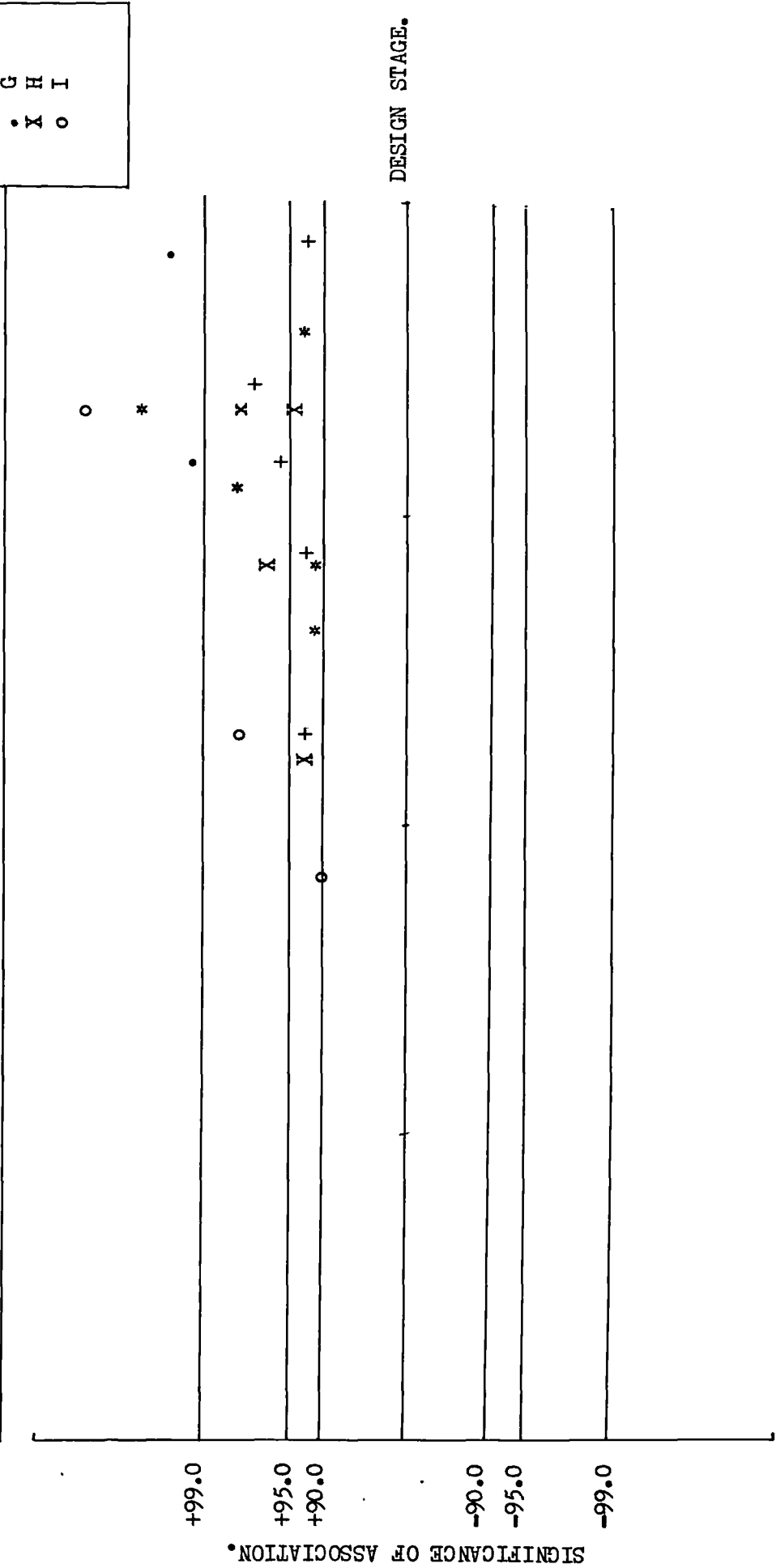
* + x • X O



Outline Proposals. Scheme Design. Detailed Design. Production Information.
DESIGN STAGE.

*	A
+	B
x	C
.	G
X	H
O	I

Figure 18. Variations in the significance of association between references to Previous Designs and expressions of Dissatisfaction in relation to the current Design in Architect contributions.

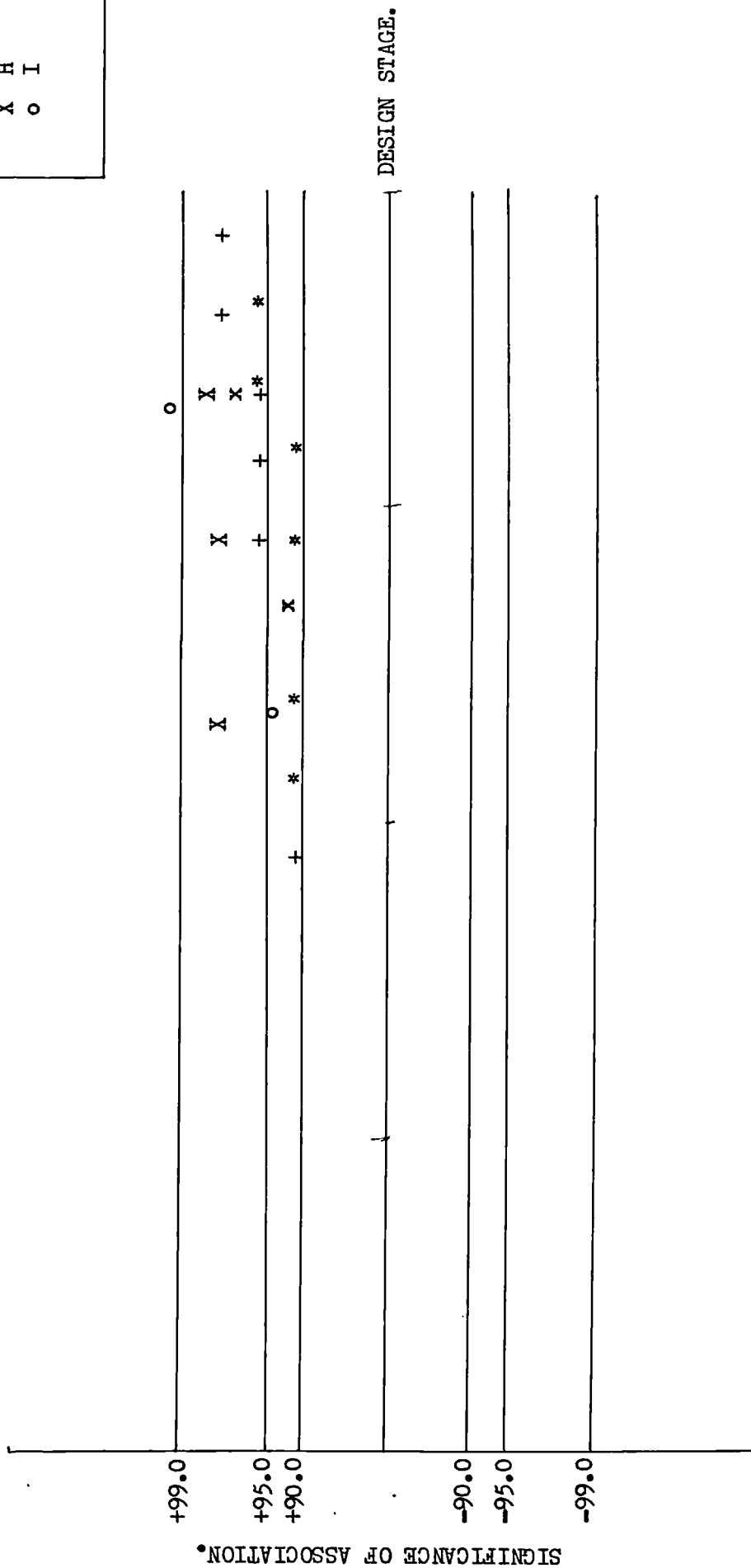


SIGNIFICANCE OF ASSOCIATION.

DESIGN STAGE.

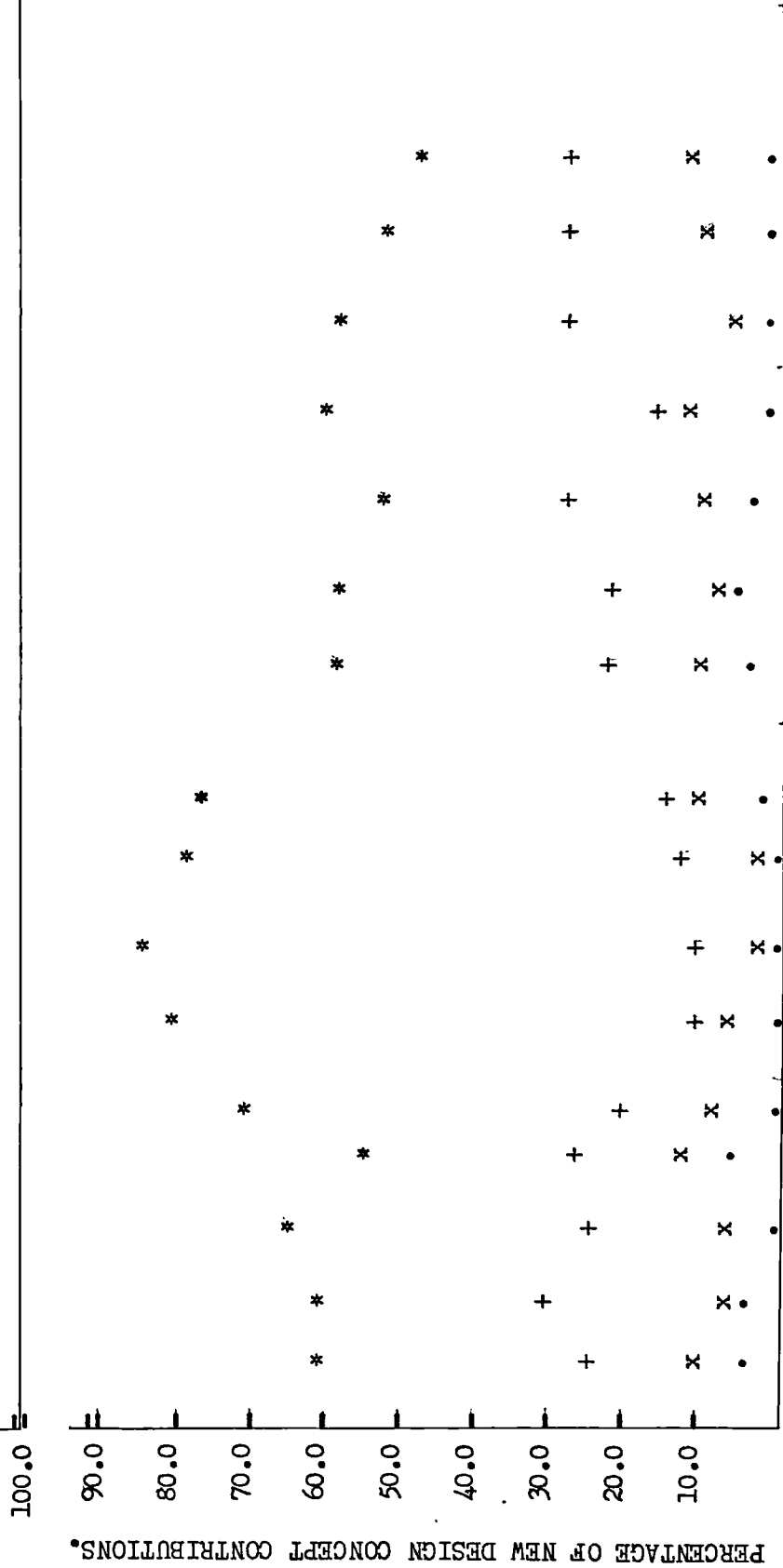
Figure 19. Variations in the significance of association between references to Previous Designs and references to Previously Agreed Current Design Goals.

*	A
+	B
x	C
.	G
X	H
o	I



* ARCHITECT
 + SURVEYOR
 x CLIENT
 . OTHERS

Figure 20(A). Distribution of new design concepts contributions by Design Team members in Project A.

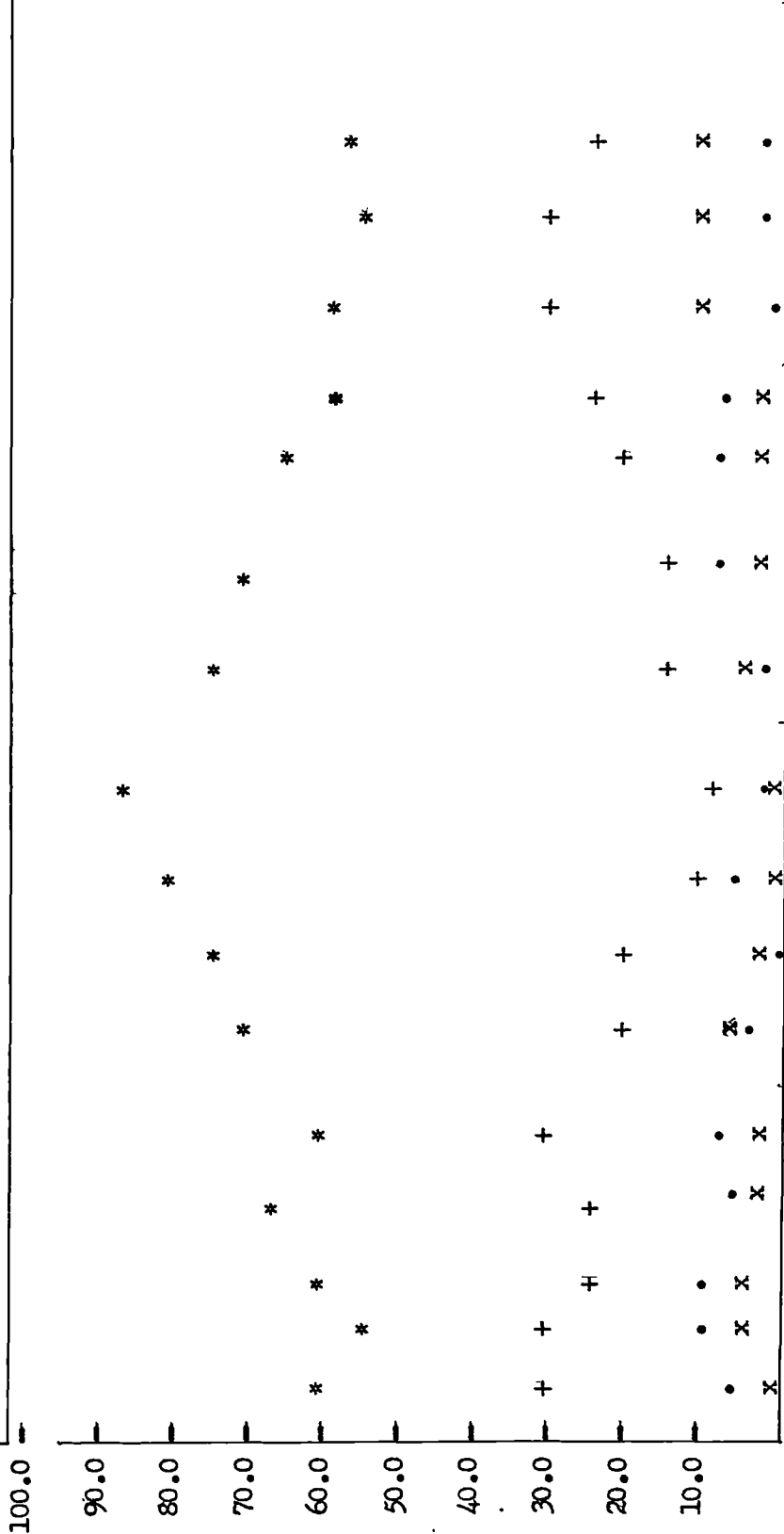


Outline Proposals. Scheme Design. Detailed Design. Production Information.
 DESIGN STAGE.

PERCENTAGE OF PREVIOUSLY UNDISCUSSED MATERIALS CONTRIBUTIONS.

* ARCHITECT
 + SURVEYOR
 x CLIENT
 • OTHERS

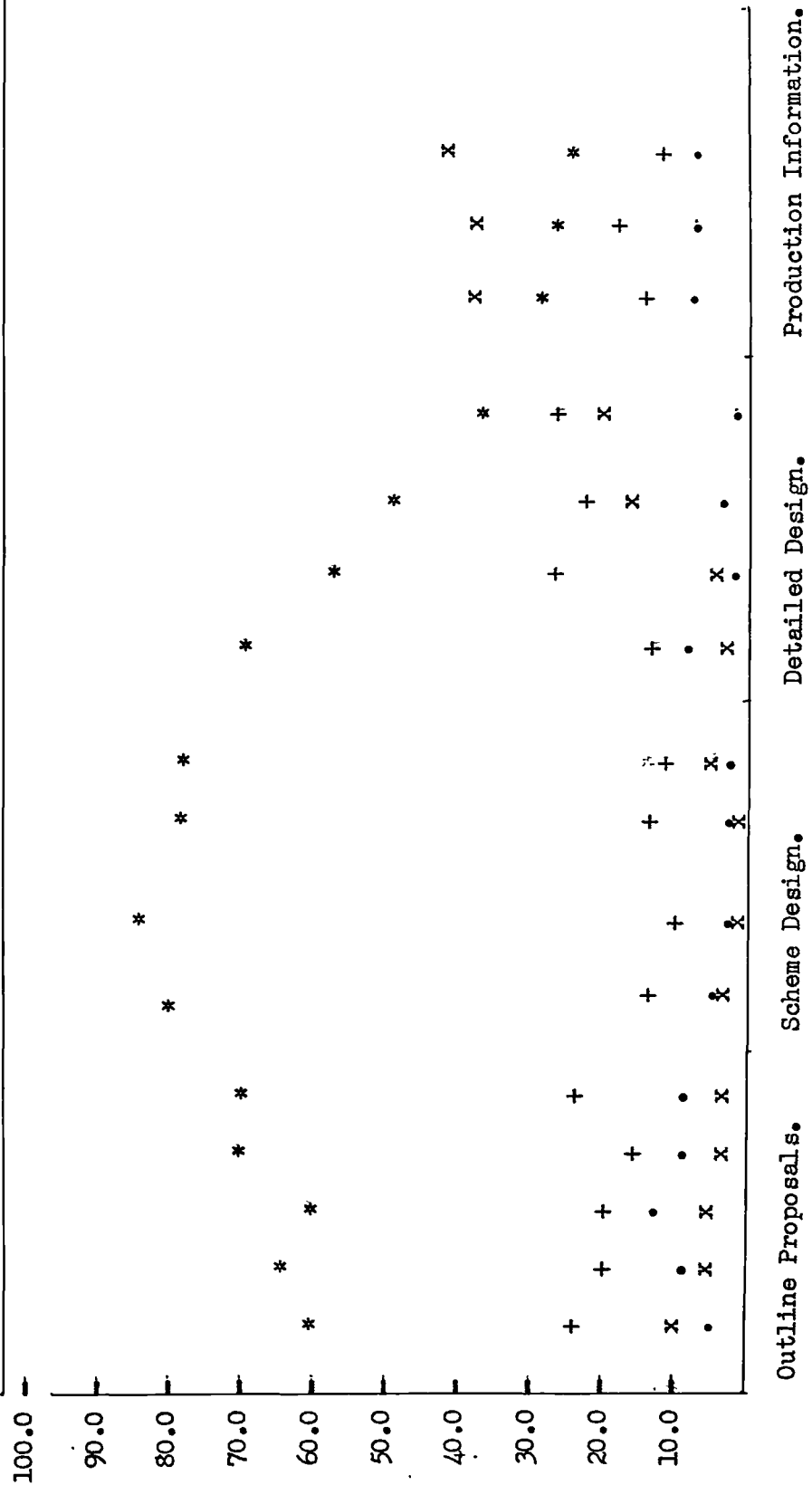
Figure 20(B). Distribution of previously undiscussed materials contributions by Design Team members in Project A.



Outline Proposals. Scheme Design. Detailed Design. Production Information.
 DESIGN STAGE.

* ARCHITECT
 + SURVEYOR
 x CLIENT
 • OTHERS

Figure 20(C). Distribution of suggested design courses of action contributions in Design Team members in Project A.



PERCENTAGE OF NEW DESIGN COURSE OF ACTION CONTRIBUTIONS.

PERCENTAGE OF NEW DESIGN CONCEPTS (AESTHETICS) CONTRIBUTIONS.

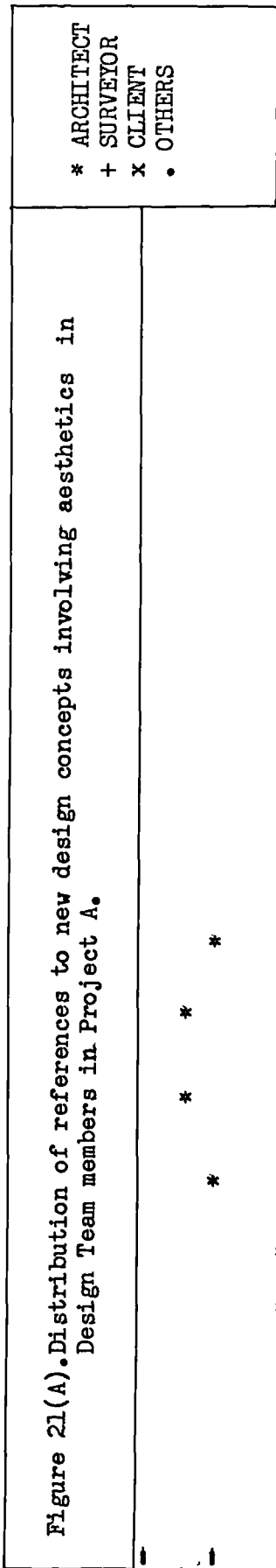
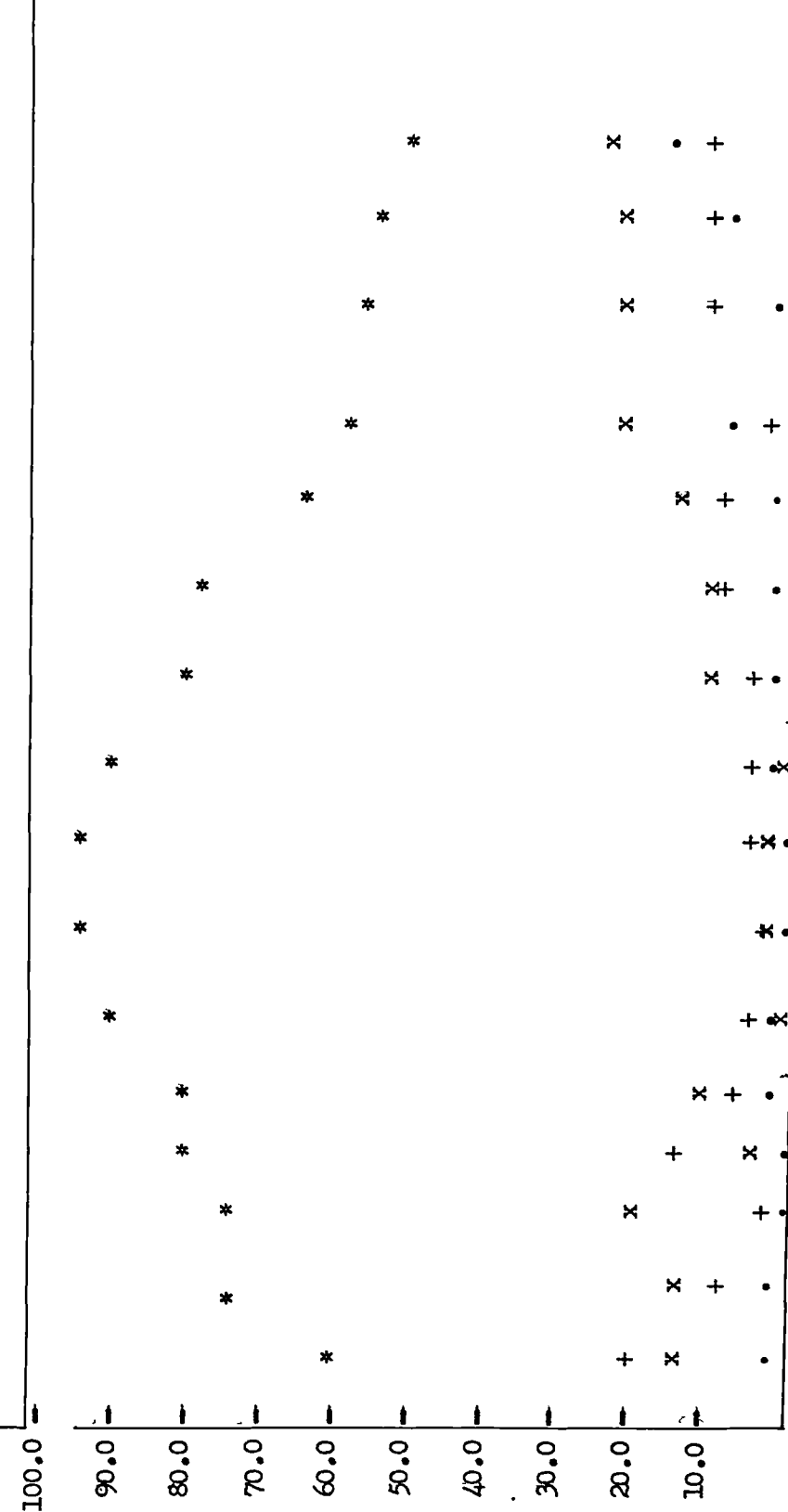


Figure 21(A). Distribution of references to new design concepts involving aesthetics in Design Team members in Project A.



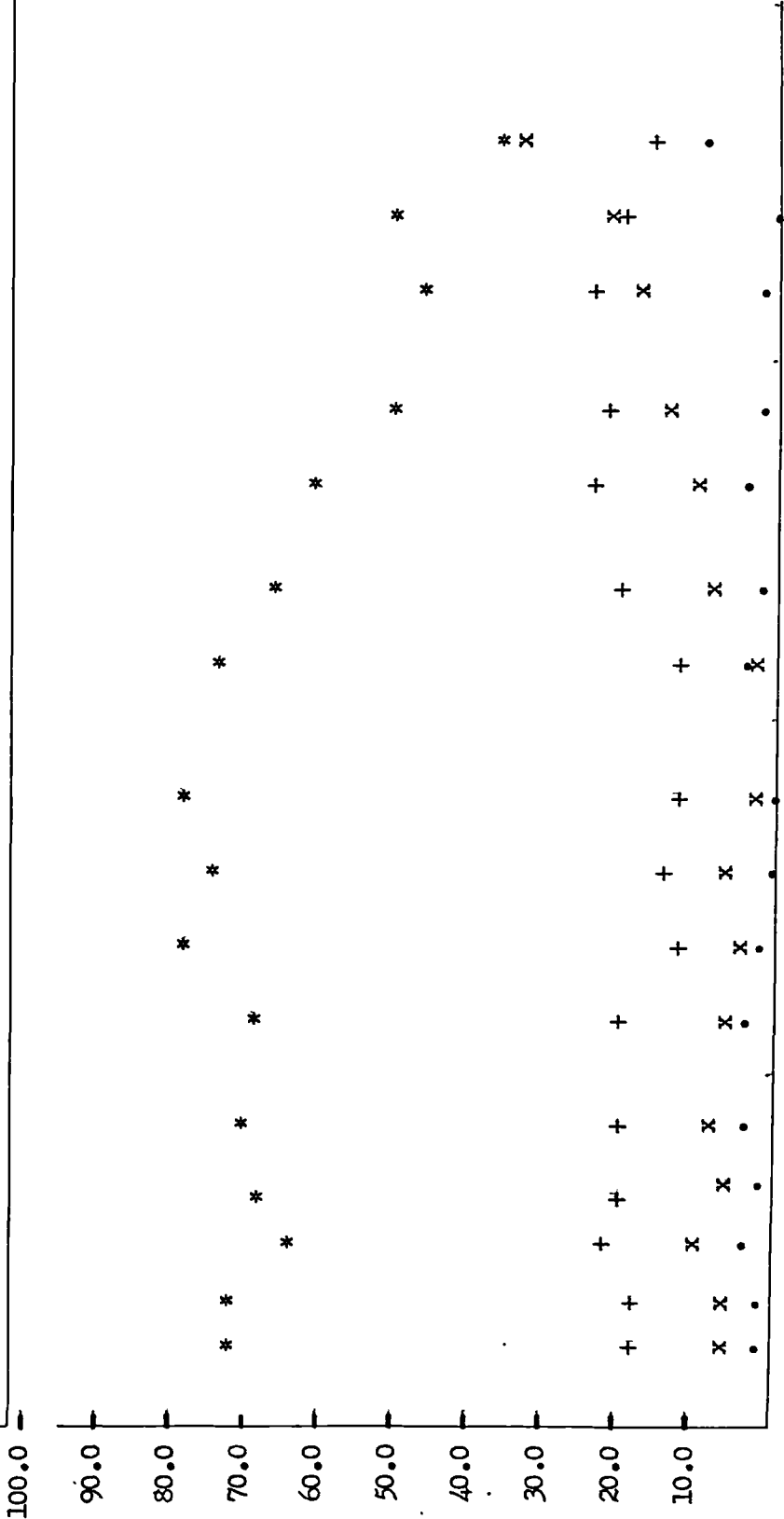
Outline Proposals. Scheme Design. Detailed Design. Production Information.
DESIGN STAGE.

