STRATEGIES FOR IMPROVING PROBLEM SOLVING, HUMAN GROUP PROCESSES AND RELATED TRAINING

Volume I

Thesis Presented by Leslie Charles Saward for the Degree of Doctor of Philosophy of the University of Aston in Birmingham.

December 1976

STRATEGIES FOR IMPROVING PROBLEM SOLVING, HUMAN GROUP PROCESSES AND RELATED TRAINING

SUMMARY OF THESIS

1. Objectives

The objectives of this research are :

i) To develop problem-solving strategies to complement the Synectics technique, a range of problem-solving and related methods developed by Synectics Inc., U.S.A., and their international affiliates;
ii) To identify and measure problem-solving styles (patterns of behaviour) of Synectics group members;
iii) To identify and measure the interpersonal interactions within Synectics groups;
iv) To develop training strategies to supplement existing Synectics training procedures.

2. Research Base

6 five-day Synectics training courses were used to collect research data. These courses provided a principal sample of 98 Synectics sessions and 39 subjects.

3. Research Methods

Two research instruments were developed to measure the styles, group problem-solving competence and interpersonal

interactions. The instruments provide a basis for investigating problem-solving behaviour and human group processes, and for drawing together developments from applied psychology, problem-solving and organisation theory.

4. Results

Using process, content and factor analysis, 10 styles were identified. No one best style was found. Several style combinations were shown to be more effective than others. With continued practice, the 6 Synectics groups improved their problem-solving competence. Various problem-solving, communication and associated training strategies are derived from the identified styles.

5. Conclusions

Style influences problem-solving effectiveness. To become effective and efficient problem solvers, individuals should develop a range of styles and a high level of competence. Effectiveness can be improved by achieving style matches between individuals. Style flexibility is necessary to attain style matches.

6. Contribution to Knowledge

It is claimed that the contribution to knowledge is :

i) The design, development and application of two research instruments, one of which employs closed circuit television

in a specialised manner;

ii) The identification and exploration of problem-solving styles, problem-solving competence and interpersonal interactions within groups;

iii) The identification and development of role strategies;

iv) The development of a problem-solving handbook.

.....

To My Mother,

Eleni Saward - An Exceptional Lady

PREFACE

Volumes I, II, III and IV

The principal text of this thesis is presented in Volumes I and II. Appendices related to this research are shown in Volume III. Volume IV is the management report of this research. The Contents give chapter/appendix headings and pages. A summary and detailed list of contents precedes each chapter.

Synectics Terminology

Throughout the thesis, Synectics terms are printed in capitals in order to distinguish their specialist meanings. Definitions of Synectics terms are presented in Chapter Two.

Grammar

The male gender is used throughout the thesis for grammatical simplicity.

Trademark

'Synectics' is a registered trademark. Synectics training may be conducted only by approved licensees of the technique.

.....

ACKNOWLEDGEMENTS

I wish to extend my thanks to :

* Sydney Gregory - who taught me how to tighten my research, and assisted greatly in fitting together the pieces of the 'jigsaw'.

* Ray Taylor - who helped to put my ideas and written work into an overall perspective.

* Alan Montgomerie and the other staff members of the Interdisciplinary Higher Degrees Department - their unflagging energy to resolve administrative and personal problems is appreciated enormously.

* Vincent Nolan and the other staff members of Abraxas Management Research, who sponsored with S.R.C./S.S.R.C. this research.

The following individuals also deserve mention : Christopher Louman of I.B.M. (U.K.) Ltd., the staff members of Synectics Inc. (especially Marvin, Jo, Bill and Diane M.), Dr. Moya Dowson, and the University of Aston Library staff.

Finally, I would like to thank all those who participated in this research : their help in answering my questions was invaluable.

.....

VOLUME I

RESEARCH TASK

Volume I of this dissertation is concerned with :

i) The choice of research task;

ii) A literature review of studies related to the research task.

.....

CONTENTS

.....

CHAPTER ONE

INTRODUCTION

Summary

This chapter sets out the scope of this research, which is summarised briefly overleaf in Exhibit 1. As such, an introduction to the subsequent chapters is presented.