* ARCHITECT
+ SURVEYOR
x CLIENT
• OTHERS

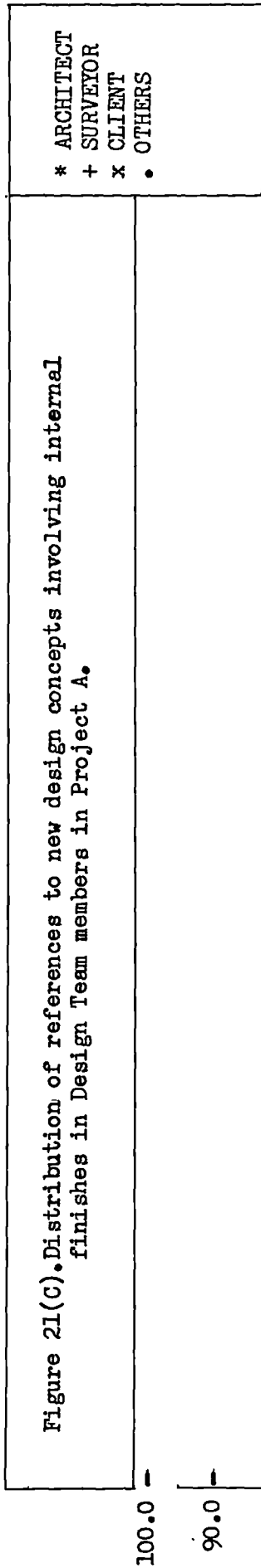
* ARCHITECT
 + SURVEYOR
 x CLIENT
 • OTHERS

Figure 21(B). Distribution of references to new design concepts involving the allocation of room layouts in Design Team members in Project A.

PERCENTAGE OF NEW DESIGN CONCEPT (LAYOUTS) CONTRIBUTIONS.



Outline Proposals. Scheme Design. Detailed Design. Production Information.
 DESIGN STAGE.



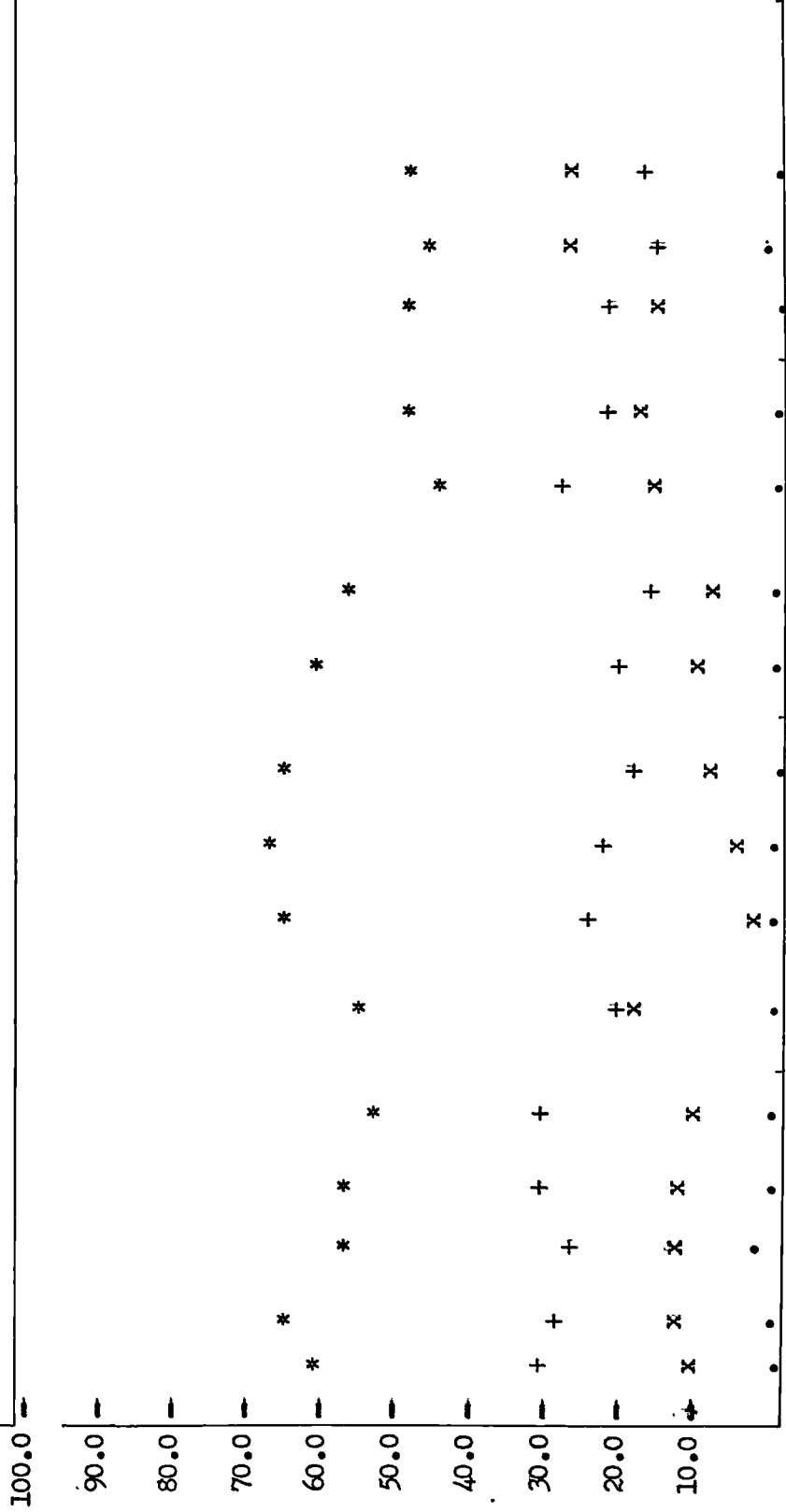
Outline Proposals. Scheme Design. Detailed Design. Production Information.

DESIGN STAGE.

PERCENTAGE OF NEW DESIGN CONCEPTS (CLADDING) CONTRIBUTIONS.

* ARCHITECT
 + SURVEYOR
 x CLIENT
 • OTHERS

Figure 21(D). Distribution of references to new design concepts involving cladding materials in Design Team members in Project A.

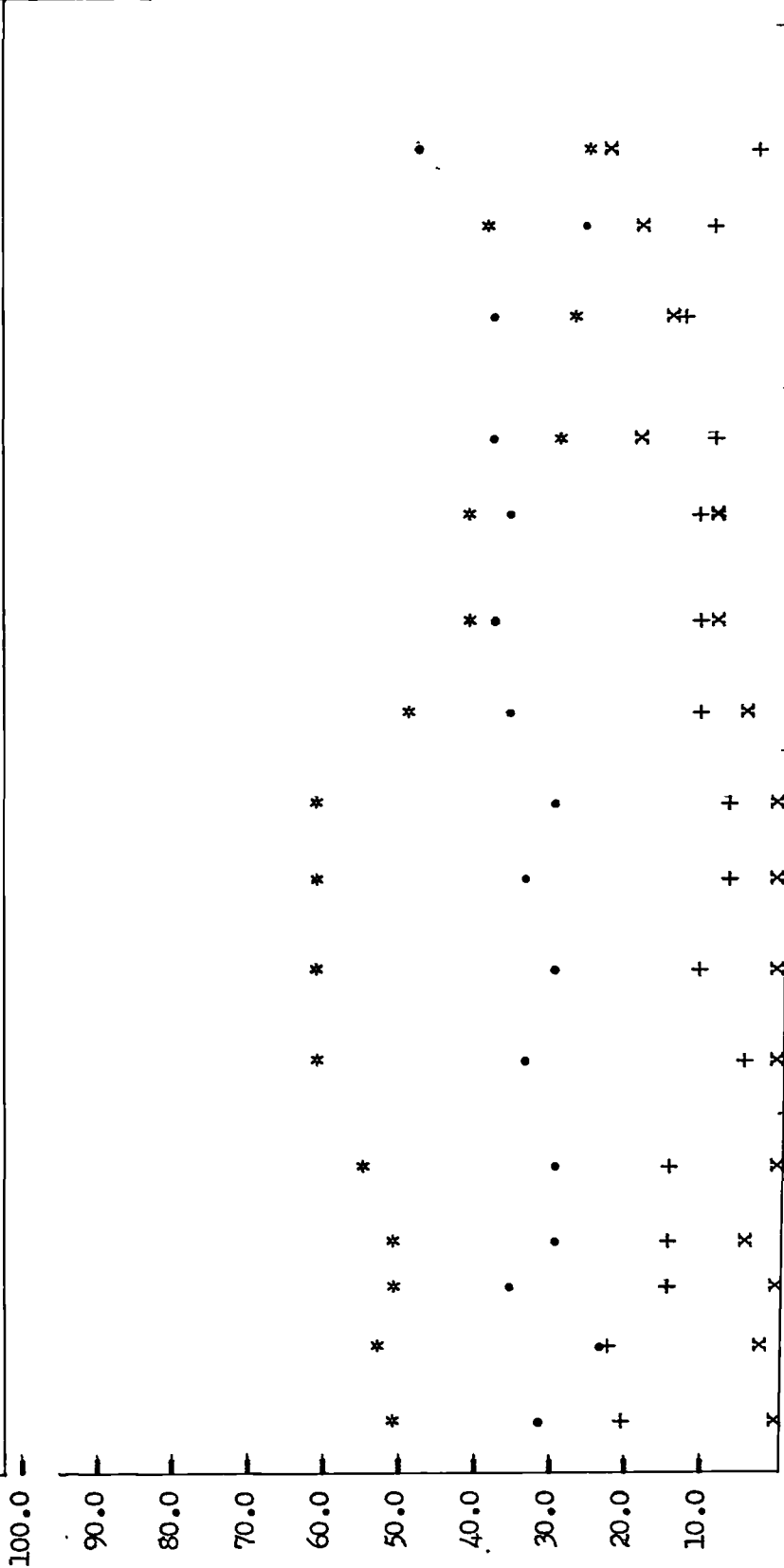


Outline Proposals. Scheme Design. Detailed Design. Production Information.
 DESIGN STAGE.

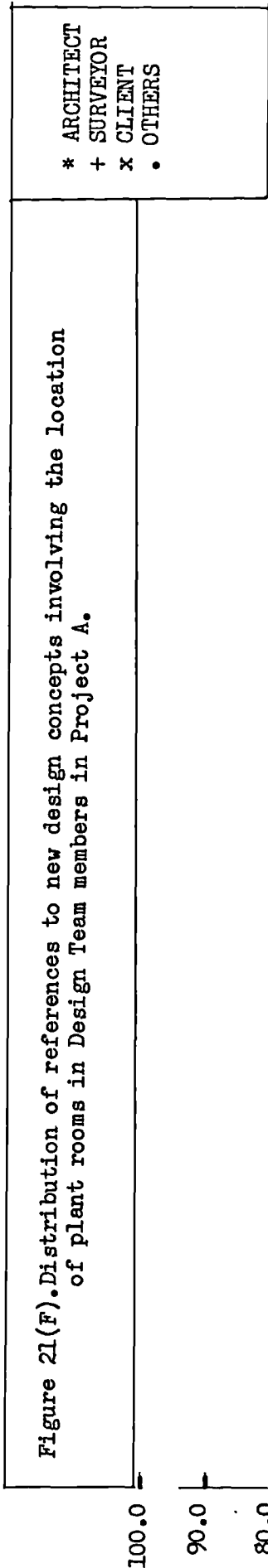
* ARCHITECT
 + SURVEYOR
 x CLIENT
 • OTHERS

Figure 21(E). Distribution of references to new design concepts involving services in Design Team members in Project A.

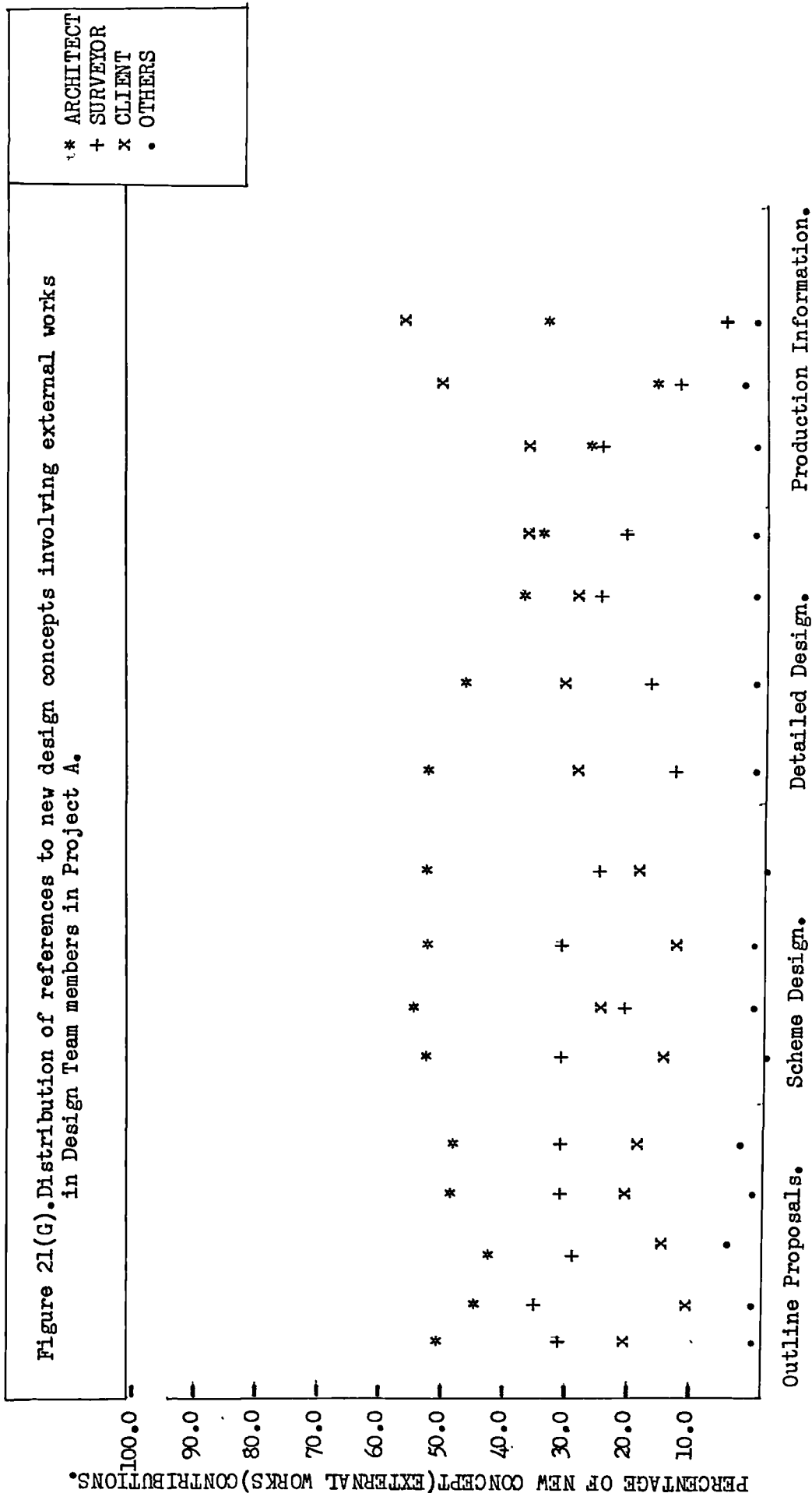
PERCENTAGE OF NEW DESIGN CONCEPTS(SERVICES) CONTRIBUTIONS.



Outline Proposals. Scheme Design. Detailed Design. Production Information.
 DESIGN STAGE.



Outline Proposals. Scheme Design. Detailed Design. Production Information.
 DESIGN STAGE.

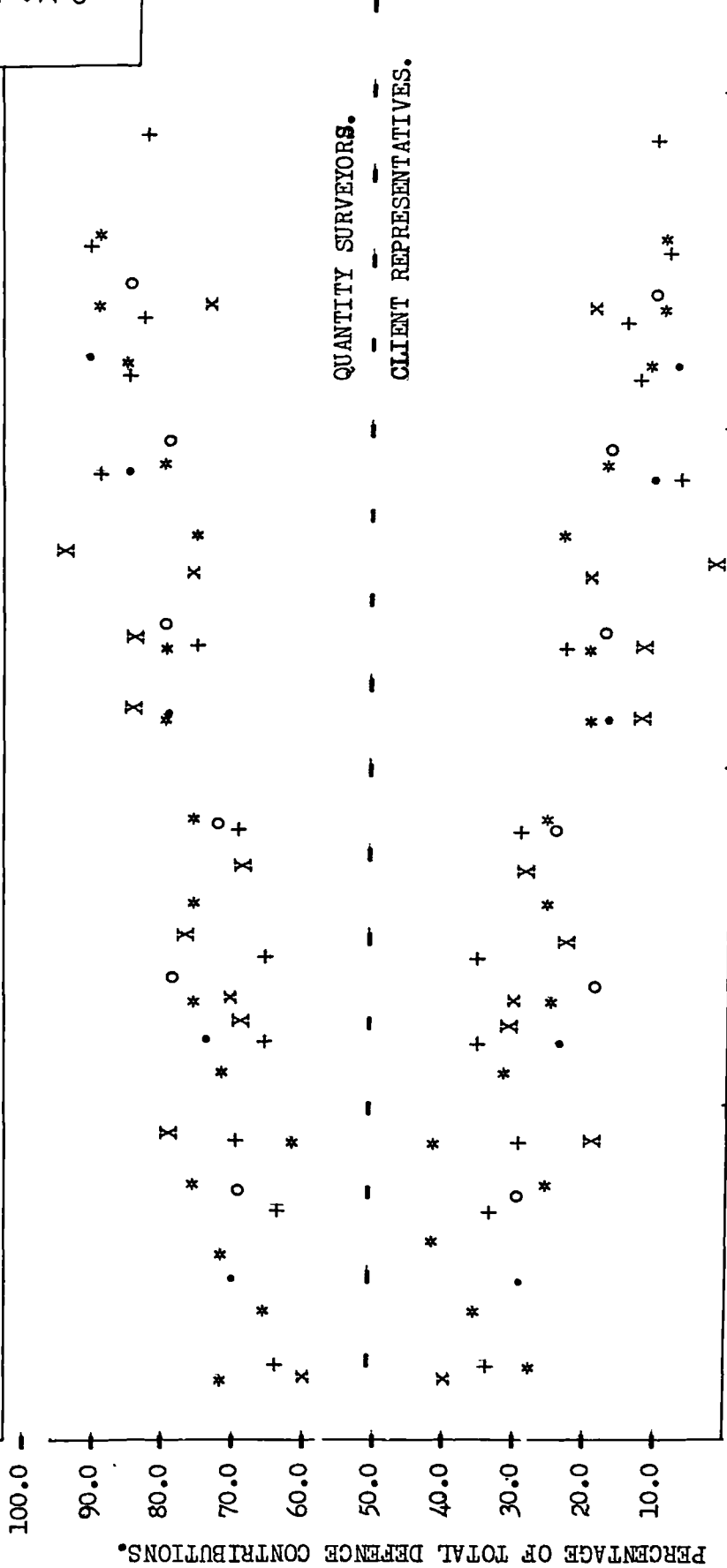


DESIGN STAGE.

Figure 22. Distribution of defences to new design concepts contributions made by the Architect in Quantity Surveyor and Client contributions.

A
B
C
D(b)
F
H

*
+
x
•
X
o

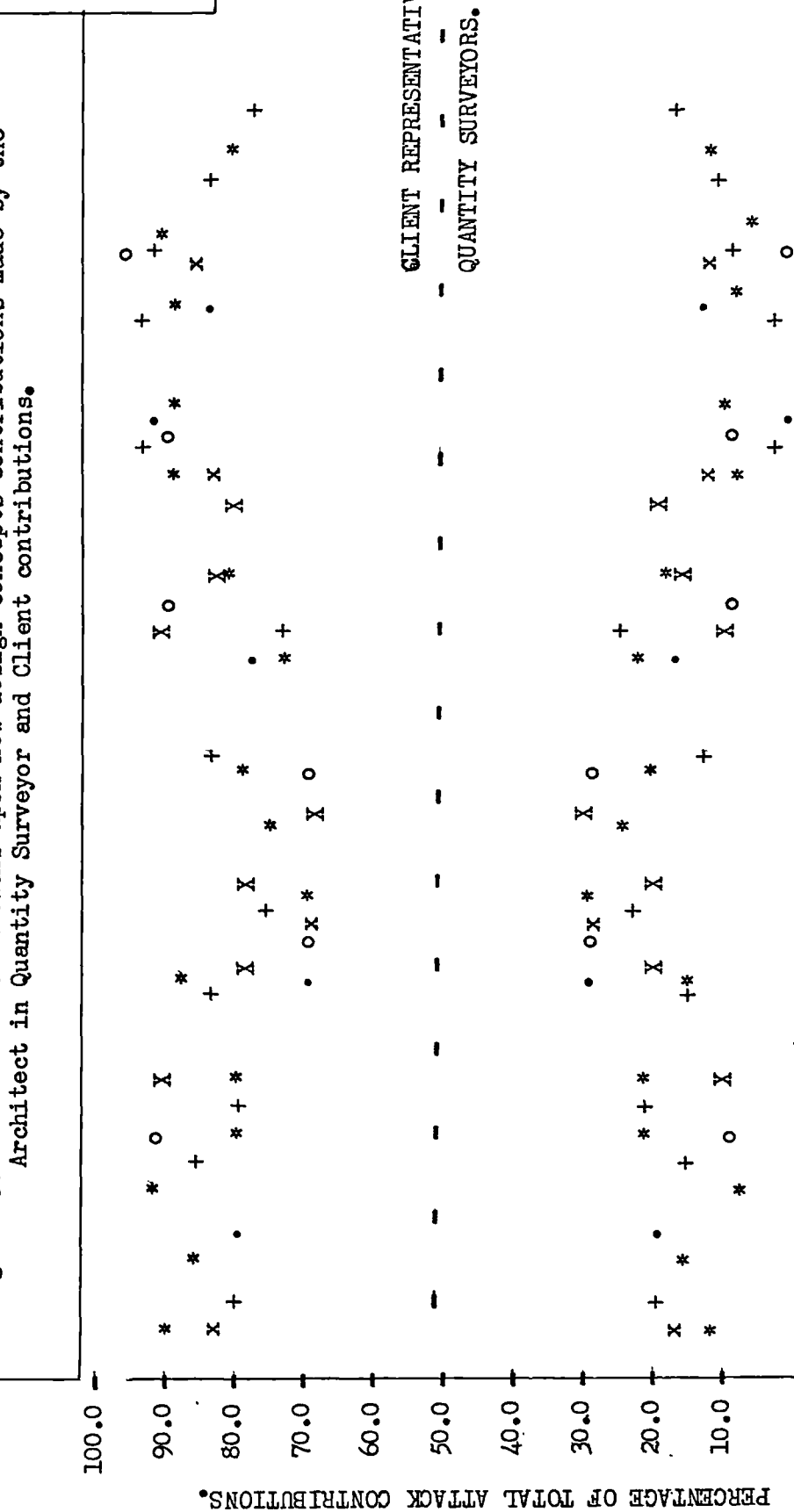


Outline Proposals. Scheme Design. Detailed Design. Production Information.

DESIGN STAGE.

Figure 23. Distribution of attacks upon new design concepts contributions made by the Architect in Quantity Surveyor and Client contributions.

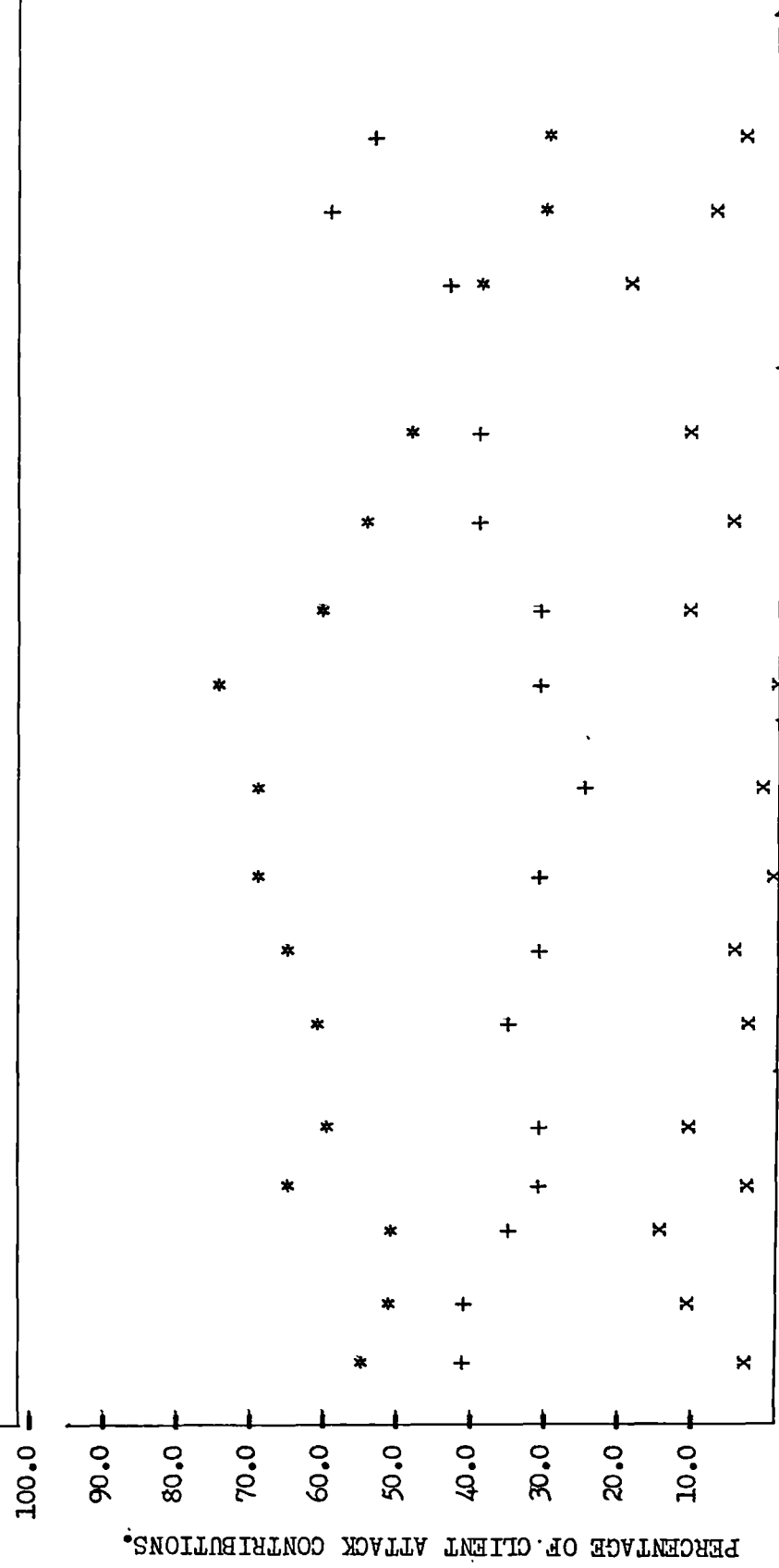
A
B
C
D(b)
F
H



Outline Proposals. Scheme Design. Detailed Design. Production Information.
DESIGN STAGE.

* MAINTAINANCE
 + INITIAL COST
 x OTHERS

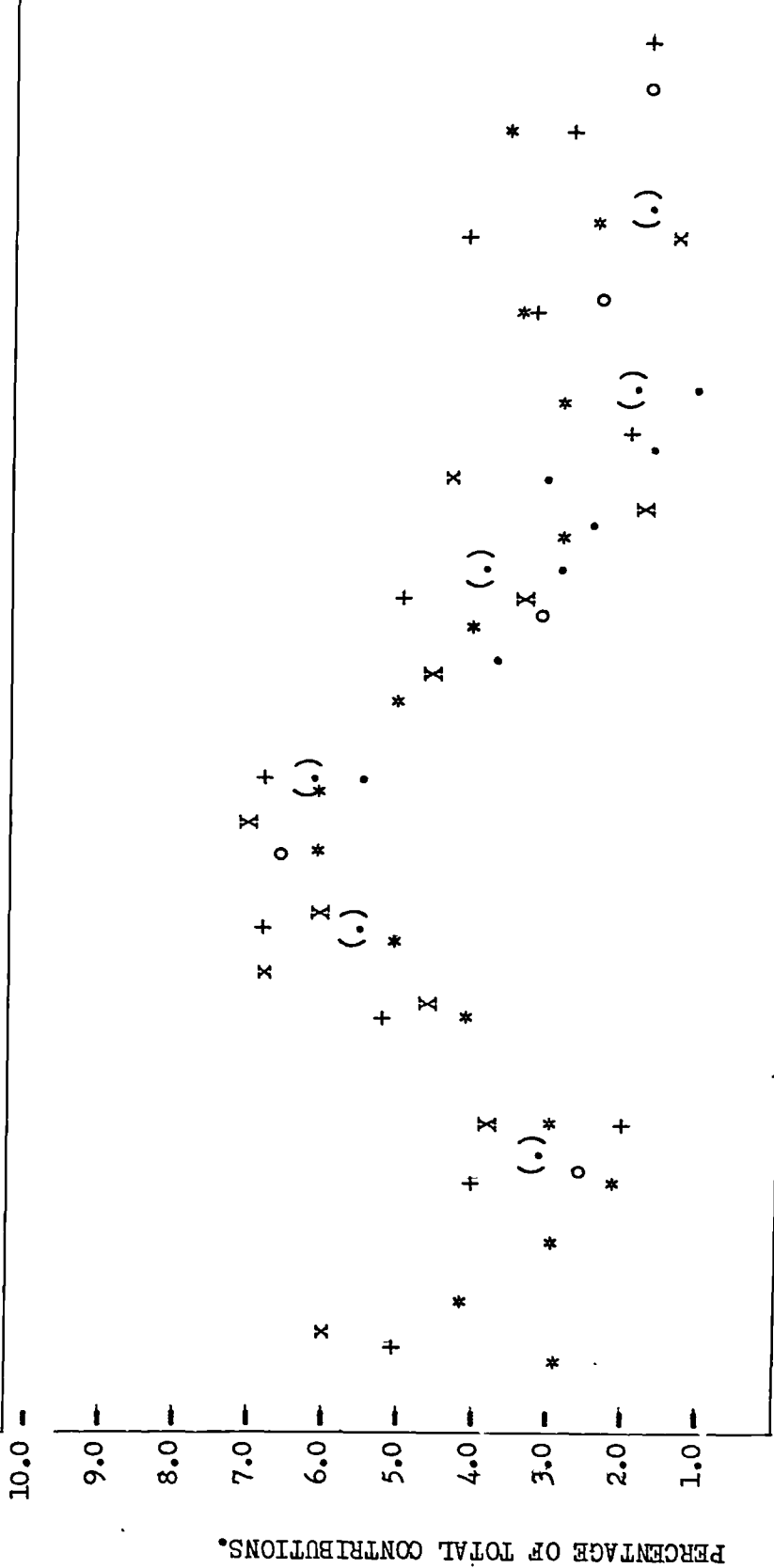
Figure 24. Distribution of attack bases in Client attack contributions against new design concepts contributions made by the Architect in Project A.



Outline Proposals. Scheme Design. Detailed Design. Production Information.
 DESIGN STAGE.

Figure 25. Proportion of references to new design concepts in Architect contributions.

*	A
+	B
x	C
•	E
X	F
o	G
(.)	H

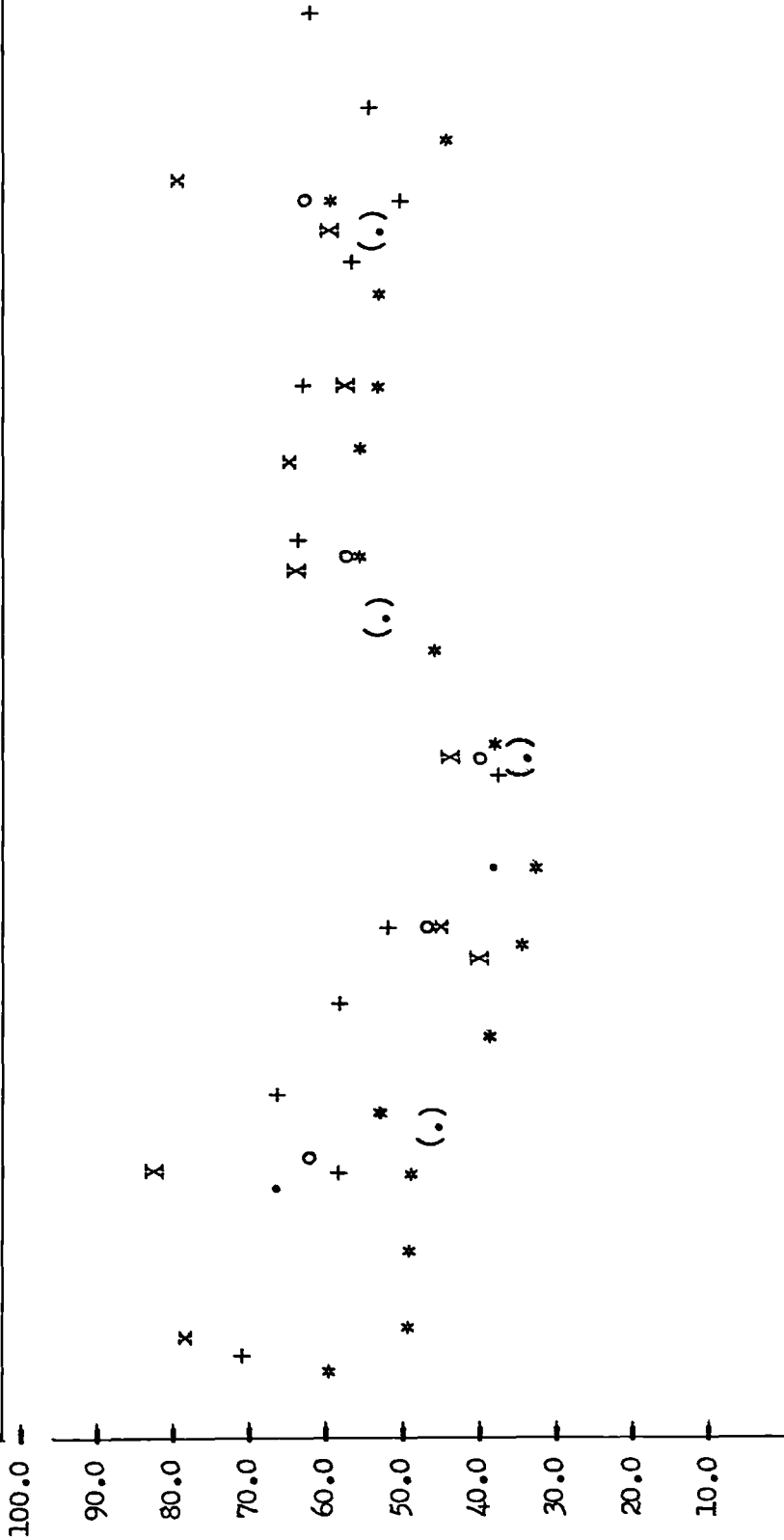


Outline Proposals. Schem Design. Detailed Design. Production Information.

DESIGN STAGE.

Figure 26. Proportion of Architect defence contributions based upon similarities to a previously agreed design goal, issued in defence of a suggested new design concept, in response to a Client attack contribution.

* A
+ B
x C
• D(a)
X H
O I
(.) J



Outline Proposals. Scheme Design. Detailed Design. Production Information.
DESIGN STAGE.

Figure 27. Variations in the significance of association between Aesthetics and Design in Architect contributions.

* A
 + B
 x C
 • D(b)
 X G
 O H
 (•) I

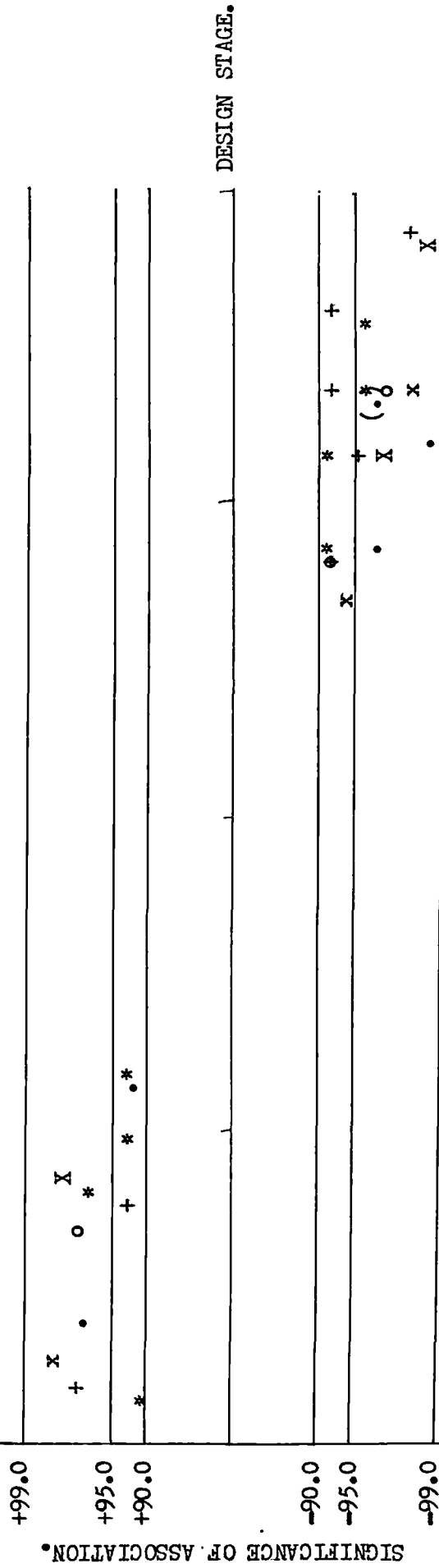
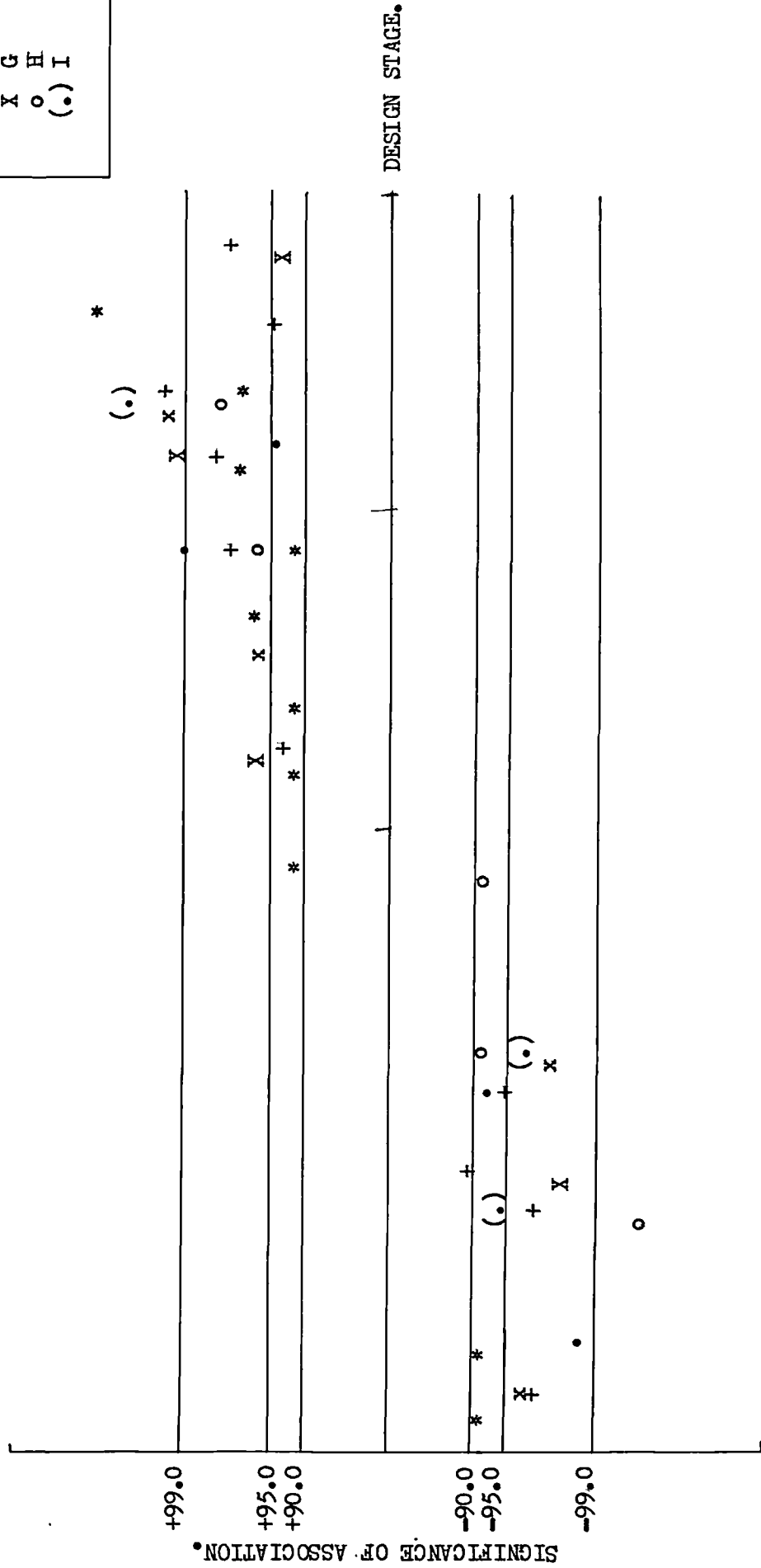


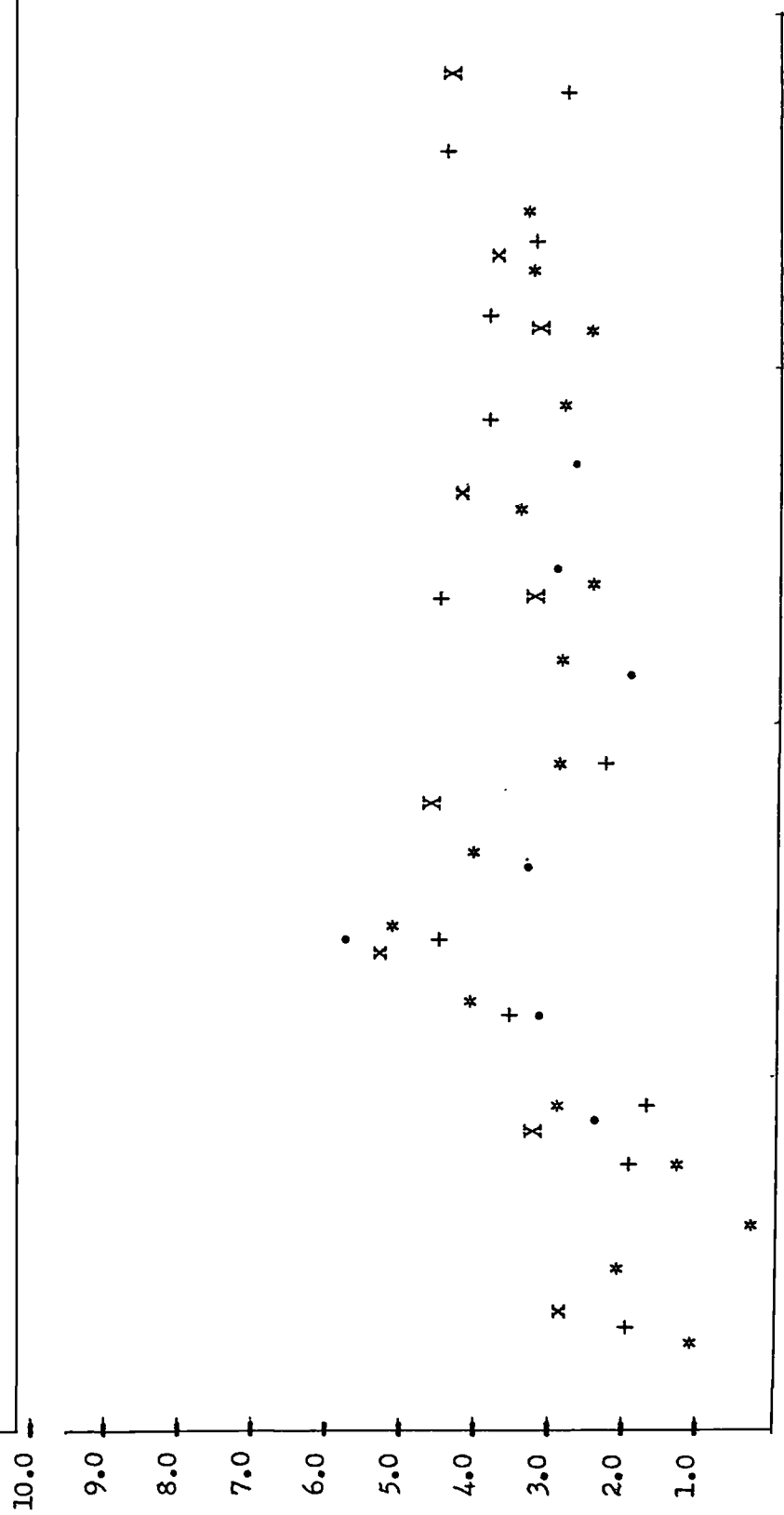
Figure 28. Variations in the significance of association between Cost and Design in Architect Contributions.

*	A
+	B
x	C
•	D(b)
o	G
(.)	H
	I



A	B	C	F	G
*	+	x	•	X

Figure 29. Proportion of attacks upon all aesthetic contributions made by the Architect by all Design Team members.



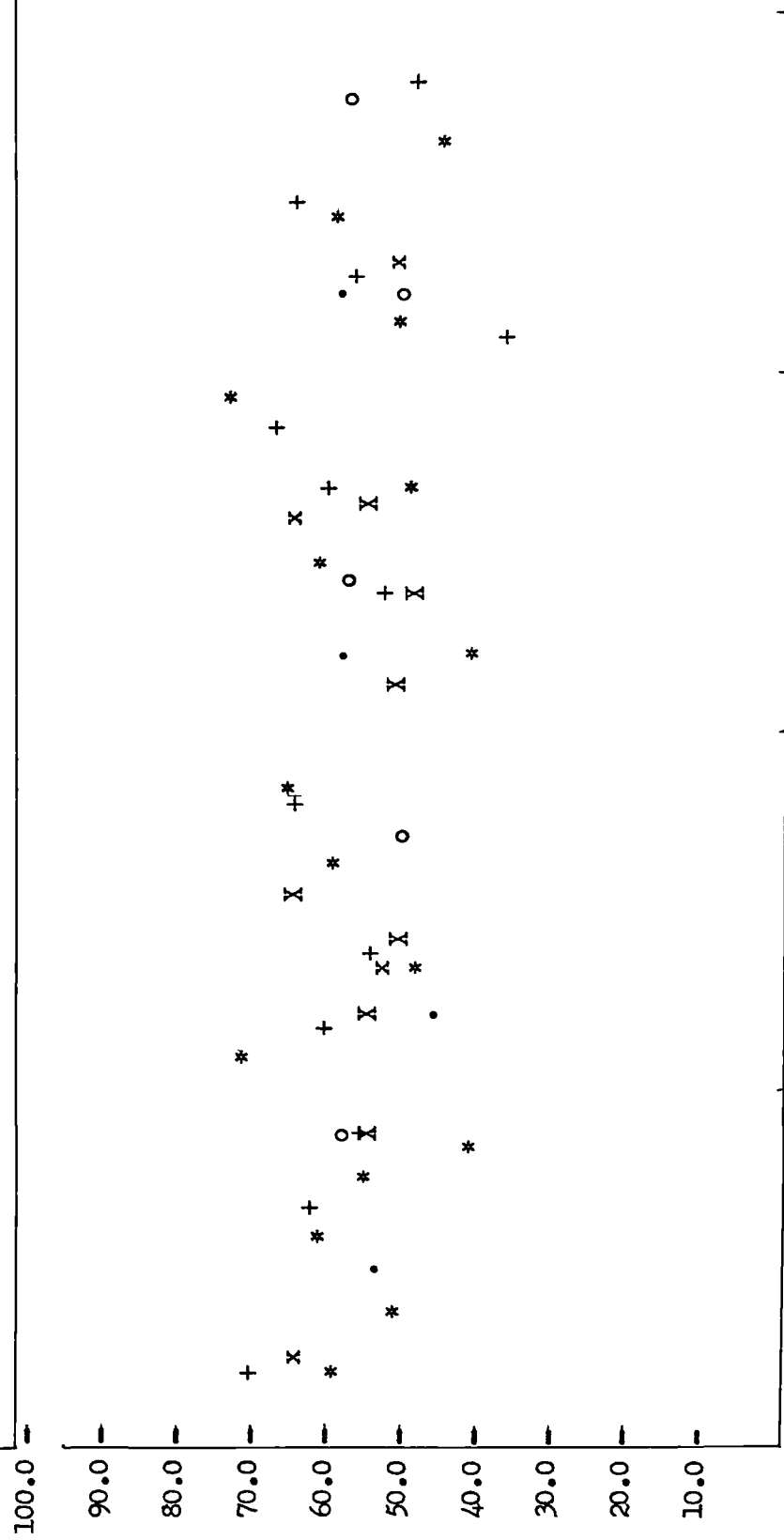
Outline Proposals. Scheme Design. Detailed Design. Production Information.

DESIGN STAGE.

A
B
C
D(b)
F
G

*
+
x
•
X
o

Figure 30. Proportion of attacks upon aesthetics based Architect contributions based upon costs.

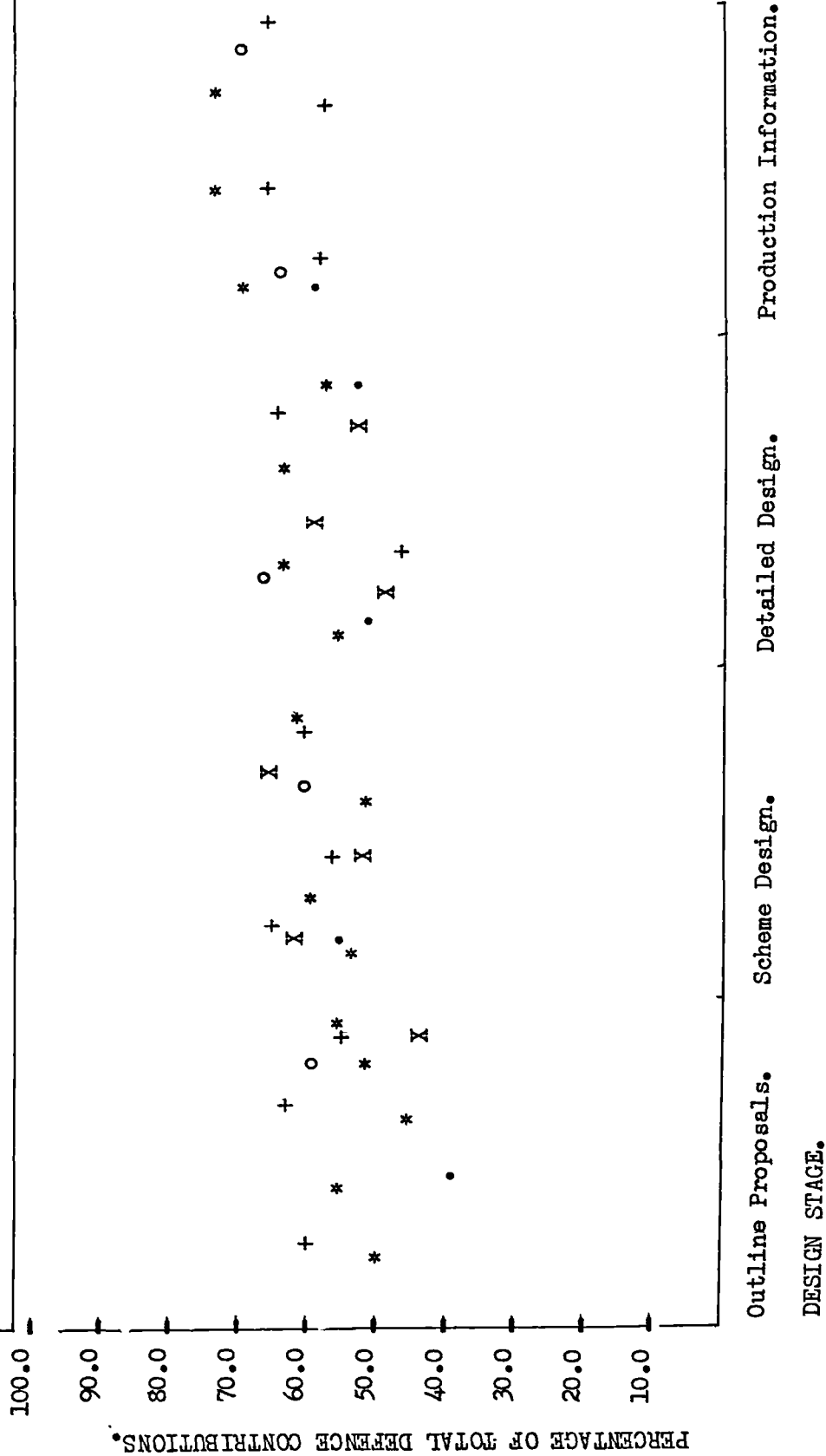


Outline Proposals. Scheme Design. Detailed Design. Production Information

DESIGN STAGE.

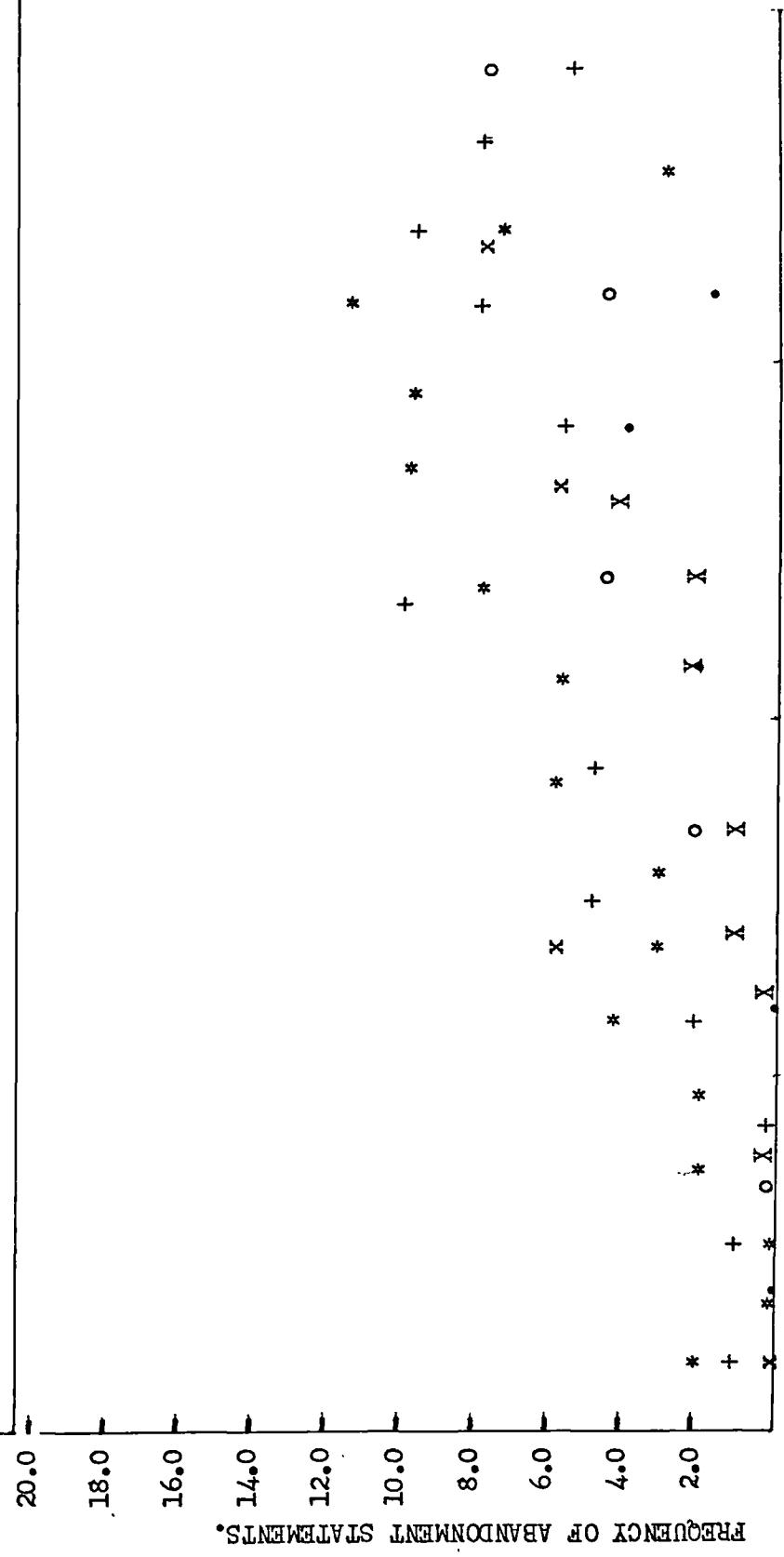
* A
 + B
 x C
 • D(b)
 X F
 o G

Figure 31. Proportion of Architect defence contributions based upon cost comparisons with workable alternatives, made in response to attacks upon an aesthetics based contributions.