Contents

EXHIBIT 1 : Scope of Research

Task	Process	Product
Introduction : * Objectives * Motivation * Summary Literature Review * Synectics Methods (Chapter 2) * Leadership and Management Styles (Chapter 3) * Problem Solving (Chapter 4) * Human Group Processes (Chapter 5) * Training (Chapter 6) * Creativity (Chapter 7)	Chapter 8 : Development of criterion measures Application of research instruments : T.A.F. A & B and S.Q.S.Q. The use of C.C.T.V. as a training and research aid. Q-Methodology (Factor Analysis); Process Analysis; Content Analysis	Chapters 9 & 10 : Styles, Competence Factors and Interpersonal Interactions Strategies for improving problem solving, human group processes and related training Conclusions, Discussion, Recommendations and Limitations Synectics Problem-Solving Handbook

1.0 RESEARCH TASK

1.1 Objectives

There are 5 principal objectives :

i) To develop strategies for improving problem solving and human group processes. These strategies are intended to complement current Synectics methods.

ii) To identify and measure the styles of the individuals participating within Synectics problem-solving sessions.

iii) To identify and measure the interpersonal interactions of Synectics group members.

iv) To measure the changes over time in the level of group problem-solving competence (ability in using Synectics methods).

v) To assist the development of Synectics training by developing related strategies.

1.2 Motivation

Much of the original motivation for this research stemmed from my early Synectics experiences. In November 1973 I attended the five-day Synectics Basic Course organised by Abraxas Management Research. My feelings were then that Synectics methods encouraged an atmosphere of speculation

within groups, where rapid idea development and energetic commitment to solutions could occur. However, it was evident at times that the styles and interactions of the Synectics group members appeared almost in conflict. Thus, supported by the Abraxas staff members, research proposals and hypotheses were formulated in order to investigate the underlying dynamics of Synectics group operation.

1.3 Hypotheses

The following hypotheses are concerned with the principal roles of Synectics methods (LEADER, CLIENT and PARTICIPANT), the styles which are employed and the strategies derived from the styles. The hypotheses encompass the specific objectives of this research, whilst being sufficiently general to deal also with broader issues from the areas of problem solving, human group processes and related training.

Hypothesis No. 1 : That there are two LEADER role styles : a rigid and a flexible pattern of behaviour.

Hypothesis No. 2 : That there are two CLIENT role styles : an explicit and an unclear pattern of behaviour.

Hypothesis No. 3 : That there are different PARTICIPANT role styles.

There are 3 roles within Synectics group problem-solving sessions :

i) LEADER - who controls the process of the session;

ii) CLIENT - who controls the problem content and is the problem owner;

iii) PARTICIPANT - who assists the CLIENT in resolving his problem by, for example, offering ideas to him for his evaluation.

1.4 Literature Review

This is divided into 6 principal areas. The purpose is to abstract and bring together existing knowledge relevant to this research. The review areas are summarised in Exhibit 2.

EXHIBIT 2 : Literature Review

Area	Summary
Synectics Methods (Chapter 2)	Synectics skills, procedures and roles are described briefly with their history. The Synectics Problem-Solving Scheme is presented with criticism of the methods and a discussion of previous Synectics studies. (A comprehensive description of Synectics methods is presented in Volume IV.)
Leadership and Management Styles (Chapter 3)	Several theories and studies of leadership and management styles are reviewed and drawn together within a framework of task- and social-relations. Traditional leadership functions are compared with Synectics LEADER and CLIENT role requirements. Criticism is offered and areas indicated for further research.
Problem Solving (Chapter 4)	Problems, techniques, individual v. group applications, styles and strategies are discussed. The limitations of Synectics methods are indicated, as is the need to establish satisfactory criteria of problem-solving competence and effectiveness.
Human Group Processes (Chapter 5)	A framework is used to present group effectiveness studies. Synectics problem-solving groups are examined within this framework, with particular emphasis on communication patterns (interpersonal interactions) and strategies.
Training (Chapter 6)	Synectics training objectives and procedures are described. The effectiveness of Synectics training is discussed. The overall conclusion is that there should be more systematic evaluation and transfer of Synectics training.
Creativity (Chapter 7)	The relationship between Synectics methods and creativity is described and discussed in terms of definitions, theories and characteristics.