* A
 + B
 x C
 • D(b)
 X F
 O G

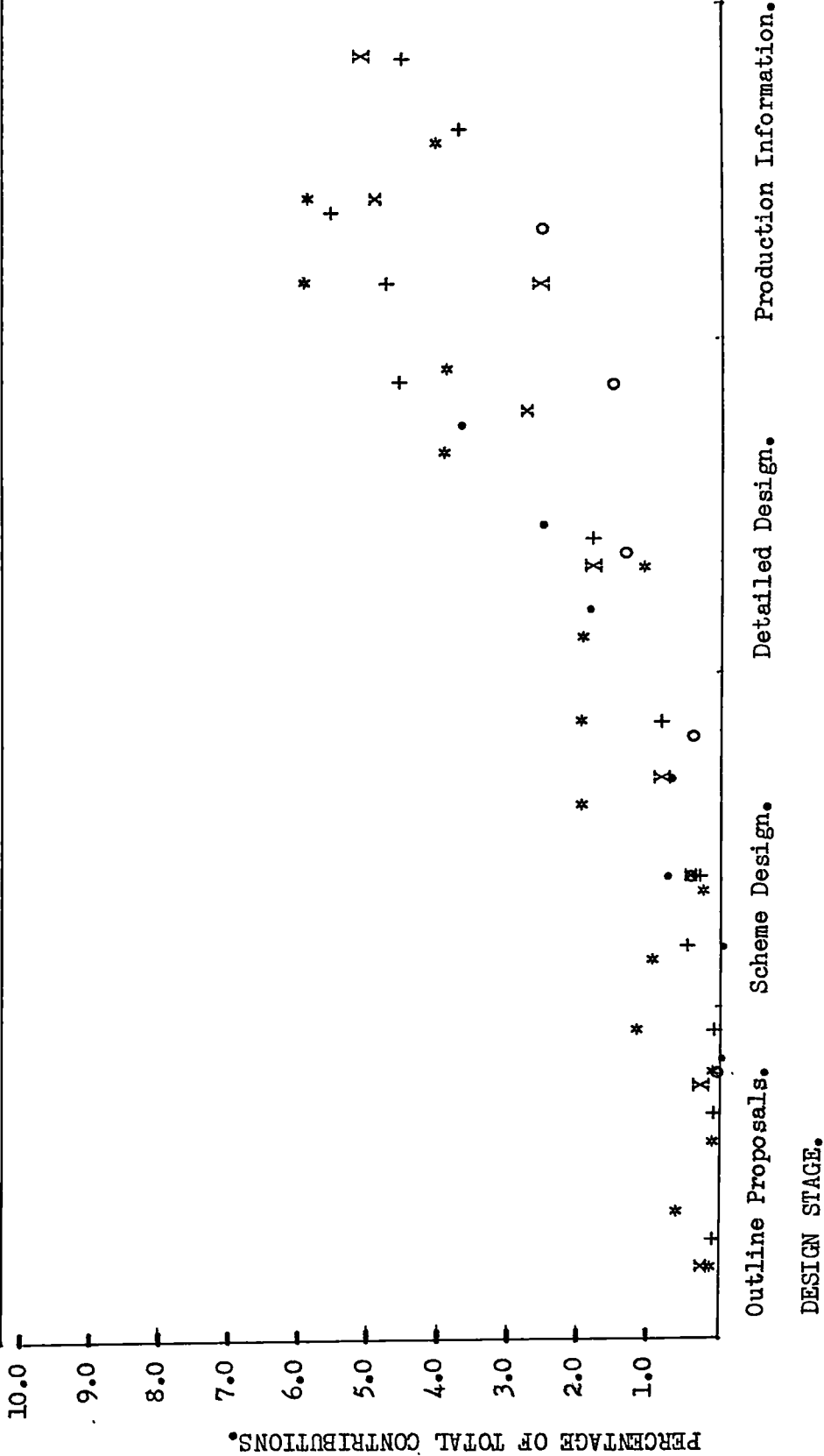
Figure 32. Frequency of abandonment of previously agreed aesthetic design concepts.



Outline Proposals. Scheme Design. Detailed Design. Production Information.
 DESIGN STAGE.

A
B
C
F
G
H

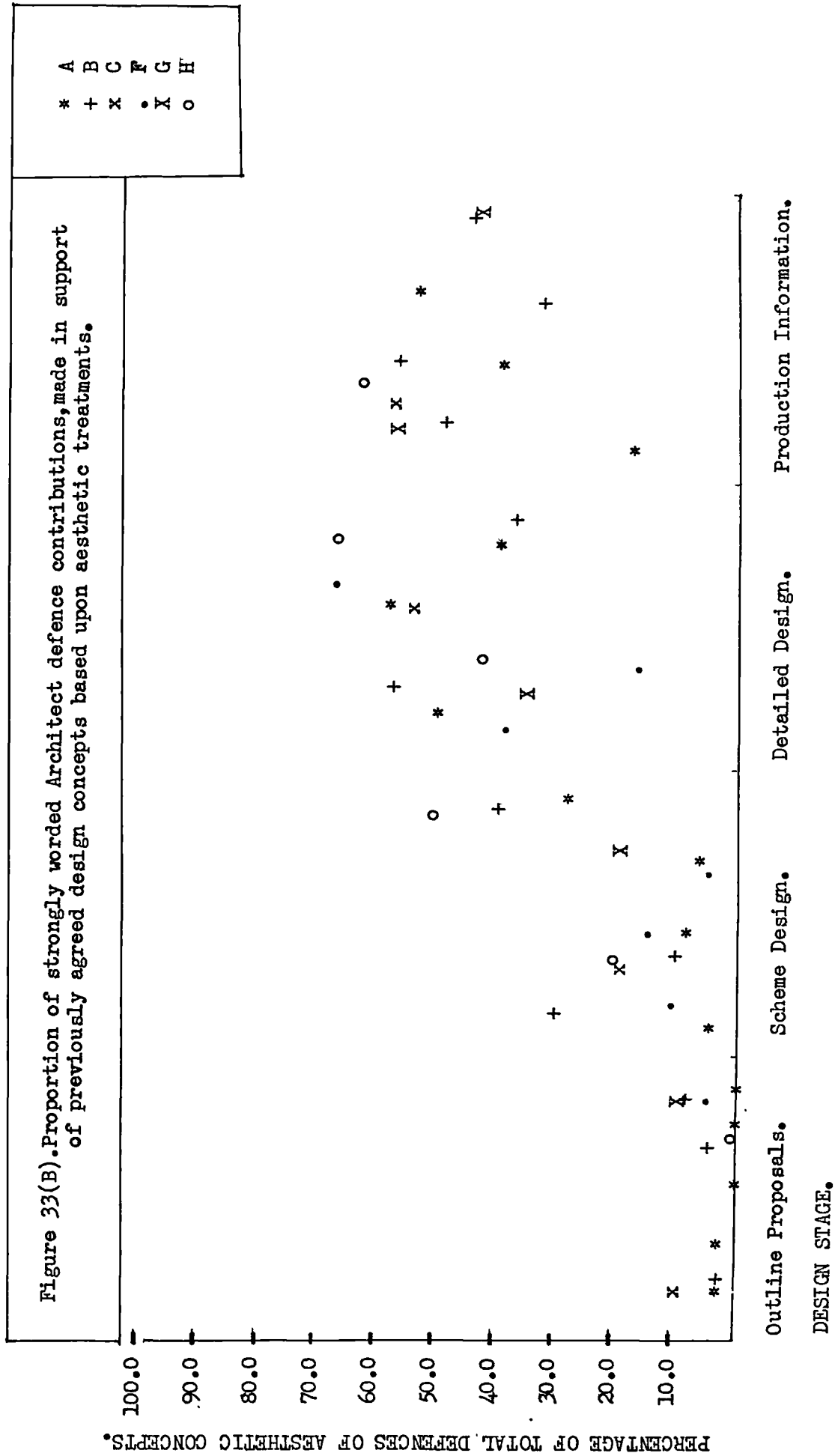
Figure 33(A). Proportion of defences of previously agreed design concepts based upon aesthetic treatments in total Architect contributions.



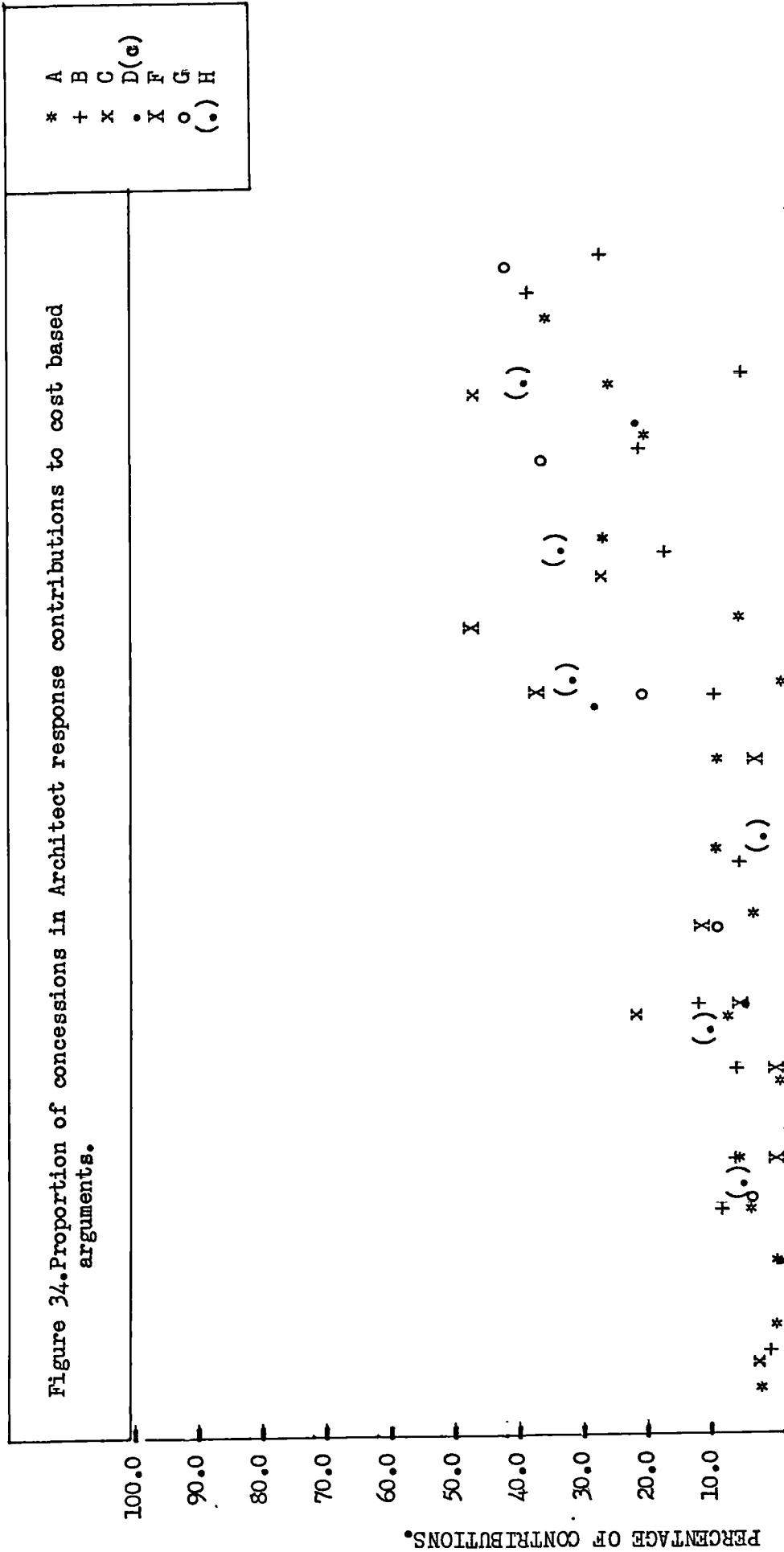
Outline Proposals. Scheme Design. Detailed Design. Production Information.

DESIGN STAGE.

PERCENTAGE OF TOTAL CONTRIBUTIONS.



PERCENTAGE OF TOTAL DEFENCES OF AESTHETIC CONCEPTS.



Outline Proposals. Scheme Design. Detailed Design. Production Information.

DESIGN STAGE.

Figure 35. Variations in the significance of association between Client and Cost in Architect contributions.

*	A
+	B
x	C
•	D(c)
X	G
o	H
(.)	I

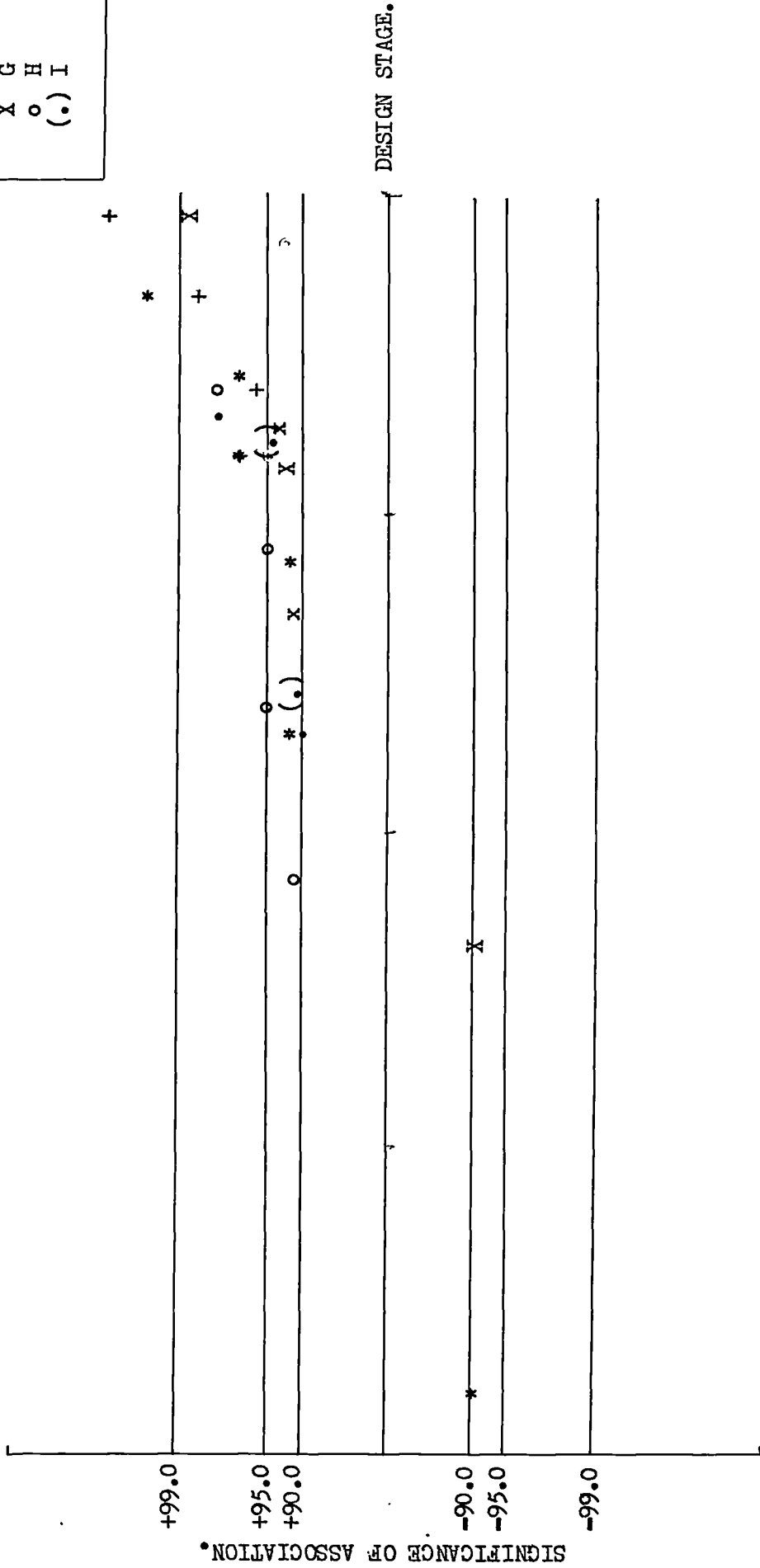


Figure 36. Variations in the significance of association between Cost and expressions of Dissatisfaction in Architect contributions.

*	A
+	B
x	C
•	D(e)
X	G
o	H
(.)	I

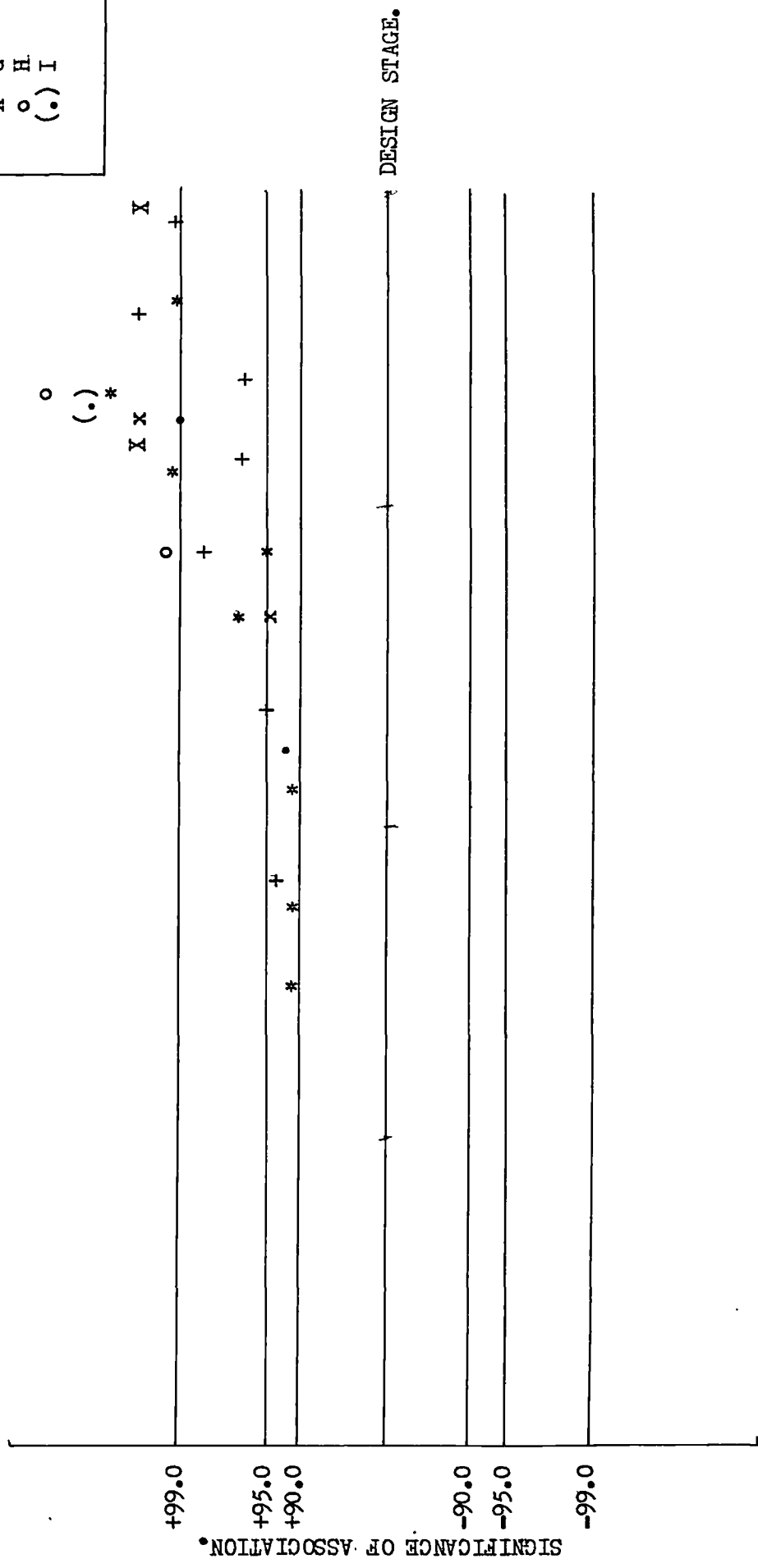
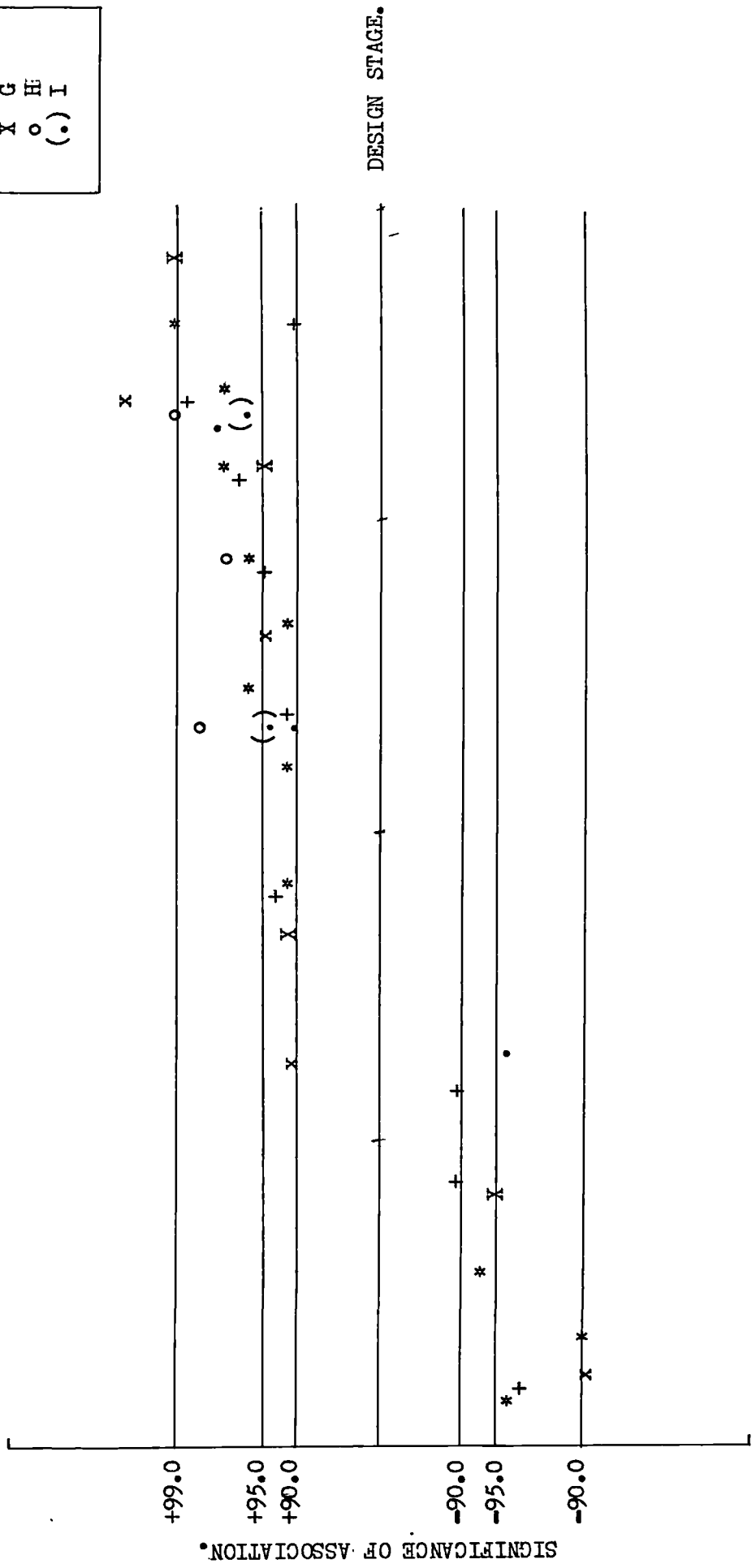
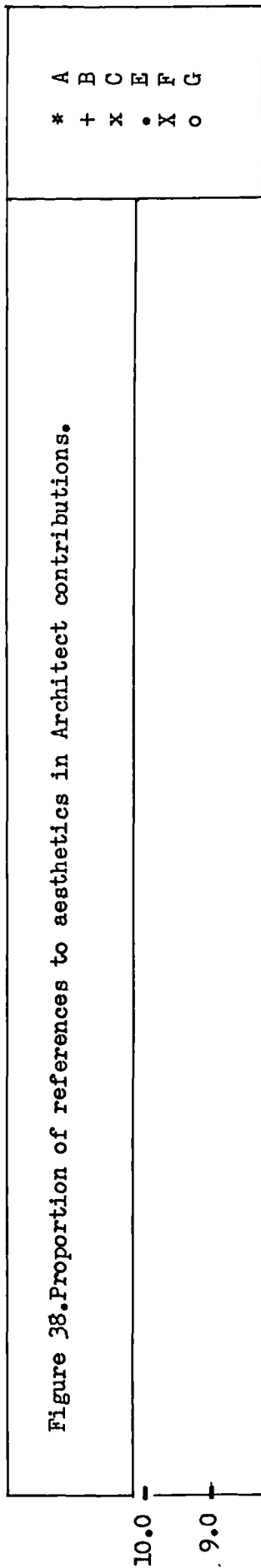


Figure 37. Variations in the significance of association between aesthetics and expressions of Dissatisfaction in Architect contributions.

*	A
+	B
x	C
•	D(c)
o	G
(.)	HE
	I





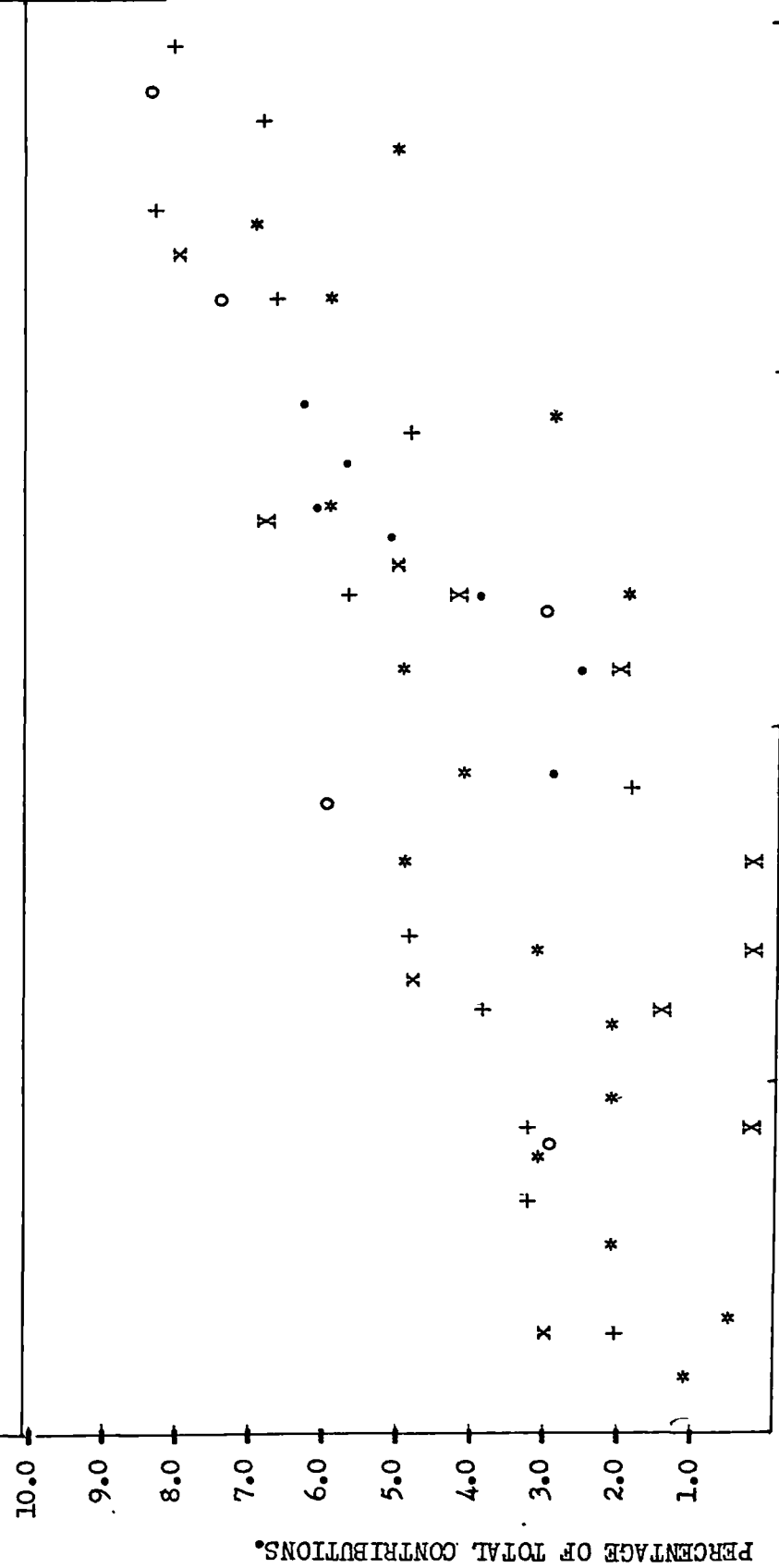
Outline Proposals. Scheme Design. Detailed Design. Production Information.

DESIGN STAGE.

PERCENTAGE OF TOTAL CONTRIBUTIONS.

A
B
C
E
F
G

Figure 39. Proportion of references to cost in Architect contributions.



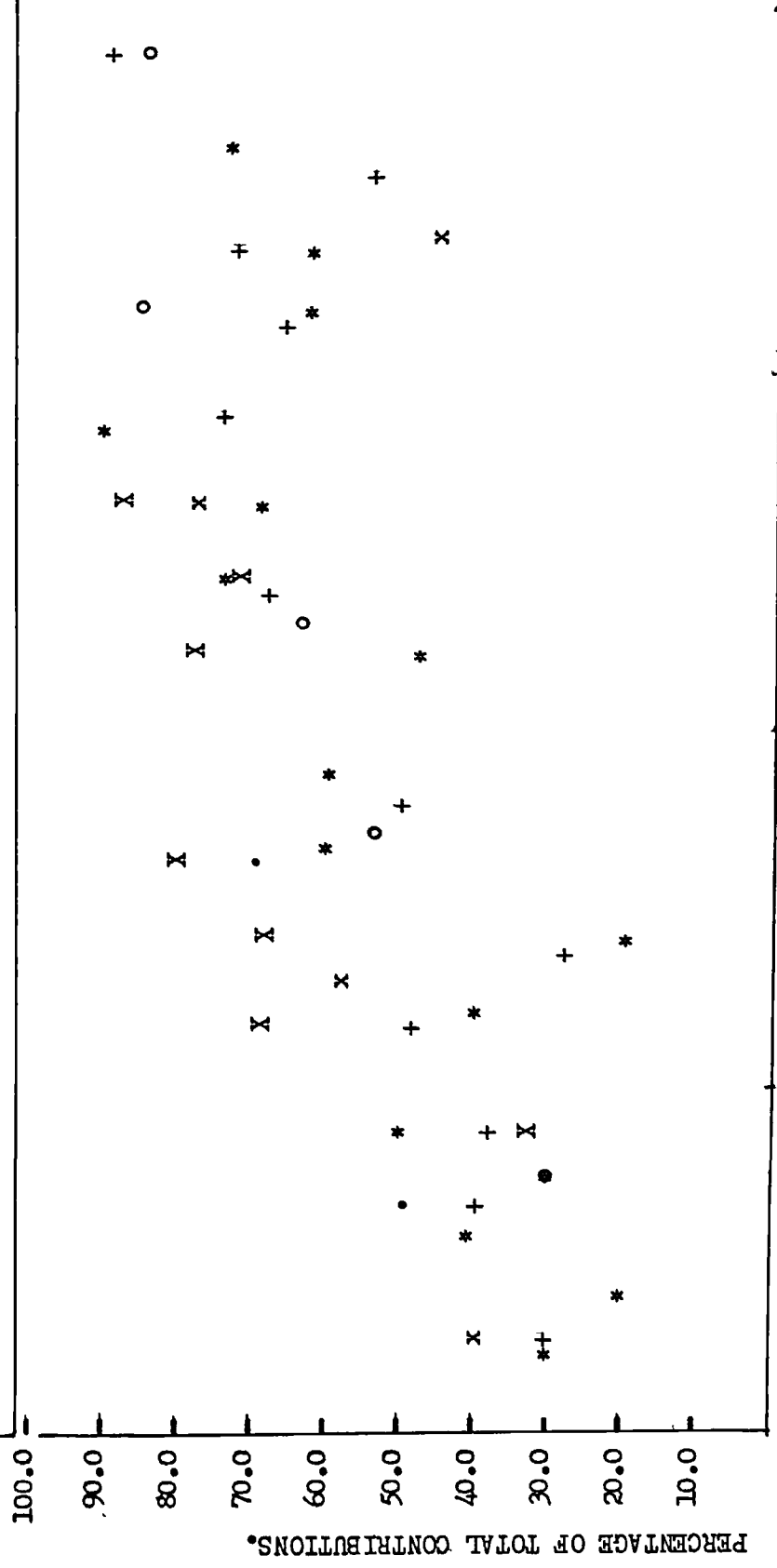
Outline Proposals. Scheme Design. Detailed Design. Production Information.

DETAILED DESIGN.

PERCENTAGE OF TOTAL CONTRIBUTIONS.

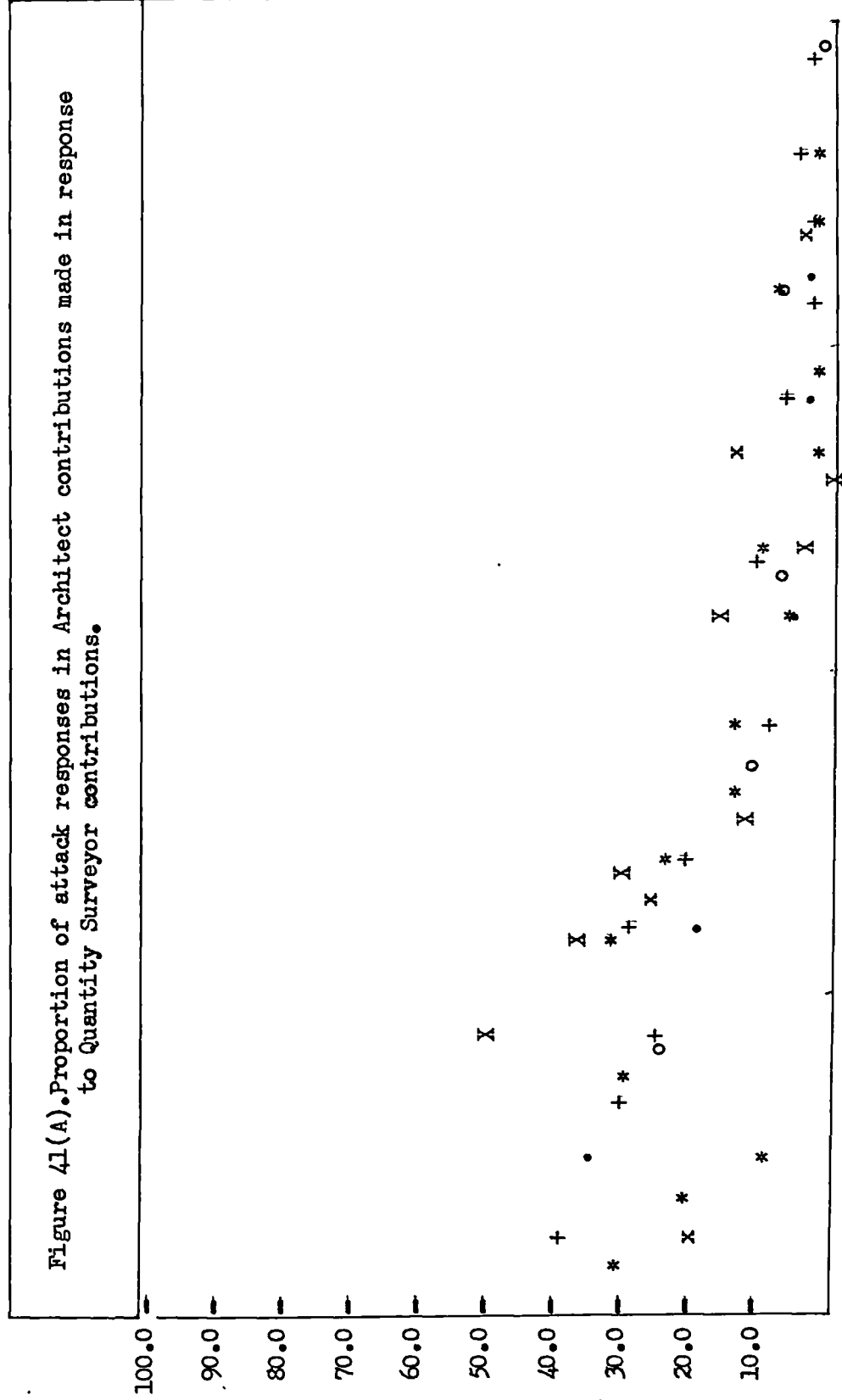
A B C D(a)
 * + X • X O

Figure 40. Proportion of supportive responses to Architect requests for information in Quantity Surveyor response contributions.



Outline Proposals. Scheme Design. Detailed Design. Production Information.
 DESIGN STAGE.

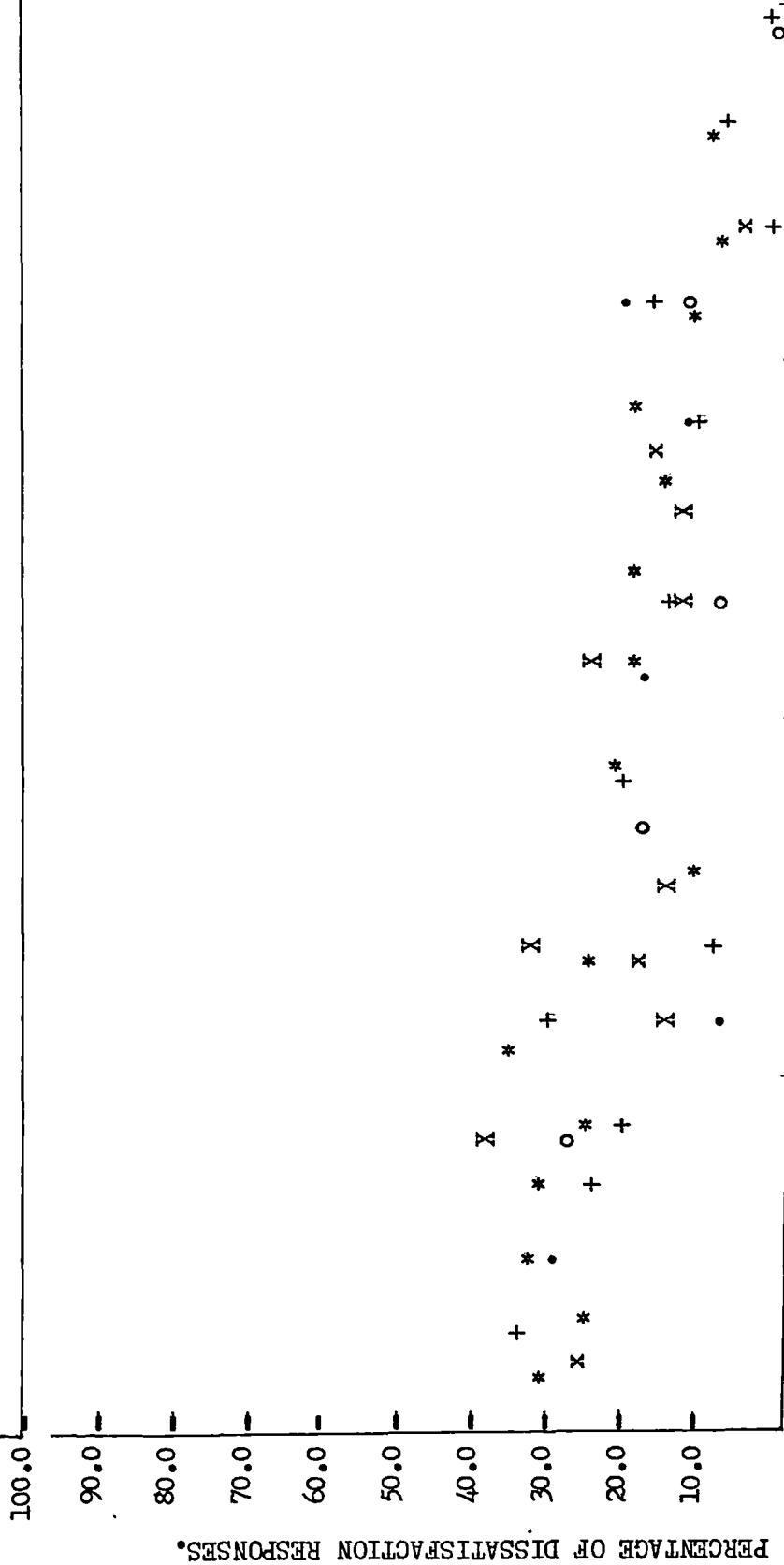
Figure 41(A). Proportion of attack responses in Architect contributions made in response to Quantity Surveyor contributions.



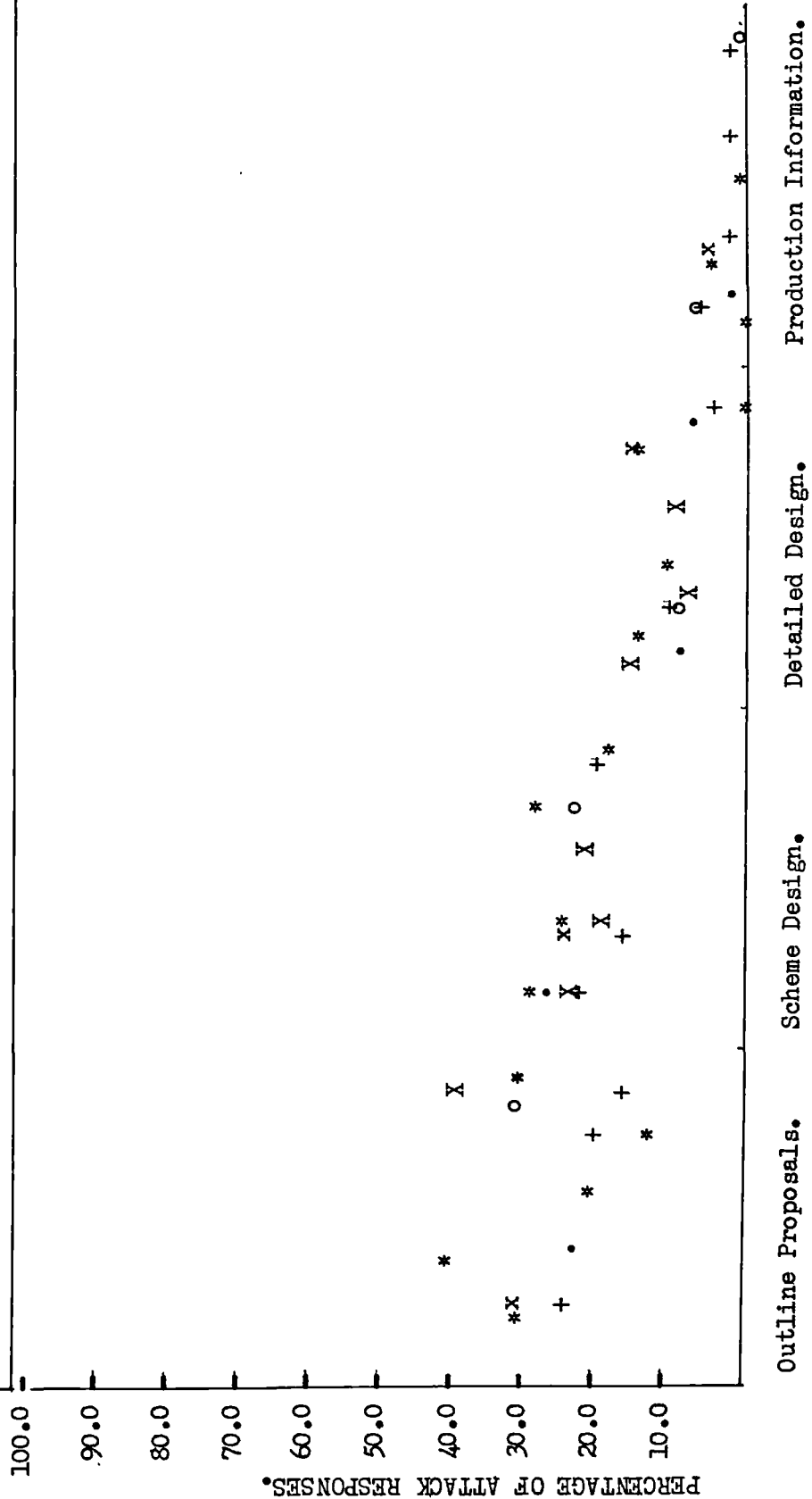
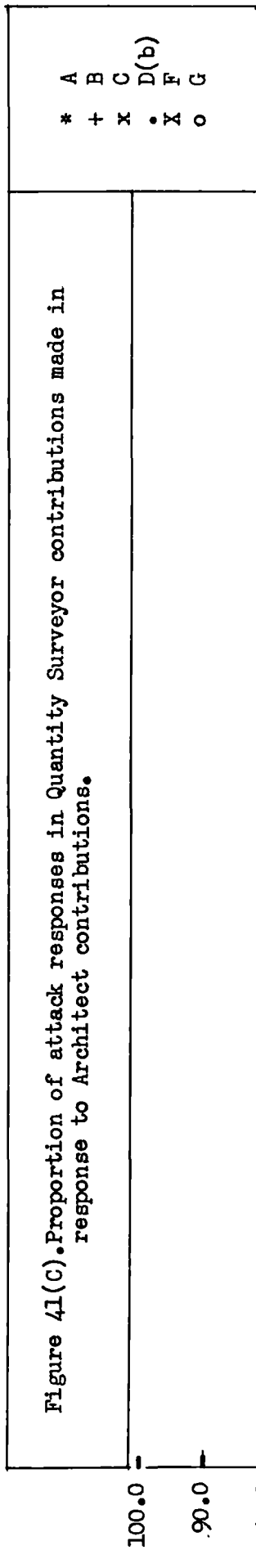
Outline Proposals. Schem Design. Detailed Design. Production Information.
 DESIGN STAGE.

A
B
C
D(b)
F
G

Figure 41(B). Proportion of dissatisfaction responses in Architect contributions made in response to Quantity Surveyor contributions.

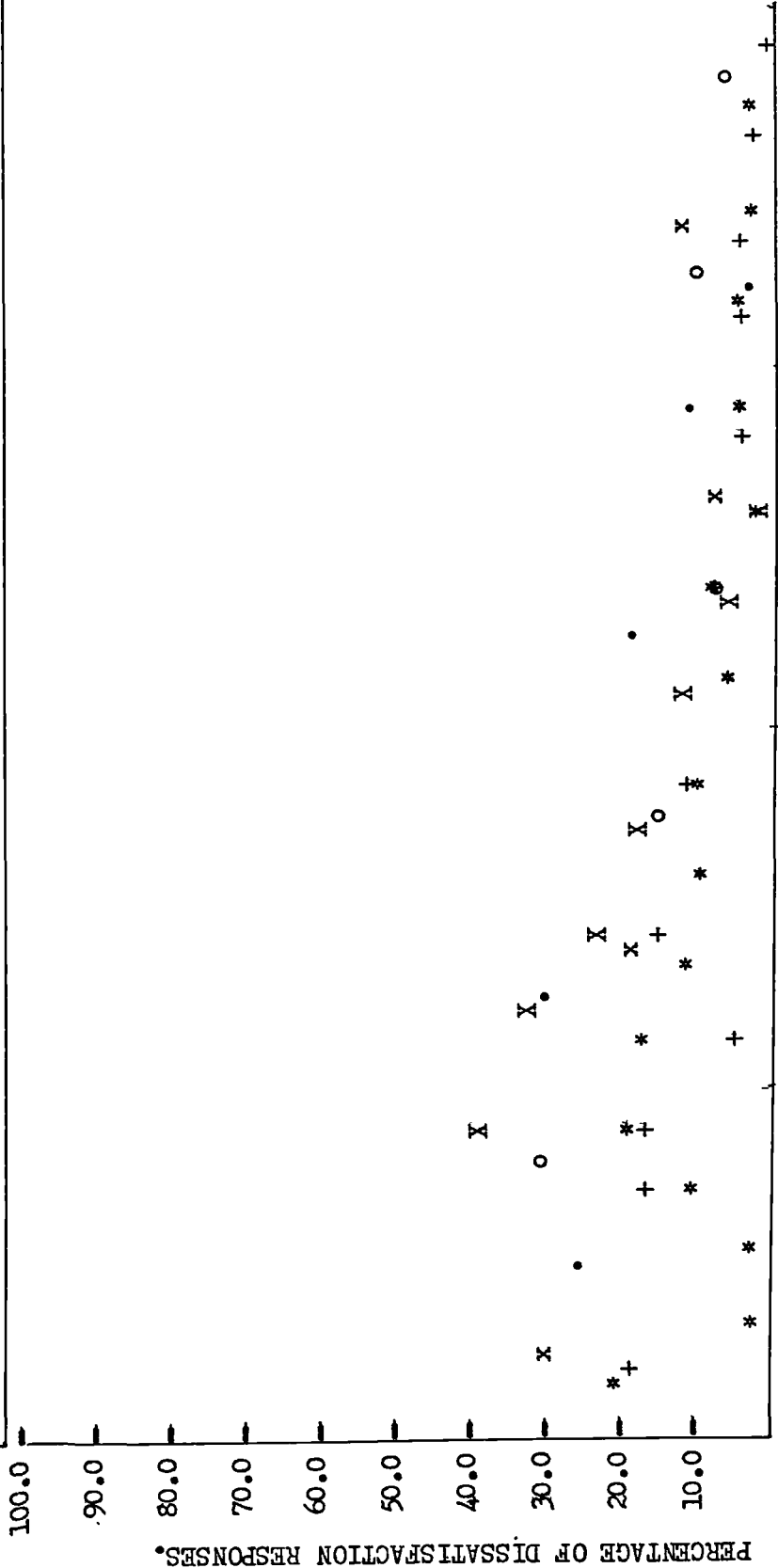
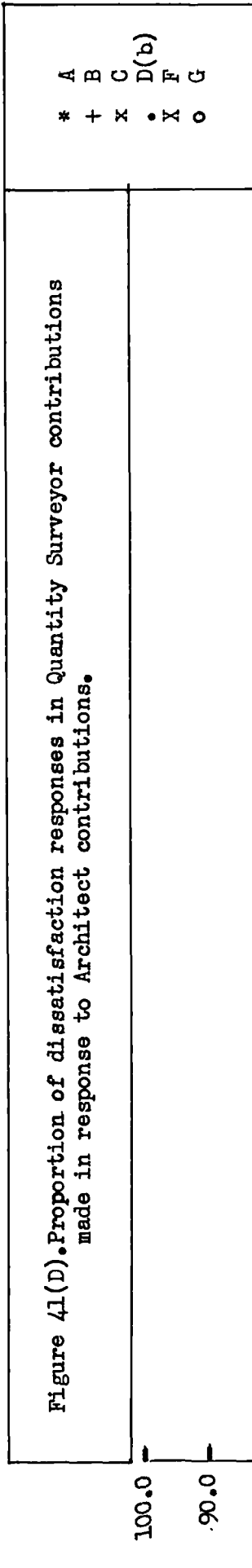


Outline Proposals. Scheme Design. Detailed Design. Production Information.
DESIGN STAGE.



Outline Proposals. Scheme Design. Detailed Design. Production Information.

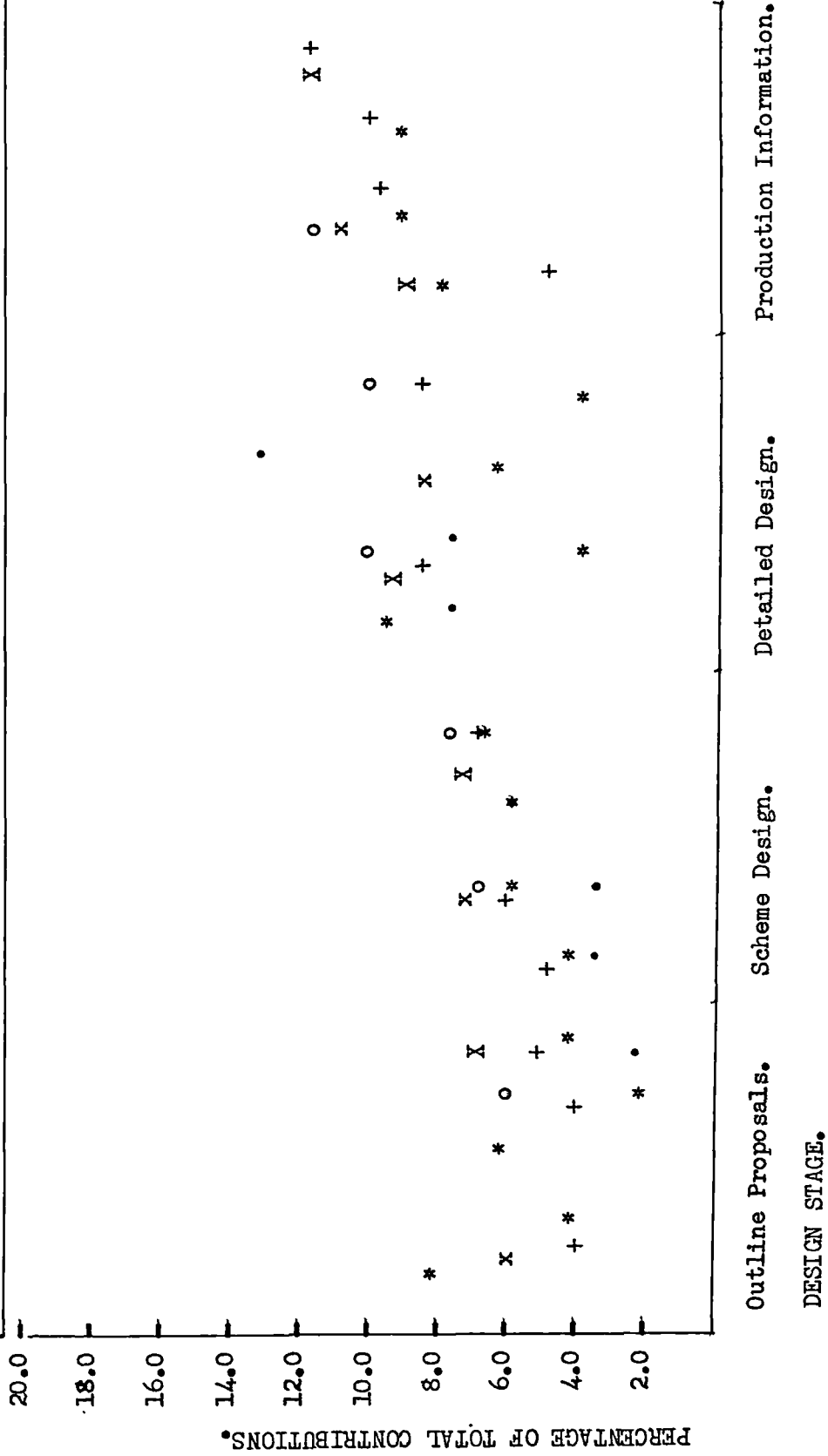
DESIGN STAGE.



Outline Proposals. Scheme Design. Detailed Design. Production Information.
 DESIGN STAGE.

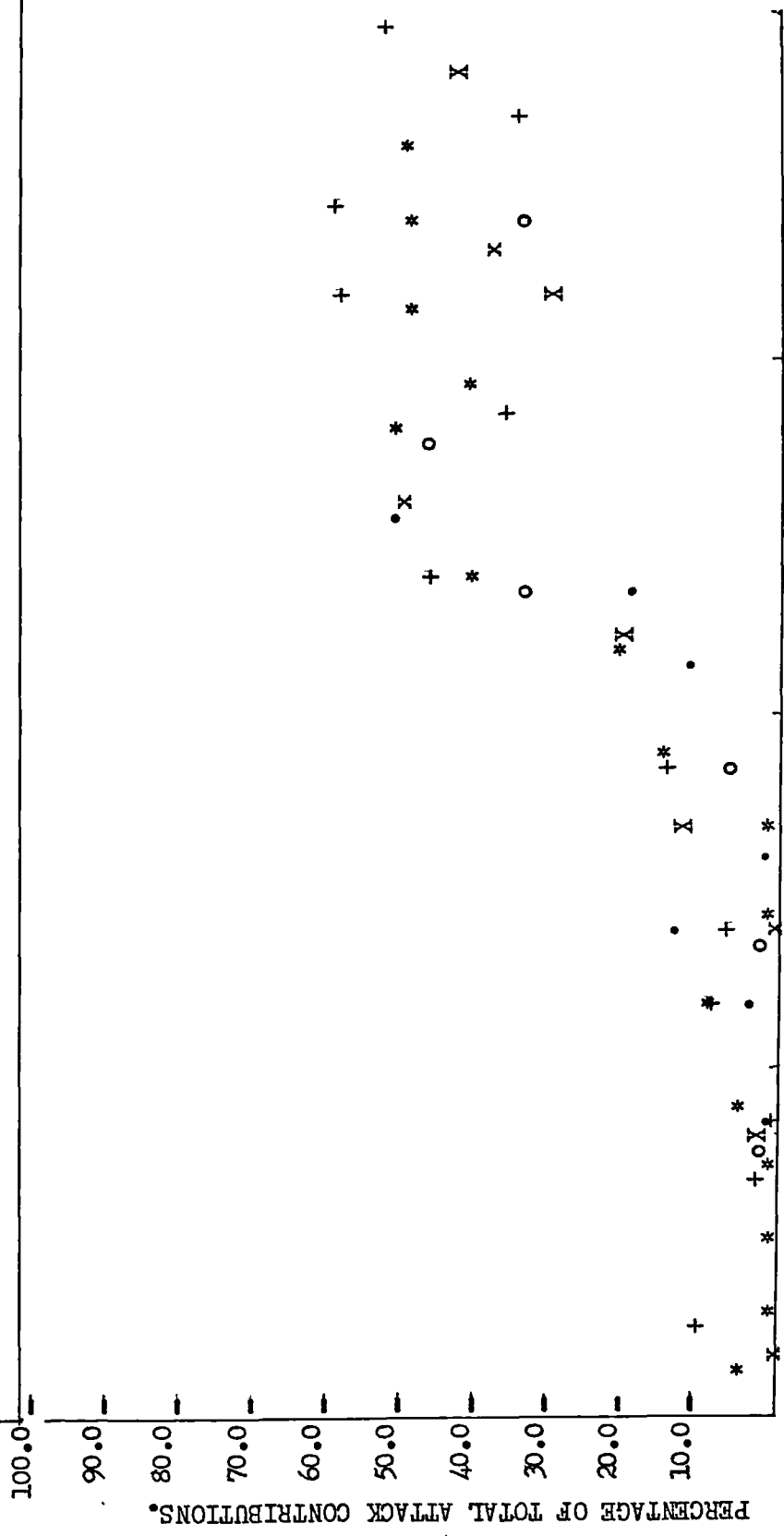
*	A
+	B
x	C
•	F
X	G
o	H

Figure 42. Proportion of Architect contributions addressed to the Quantity Surveyor.



A
B
C
F
G
H

Figure 43. Proportion of attack contributions directed at the Client Representative in Architect contributions.



Outline Proposals. Scheme Design. Detailed Design. Production Information.
DESIGN STAGE.

Figure 44. Variations in the significance of association between Self(Architect) and Client Representative in Architect contributions.

* A
 + B
 x C
 . D(b)
 X F
 o G
 (.) H

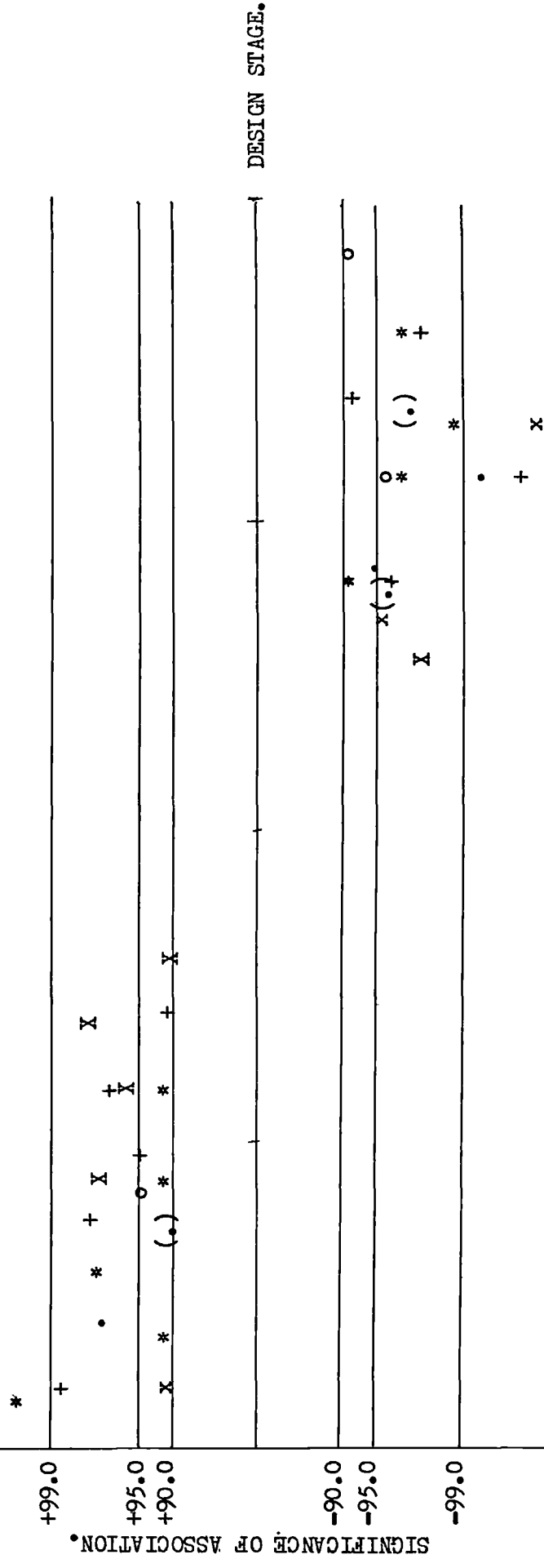
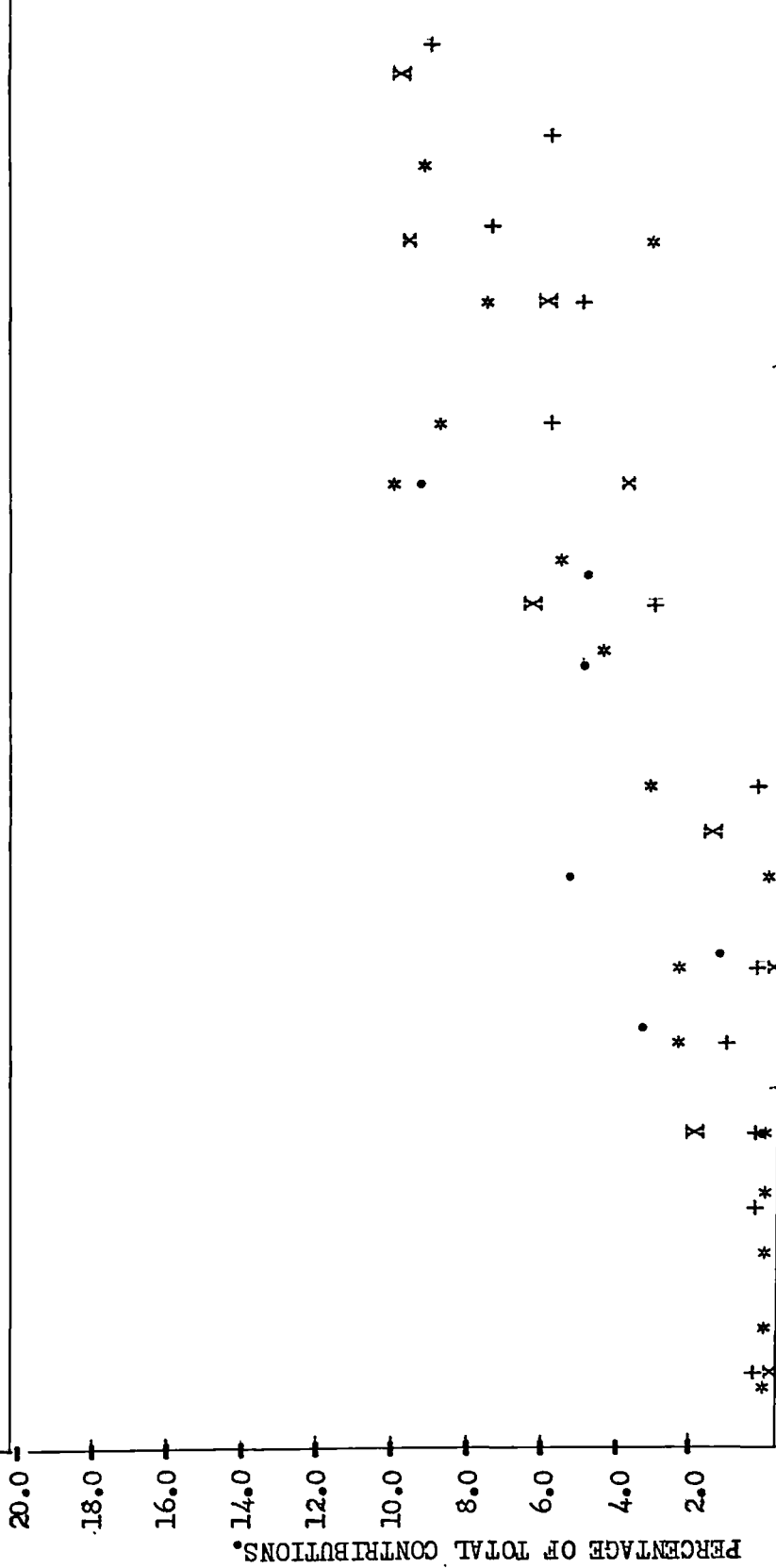


Figure 46. Proportion of quotations or references to quotations of previous Quantity Surveyor contributions in Architect contributions.

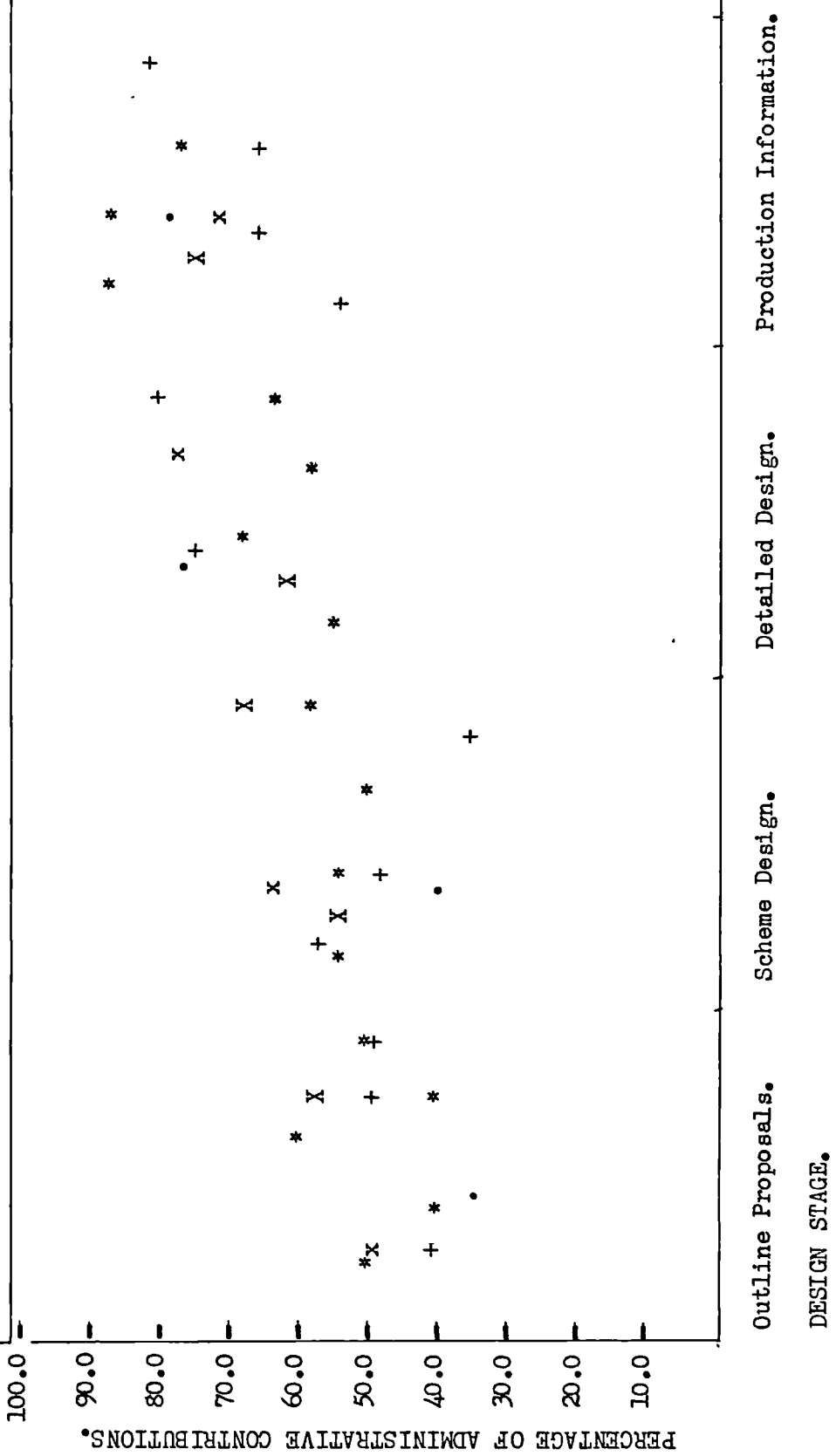
A
B
C
F
G



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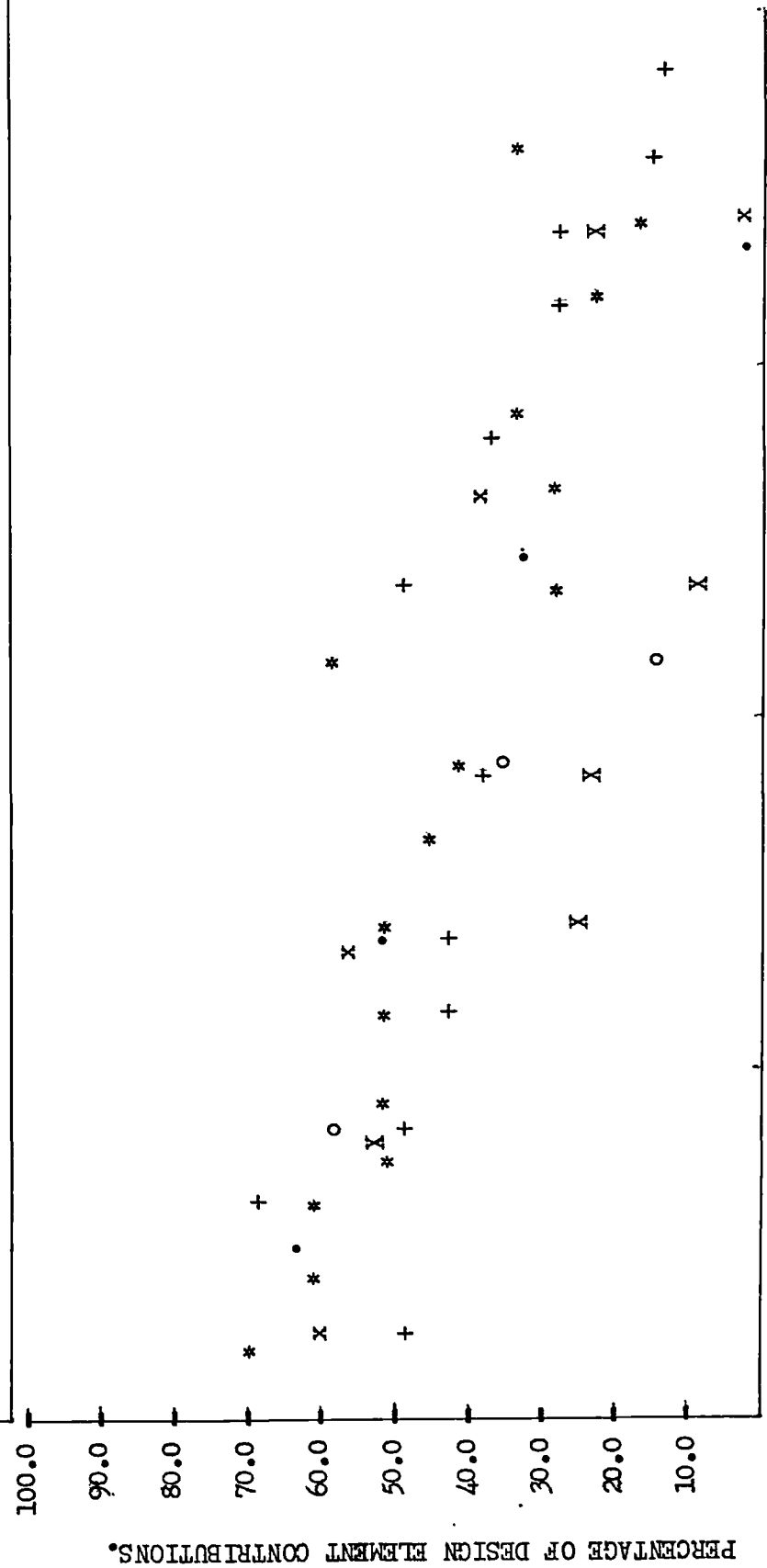
A
B
C
D(c)
I
J

Figure 47(A). Proportion of administrative element Architect contributions addressed to the Client Representative.

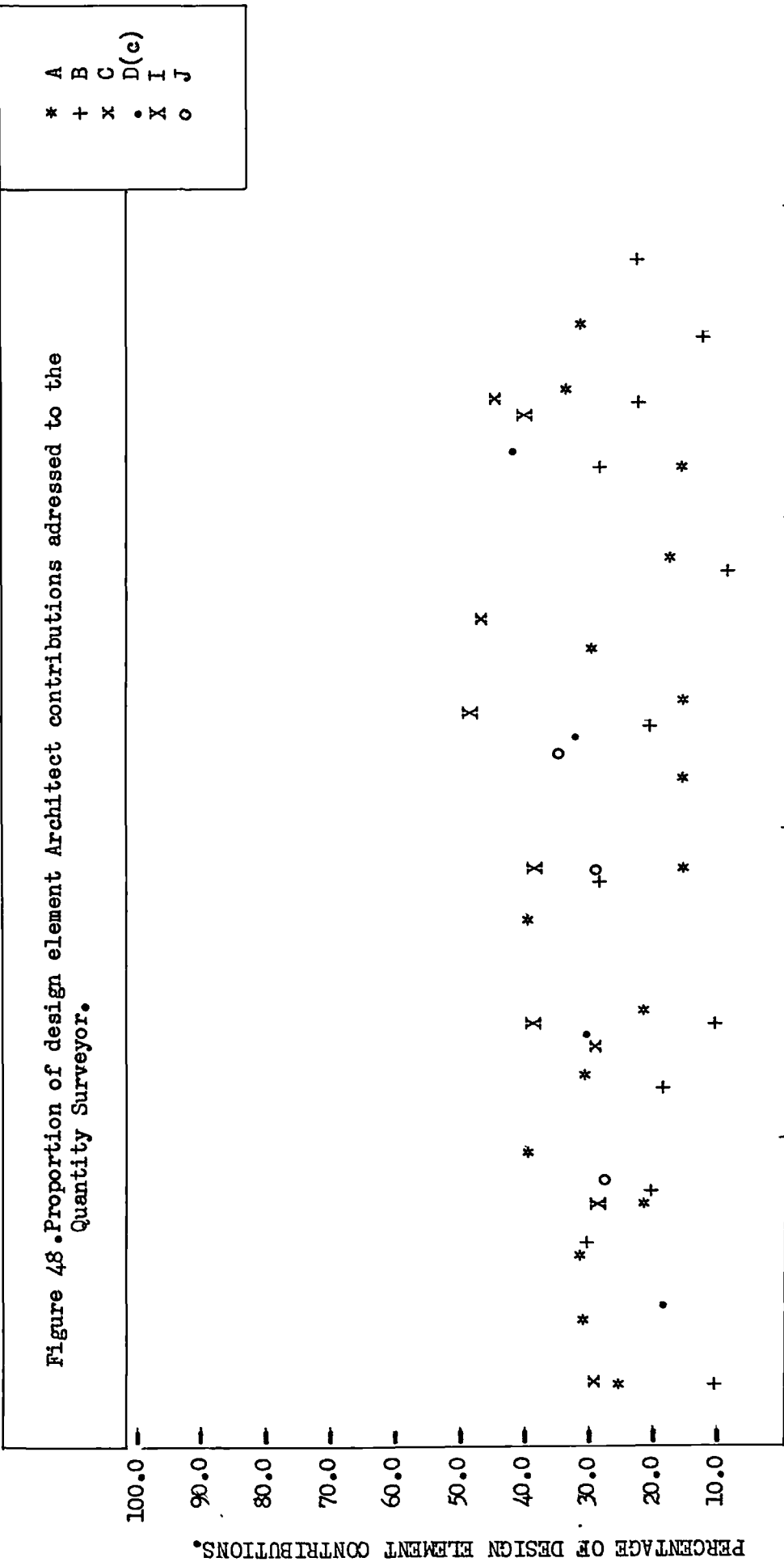


A
 B
 C
 D(c)
 I
 J
 *
 +
 x
 •
 X
 O

Figure 47(B). Proportion of design element Architect contributions addressed to the Client Representative.

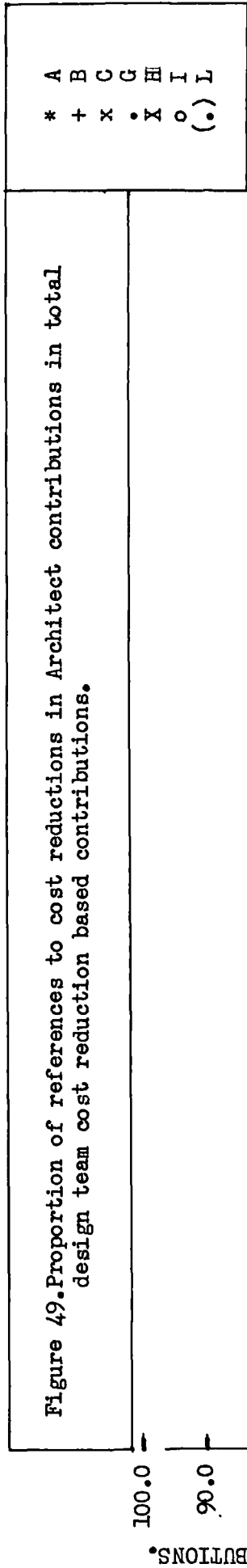


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PERCENTAGE OF TOTAL COST REDUCTION CONTRIBUTIONS.

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A
B
C
G
H
I
L

*
+
x
•
X
o
(.)

Figure 50. Variations in the significance of association between Client Representative and references to cost reductions in Architect contributions.

* A
 + B
 x C
 • G
 X H
 O I
 (•) J

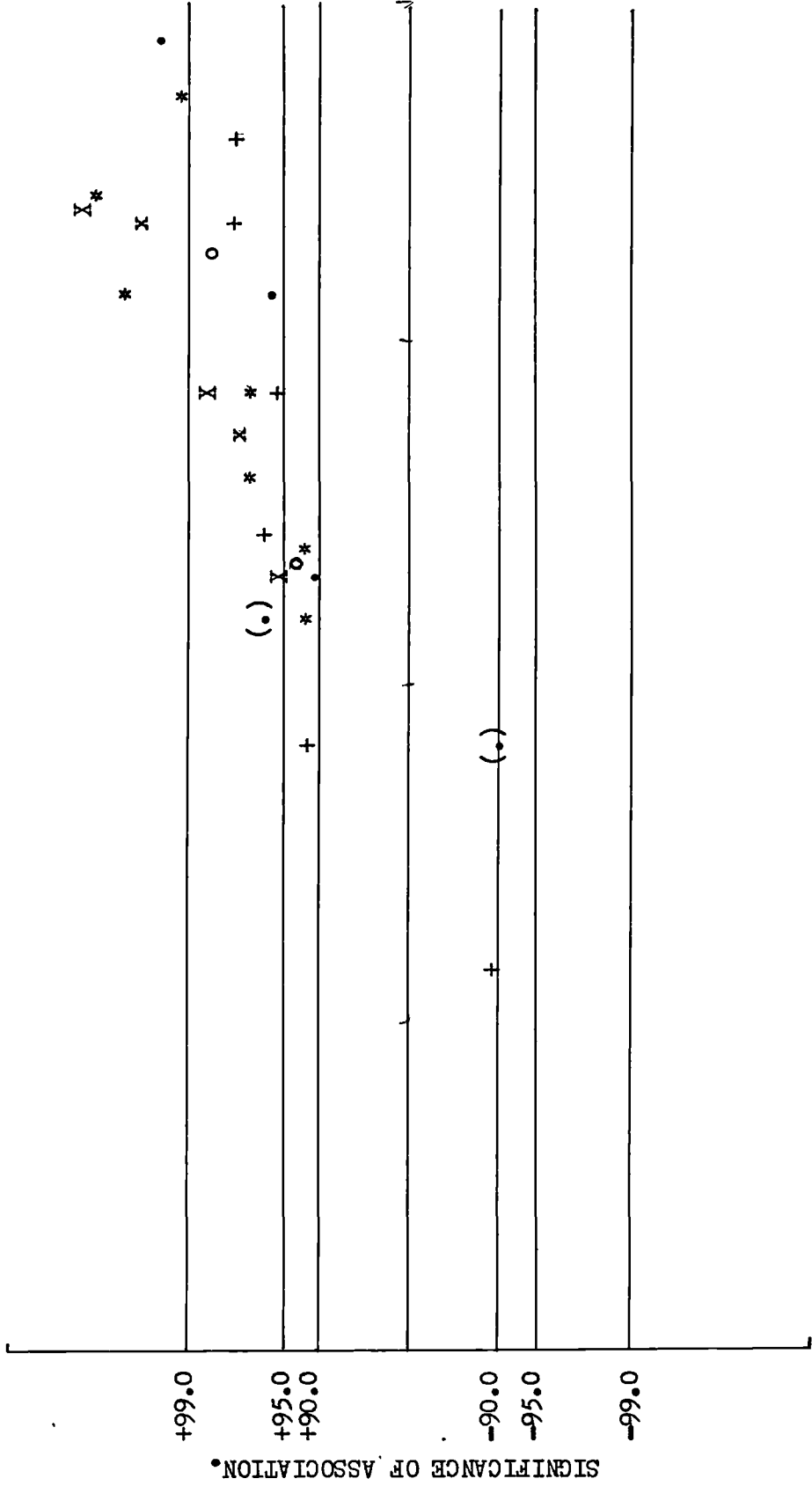
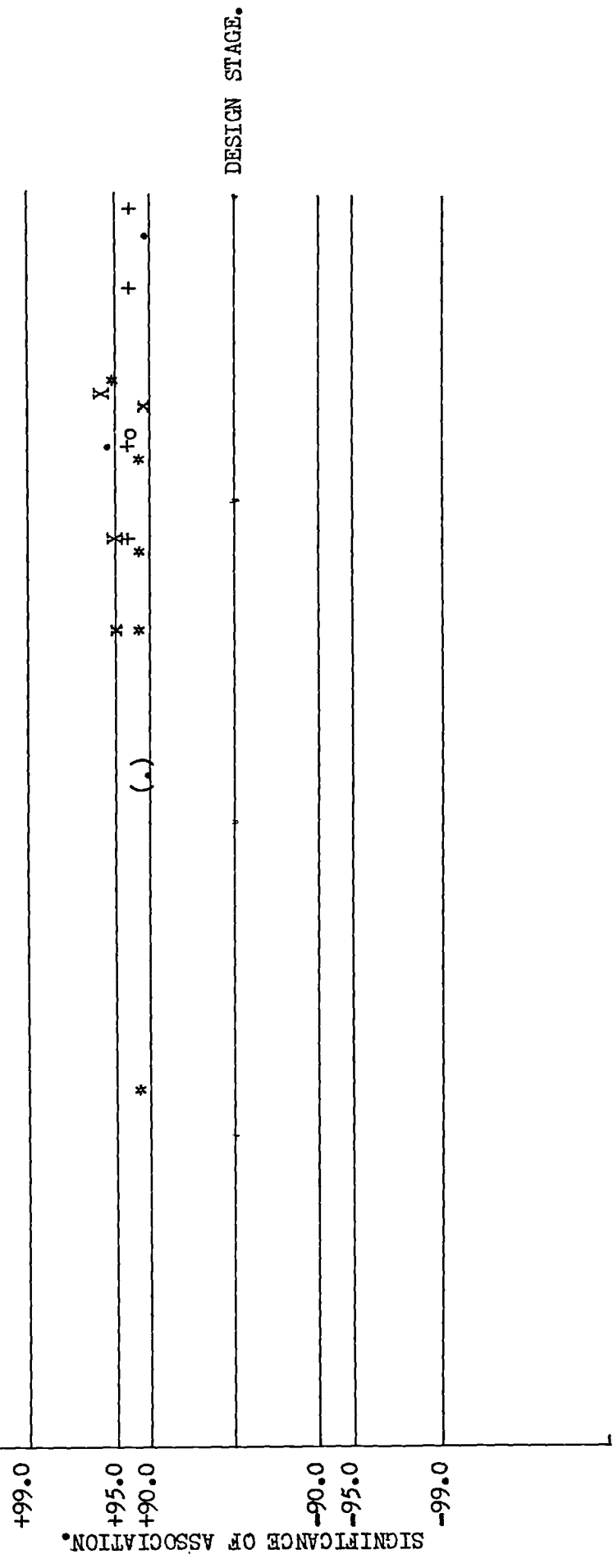


Figure 51. Variations in the significance of association between Quantity Surveyor and references to cost reductions in Architect contributions.

* A
 + B C
 x G
 • H
 o I
 (.) J



* A
 + B
 x C
 • G
 • X H
 o I
 (.) J

Figure 52. Variations in the significance of association between expressions of dissatisfaction and cost reductions in Architect contributions.

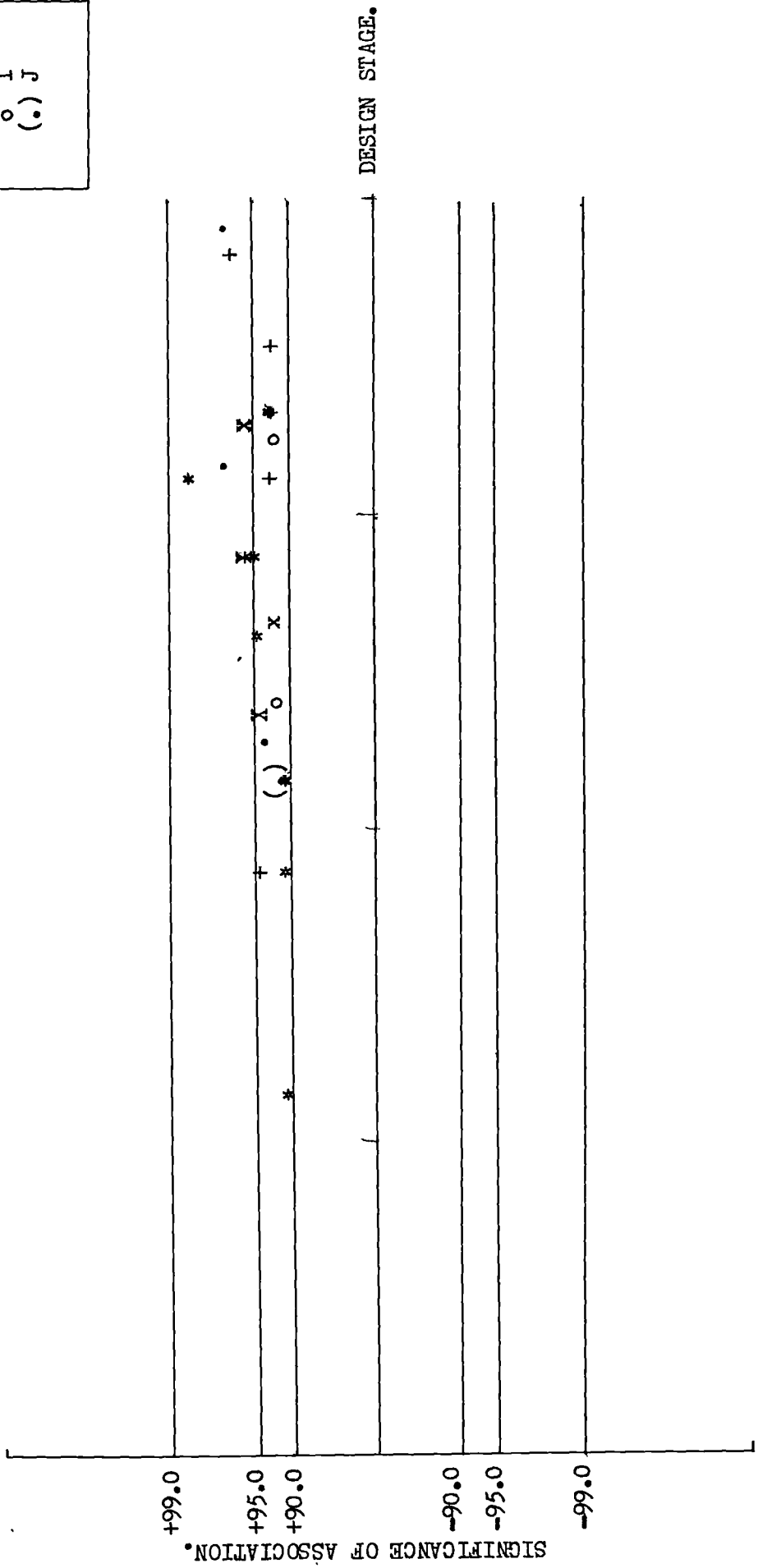


Figure 53. Variations in the significance of association between references to maintenance and cost reductions in Architect contributions.

A
 * B
 + C
 x G
 • H
 X I
 o J
 (•)

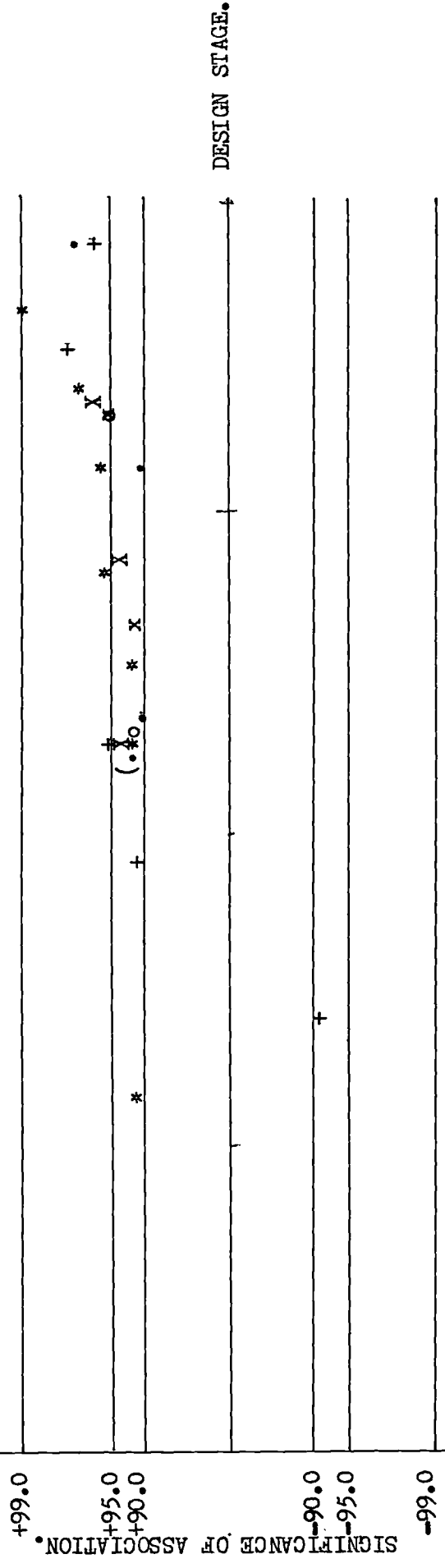
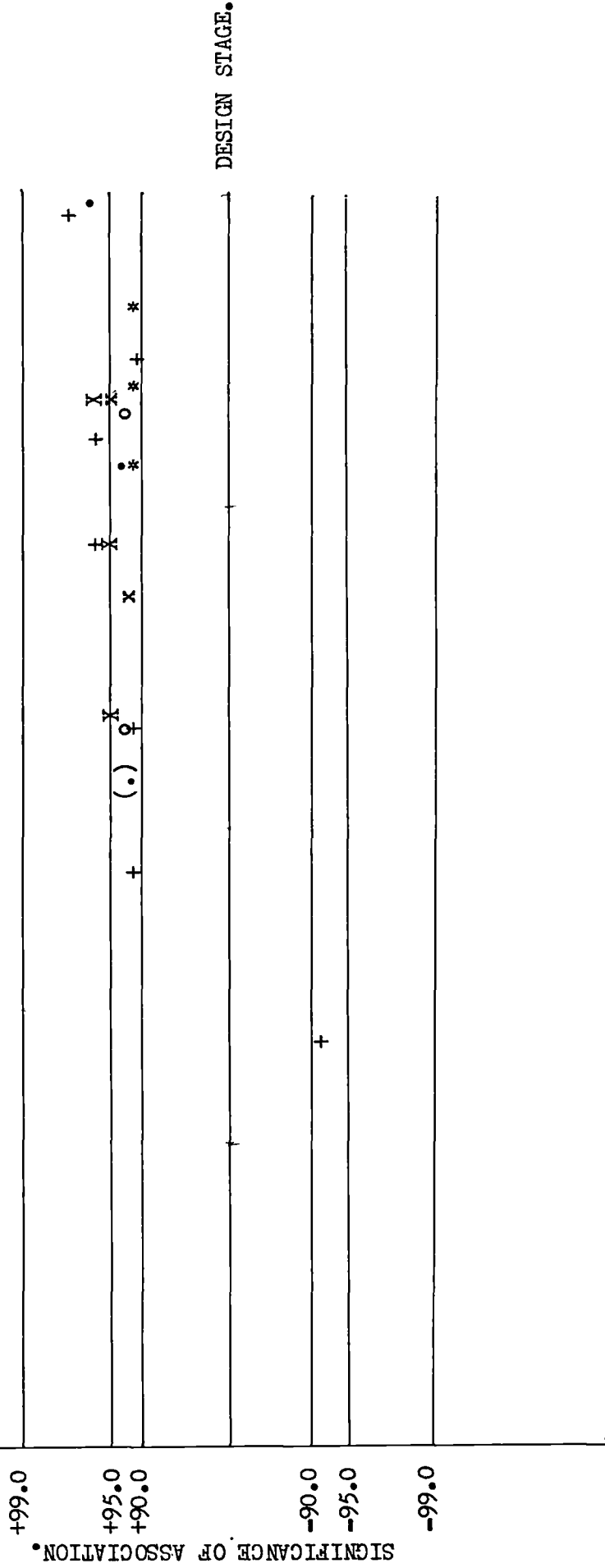


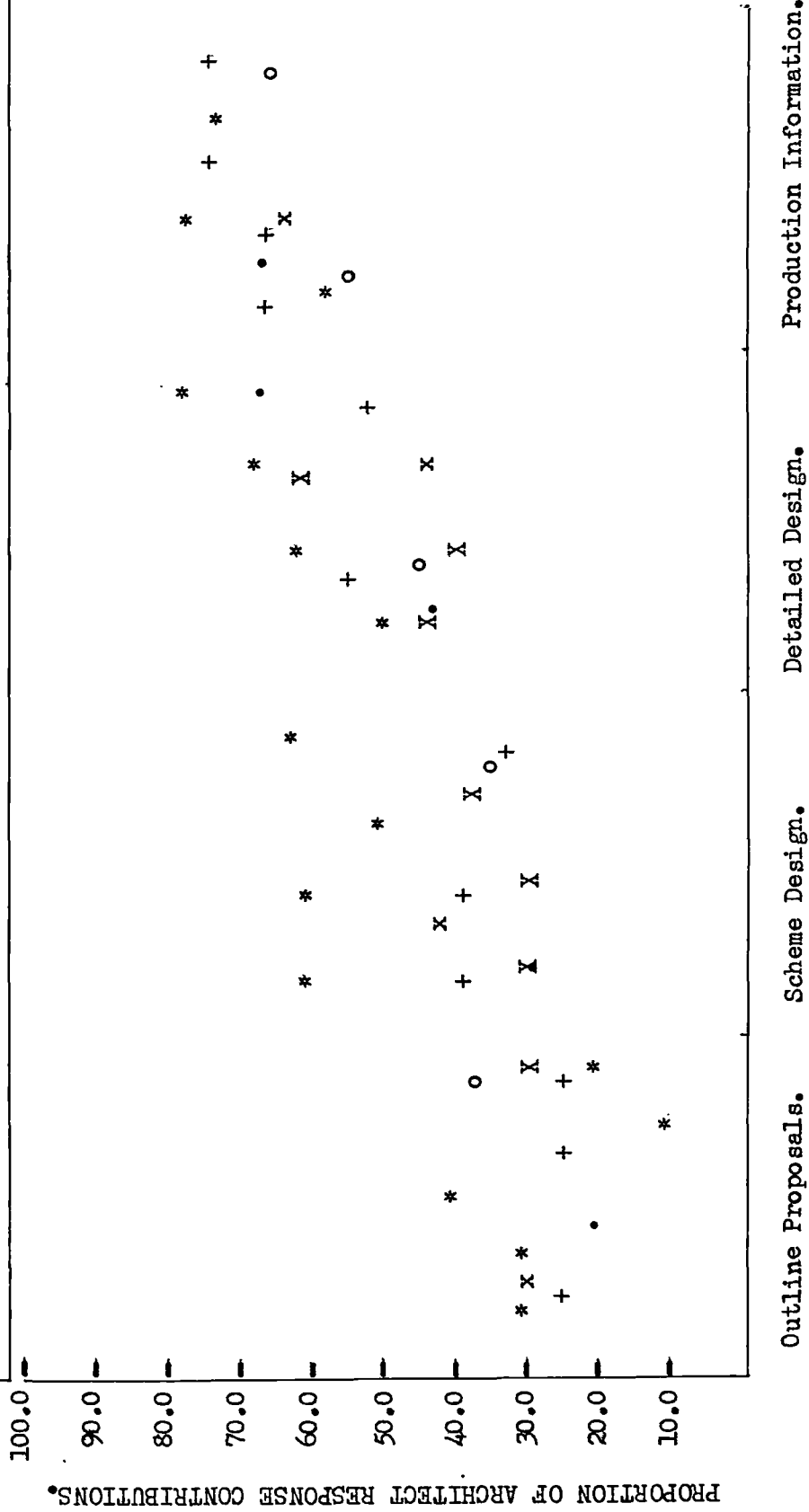
Figure 54. Variations in the significance of association between aesthetics and cost reductions in Architect contributions.

* A
 + B
 x C
 • G
 X H
 o I
 (•) J



* A
 + B
 x C
 • D(b)
 X F
 o G

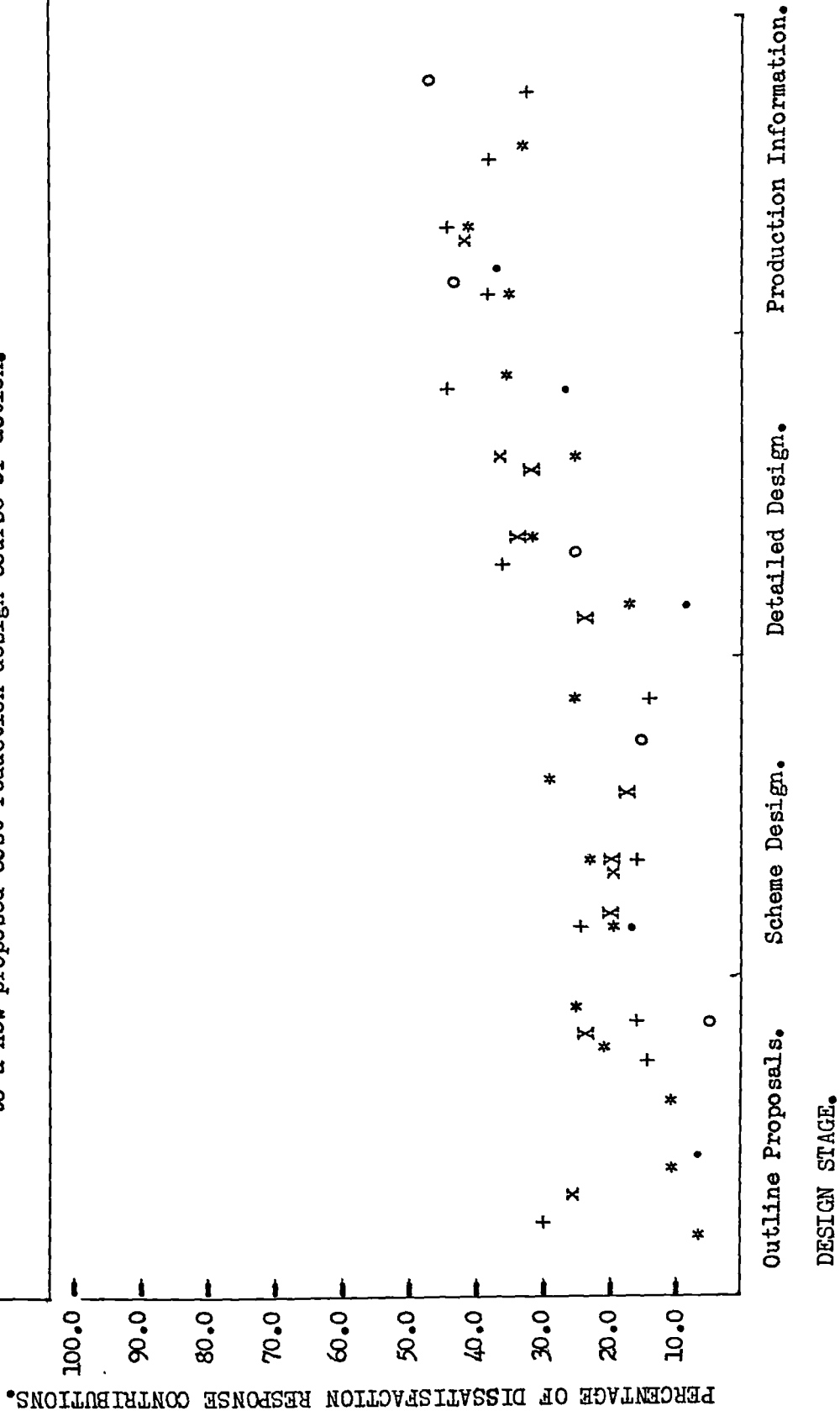
Figure 55. Proportion of Architect attack response contributions made in response to cost reduction based contributions by other design team members.



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*	A
+	B
x	C
•	D(b)
X	F
o	G

Figure 56. Proportion of Architect dissatisfaction response contributions made in response to a new proposed cost reduction design course of action.

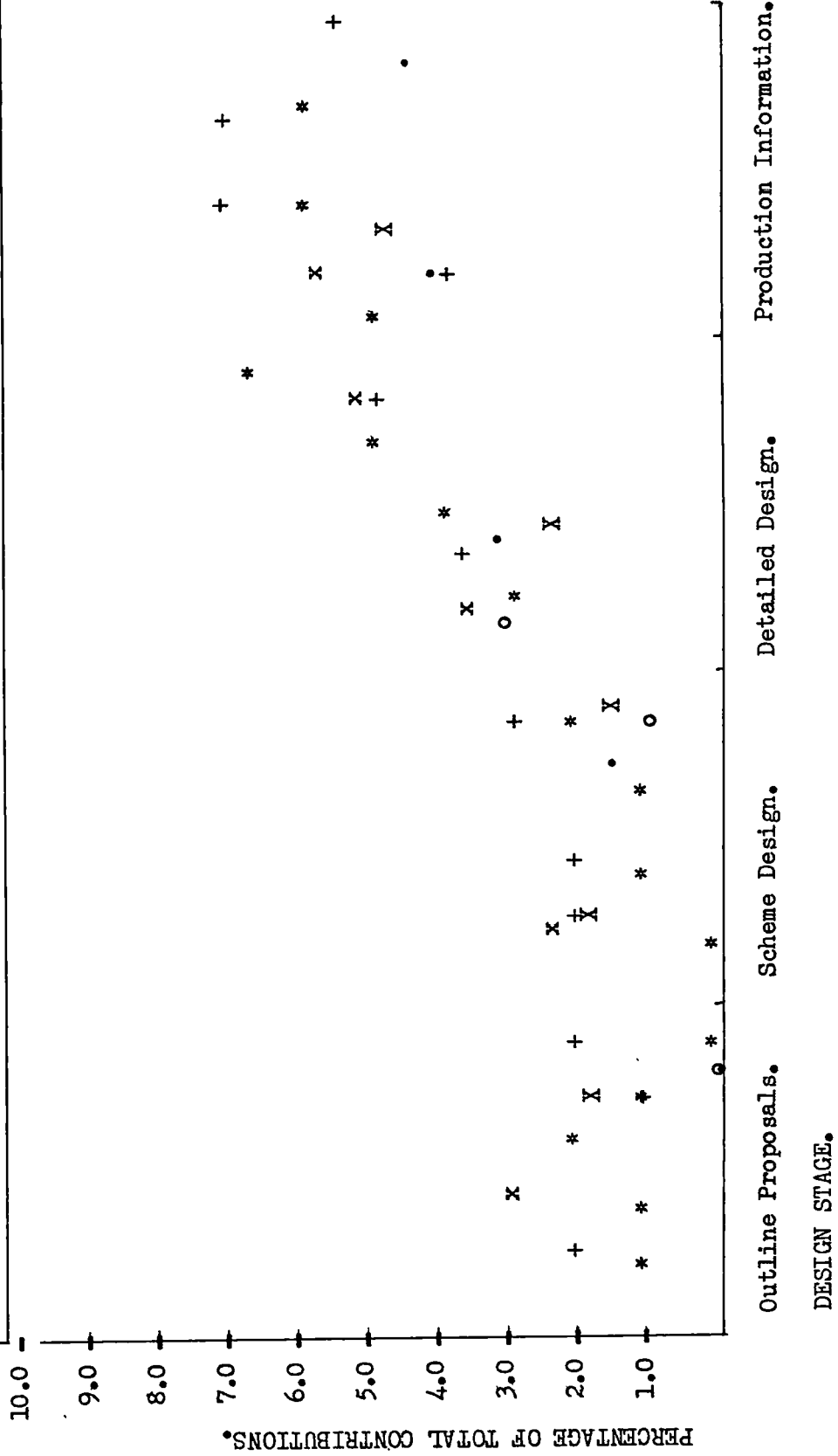


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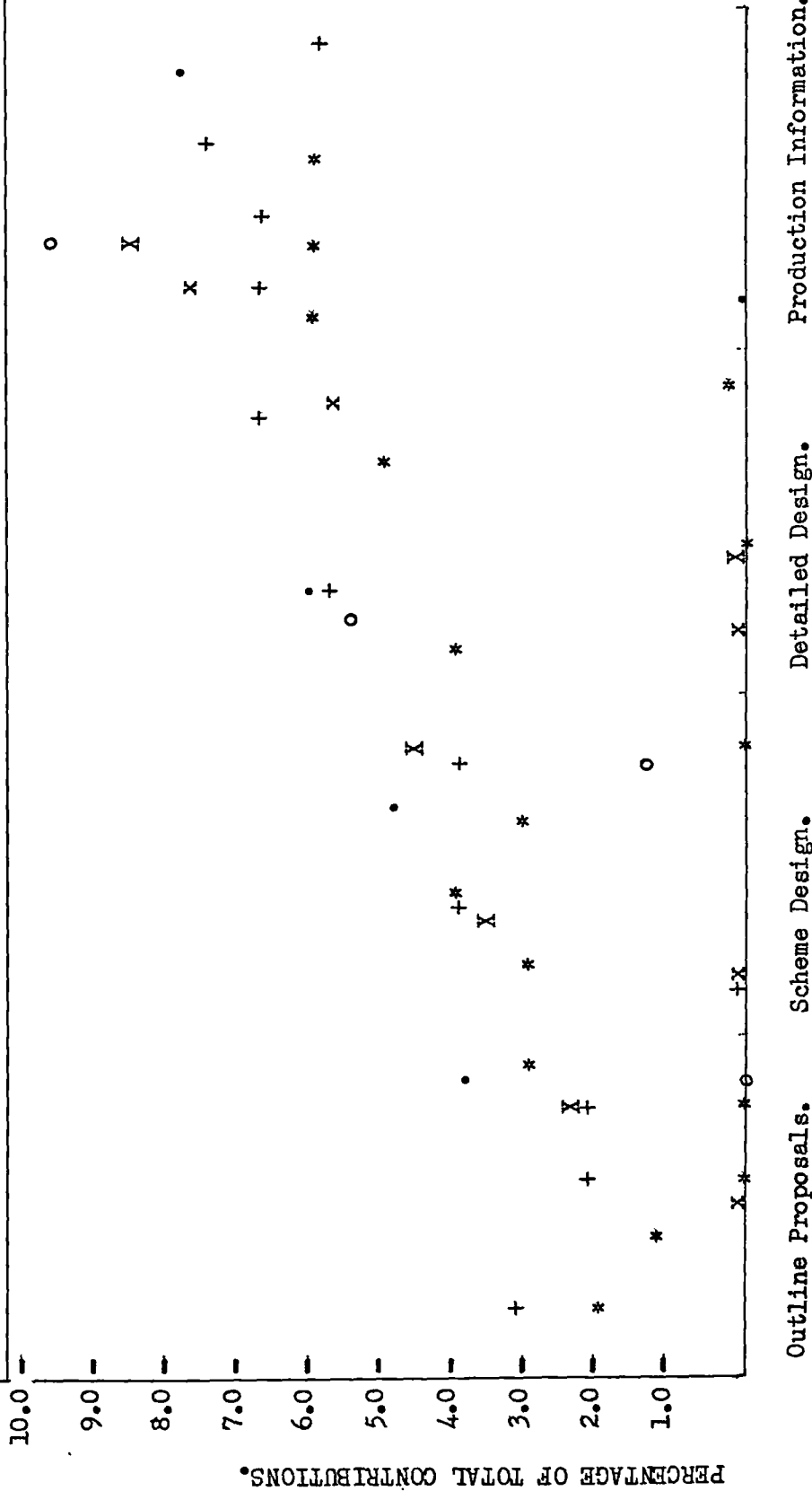
A
B
D(b)
G
I
J

Figure 57. Proportion of references to construction in Architect contributions.



A	*
B	+
D(b)	x
G	•
I	X
J	o

Figure 58. Proportion of references to market availability in Architect contributions.

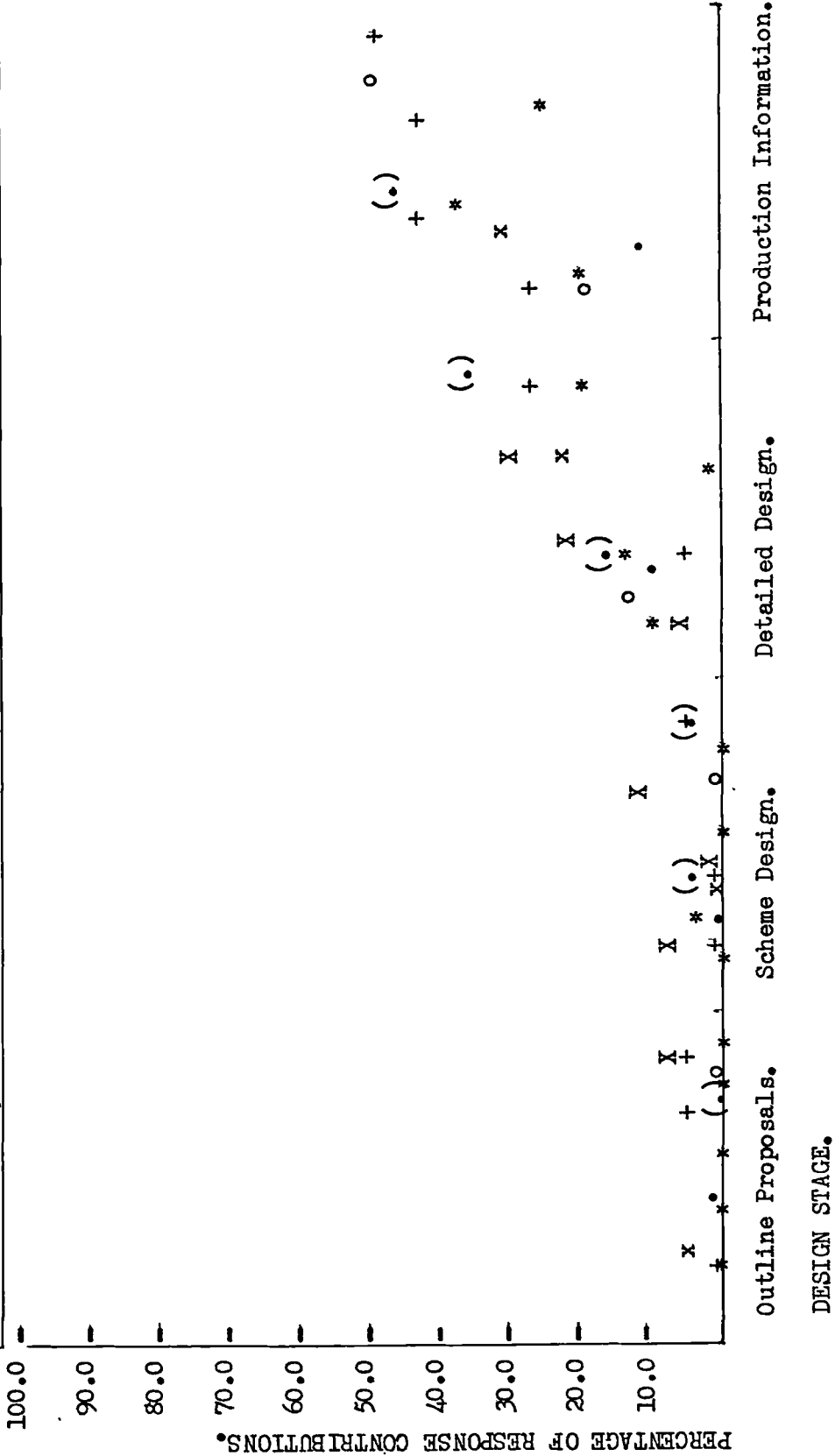


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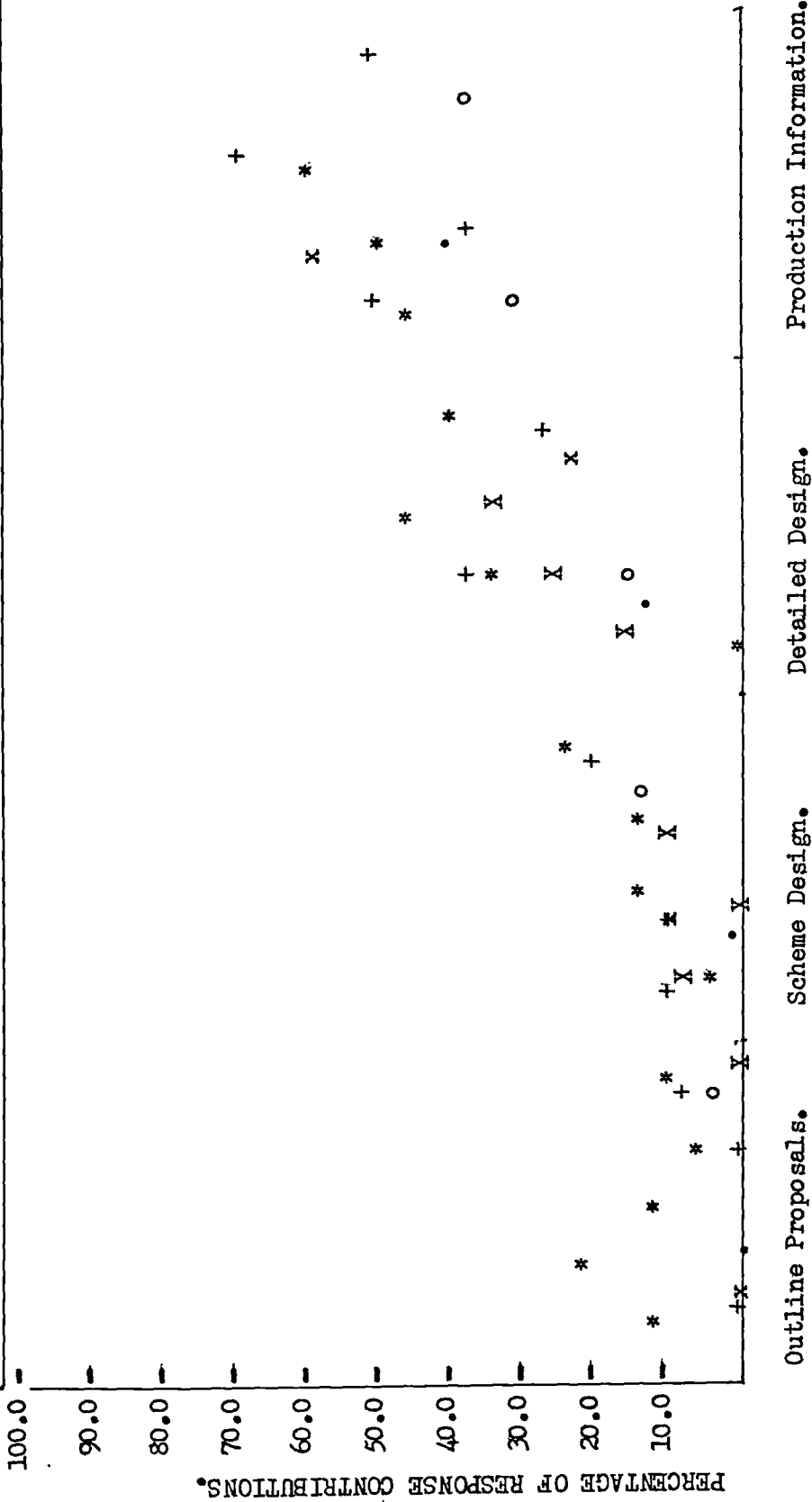
*	A
+	B
x	C
•	D(c)
o	F
(.)	G
	H

Figure 59(A). Proportion of Client Representative contributions containing a reference to construction, made in response to a new design concept suggestion contribution by the Architect.



*	A
+	B
x	C
•	D(c)
X	F
o	G
(.)	H

Figure 59(B). Proportion of Quantity Surveyor contributions containing a reference to construction, made in response to a new design concept suggestion contribution by the Architect.

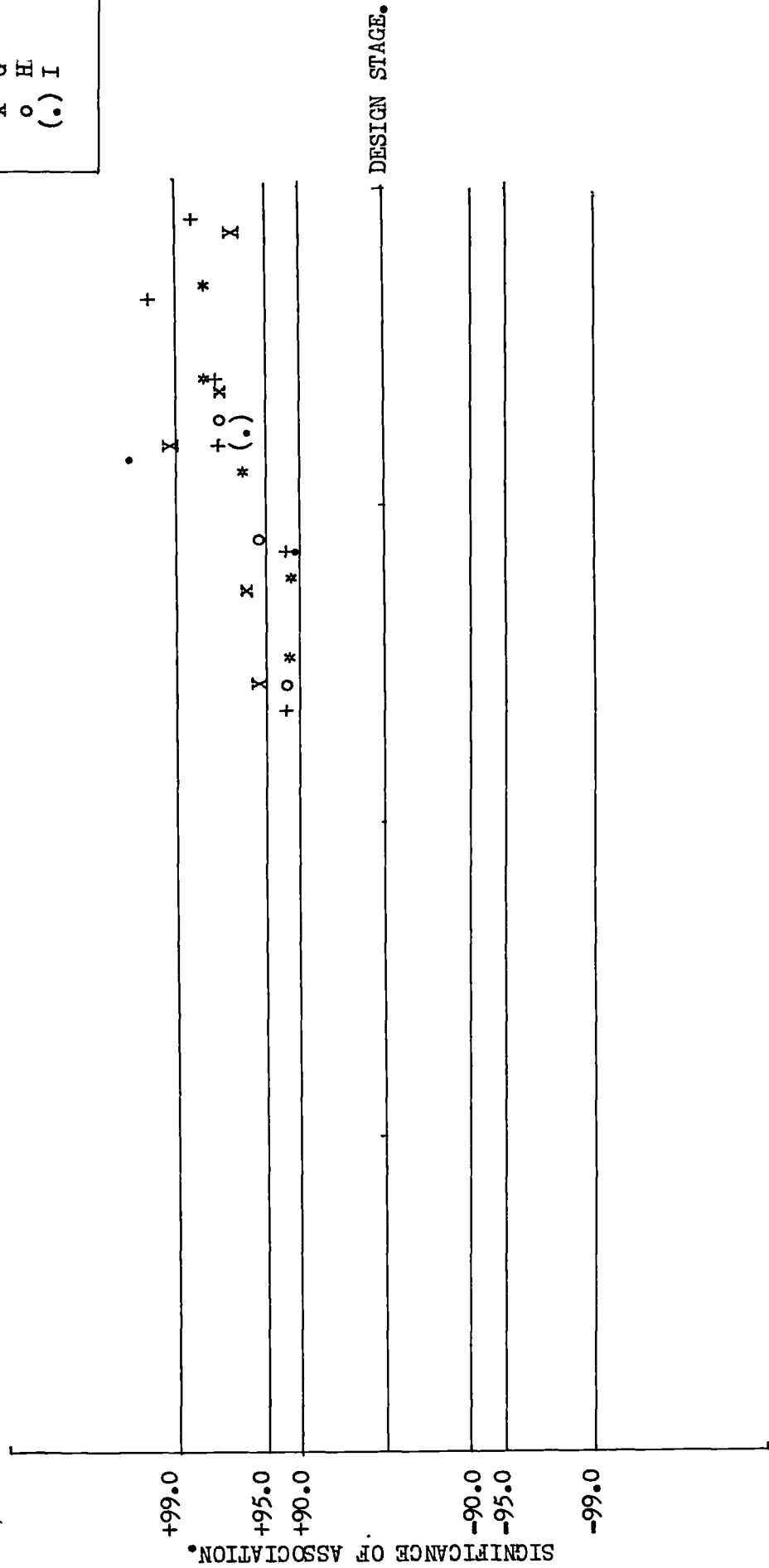


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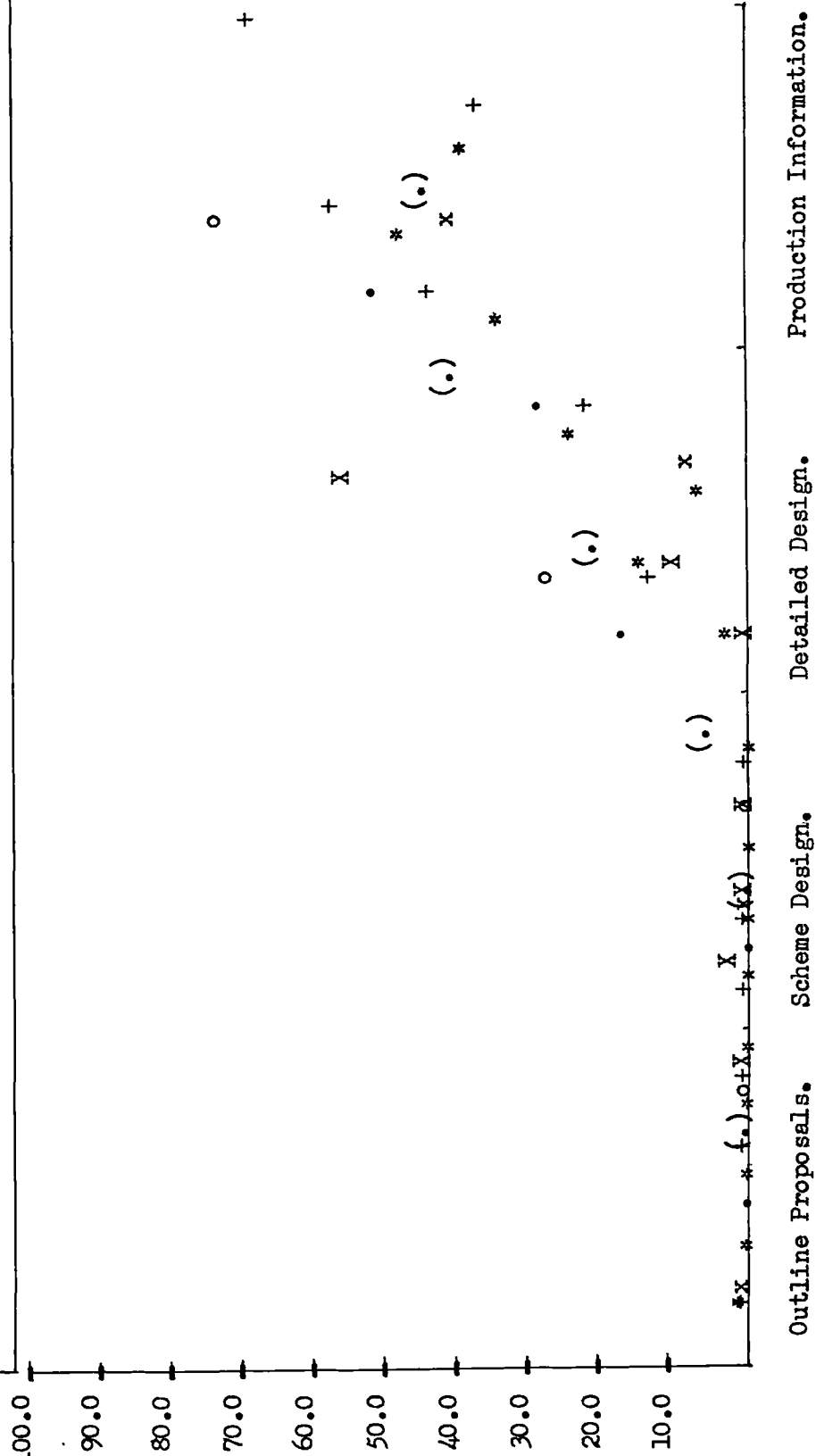
Figure 60. Variations in the significance of association between references to New Design Concepts and Construction in Architect contributions.

* A
 + B
 x C
 • D(b)
 x G
 o H
 (•) I



A
 B
 C
 D(b)
 F
 G
 H
 *
 +
 x
 •
 X
 O
 (•)

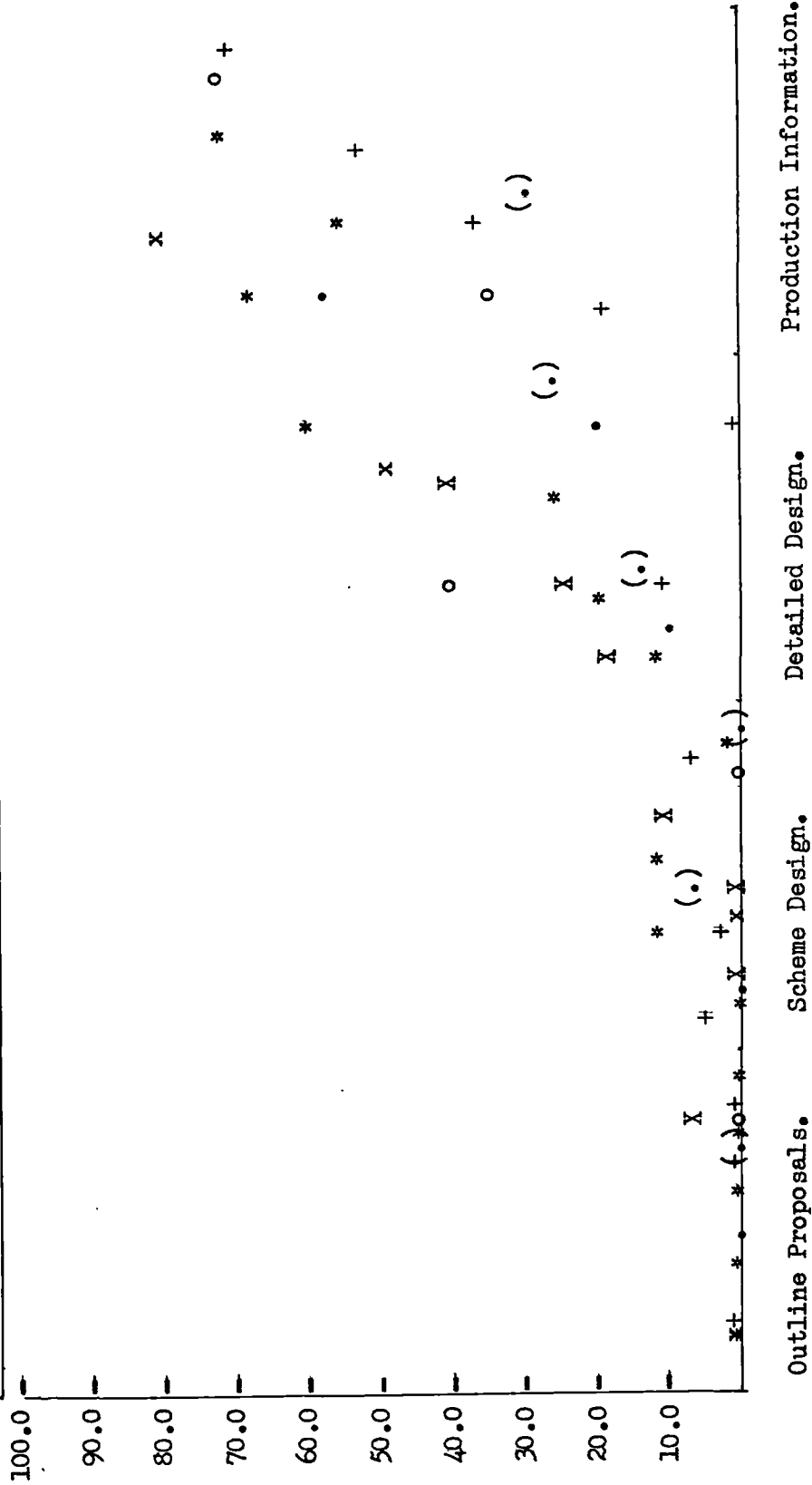
Figure 61(A). Proportion of Client objection contributions based upon construction made in response to a new design course of action proposal.



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Figure 61(B). Proportion of Quantity Surveyor objection contributions based upon construction made in response to a new design course of action proposal.

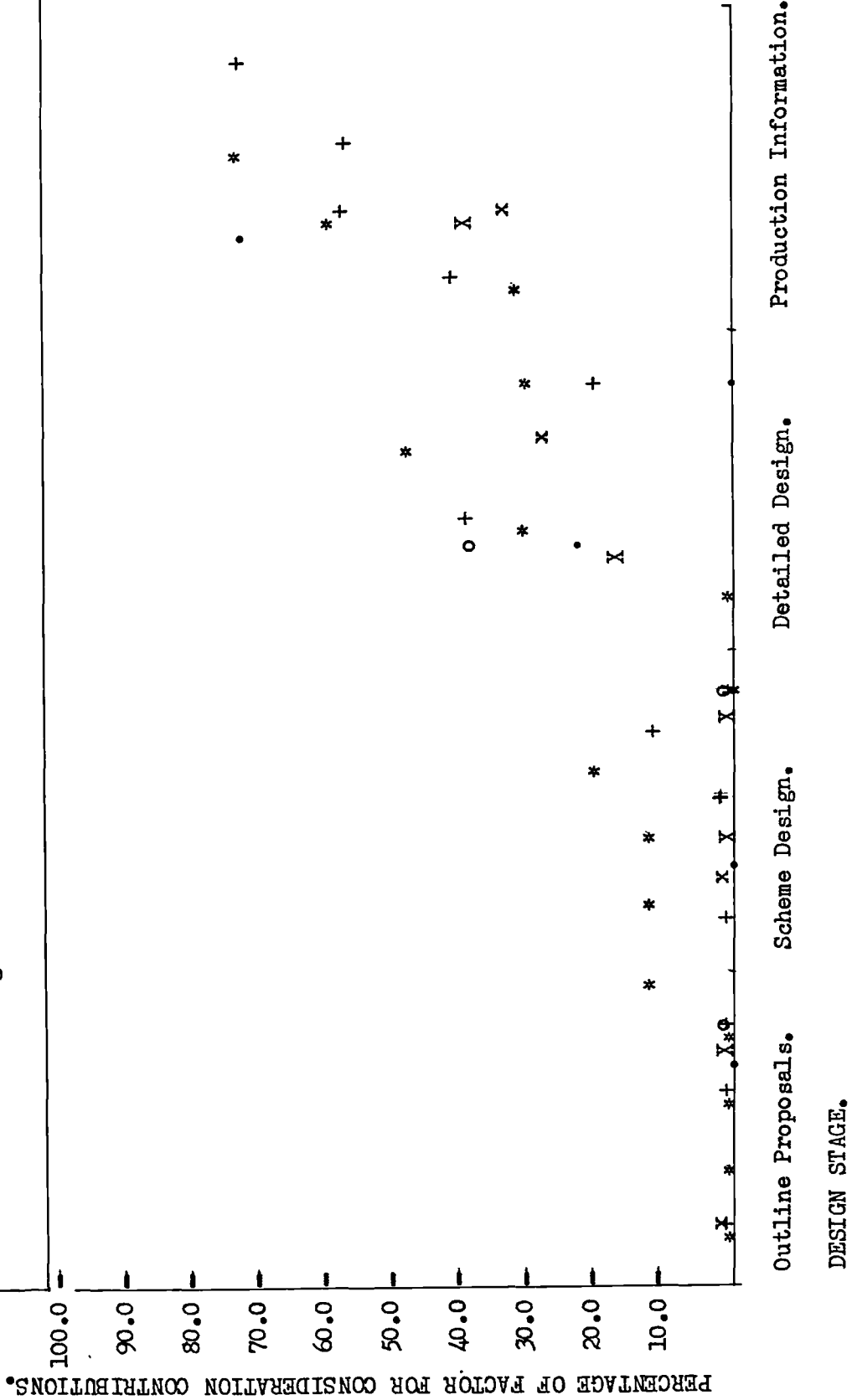
A
B
C
D(b)
F
G
H
*
+
x
•
o
(.)



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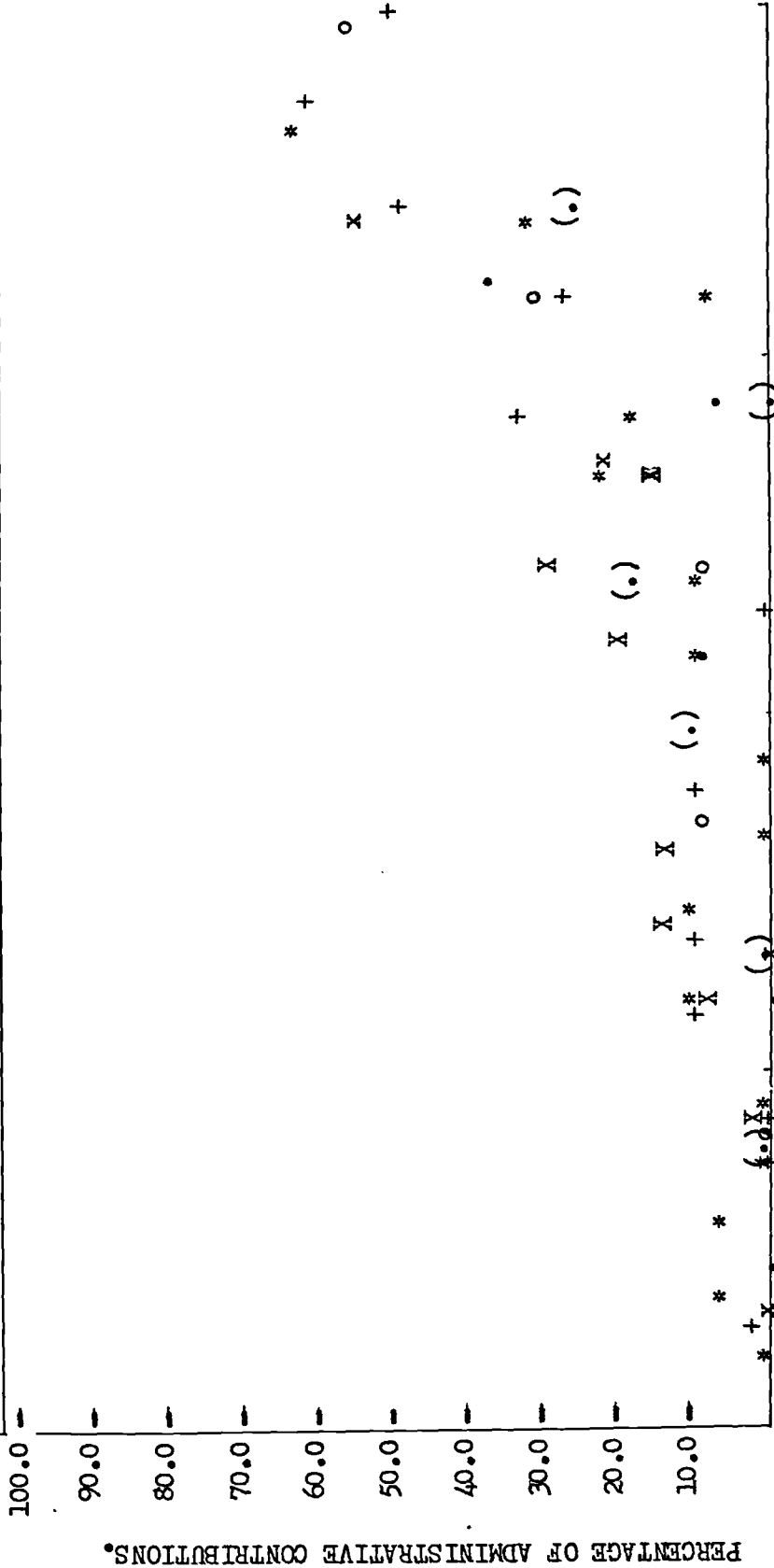
A	B	C	H	I	J
*	+	x	.	X	O

Figure 62. Proportion of Architect new design factor for consideration contributions containing a reference to construction.



*	A
+	B
x	C
.	D(b)
X	F
o	G
(.)	H

Figure 63. Proportion of Architect administrative contributions containing a reference to construction.

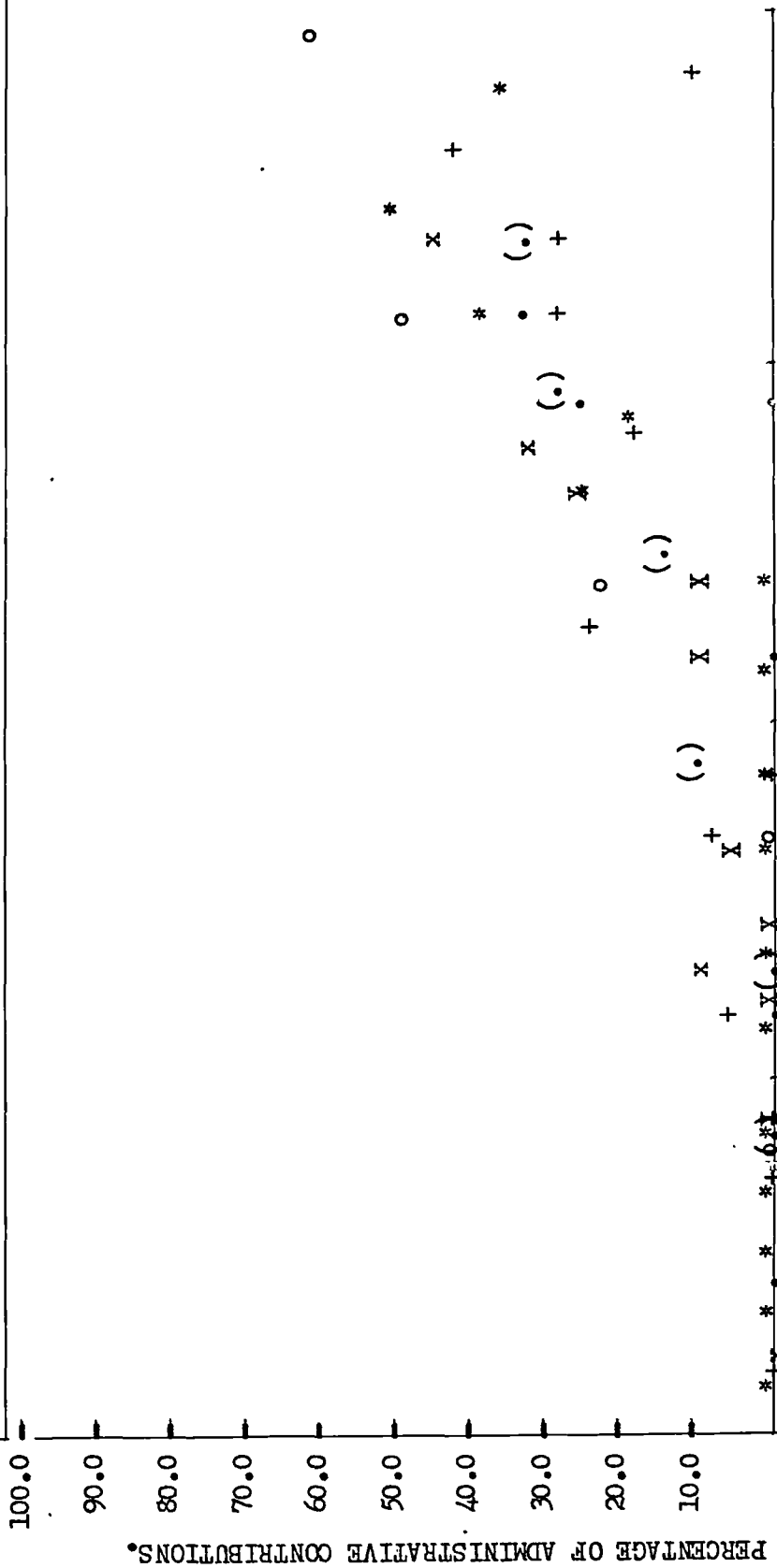


Outline Proposals. Scheme Design. Detailed Design. Production Information.

PERCENTAGE OF ADMINISTRATIVE CONTRIBUTIONS.

Figure 64. Proportion of Architect administrative contributions containing a reference to market availability.

*	A
+	B
x	C
•	D(b)
X	F
o	G
(.)	H



Outline Proposals. Scheme Design. Detailed Design. Production Information.
DESIGN STAGE.