2.0 RESEARCH PROCESS

2.1 Development and Application of Research Instruments

Chronologically this was divided into two parts. Performance criteria were established first by a detailed content and process analysis of the notes concerning 52 Synectics sessions and 6 half-hour audiotape recordings of group discussions. The criteria reflect the views of the Abraxas staff and the June - August 1974 course members.

The criterion measures of competence (efficiency) and effectiveness having been developed, the research instruments were designed and subsequently refined. The principal features of the research instruments are summarised in Exhibit 3. The instruments were used to identify and measure the styles and interpersonal interactions of Synectics group members during the November 1974 - March 1975 monthly courses.

The two research instruments are :

i) T.A.F. A and B (Experimental Videotape Analysis Forms)

This was developed and employed to investigate Hypotheses No.s 1 and 2. It is a highly structured form for systematic and replicable analysis of videotape recordings of Synectics sessions. The primary objective is to measure LEADER and CLIENT role styles, interpersonal interactions and changes in group problem-solving competence. The identified styles form the basis of the

EXHIBIT 3 : Research Instruments

	T.A.F. A & B	S.Q.S.Q.
Primary Objective	i) To investigate the LEADER and CLIENT role styles ii) To identify and measure interpersonal interactions of Synectics group members	To identify PARTICIPANT role styles
Secondary Objective	To collect data on PARTICIPANT role styles	
Method of Analysis	Content and process analysis, with sociograms (graphical illustrations)	Q-technique (factor analysis)
Research Approach	Structured form completed by researcher from videotape recordings of Synectics sessions	Questionnaire of statements completed by course members

LEADER and CLIENT problem-solving and communication strategies.

ii) S.Q.S.Q. (Synectics Q-Sort Questionnaire)

This was developed and used to investigate Hypothesis No. 3. It comprises 50 statements about being a PARTICIPANT in a Synectics session. Individuals are asked to respond to the statements in terms of agreement - disagreement along a seven-point scale. There are no right or wrong responses to the statements. Rather the purpose is to obtain quantifiable individual perceptions of what it is to be a PARTICIPANT within a Synectics session.

The data from 39 completed questionnaires were factor analysed to identify the PARTICIPANT role styles. PARTICIPANT strategies are derived from these styles. Because of the limitations of factor analysis, S.Q.S.Q. is supplemented by T.A.F. A and B to identify and measure the interpersonal interactions of PARTICIPANTS within Synectics sessions.

3.0 RESEARCH PRODUCT

3 LEADER role styles were found, 2 CLIENT role styles and 5 PARTICIPANT role styles. These are summarised in Exhibit 4.

3.1 LEADER Role Styles

i) Full-Control : Synectics methods are applied rigidly by the LEADER.

ii) Shared-Control : The LEADER offers a range of procedural options to the CLIENT. Process control tends to be shared by the LEADER and CLIENT.

iii) Absent-Control : The Synectics group members as a whole control the process of the session.

3.2 CLIENT Role Styles

i) Explicit : The CLIENT is precise and clear in his control of the content of the session.

ii) Ambivalent : The CLIENT is vague and unclear in his control of the content of the session.

3.3 PARTICIPANT Role Styles

i) Research-Orientated : This PARTICIPANT tends to demand considerable information from the CLIENT before attempting to resolve the problem.

EXHIBIT 4 : LEADER, CLIENT and PARTICIPANT Role Styles

LEADER

Full-Control :	Shared-Control :	Absent-Control :
Rigidly applies Synectics methods	Offers procedural options to the CLIENT	CLIENT and PARTICIPANTS primarily control process

CLIENT

Explicit :	Ambivalent :
Precise in his control of content	Unclear in his control of content

PARTICIPANT

Research-Orientated : Demands considerable information
Divergent : Generates different problem-solving approaches
Systematic : Is methodical and orderly
Energetic : Is a lively, but at times erratic, Synectics group member
Challenging : Is confronting and at times argumentative

ii) Divergent : This PARTICIPANT is exploratory, and generates different problem-solving approaches.

iii) Systematic : This PARTICIPANT is methodical and orderly.

iv) Energetic : This PARTICIPANT is a zealous Synectics group member, who offers speculative ideas.

v) Challenging : This PARTICIPANT tends to confront other Synectics group members and to question the merits of their ideas.

3.4 Stages in Synectics Group Development

3 stages were identified in Synectics group development, representing successive changes in group problem-solving style and competence. These stages are summarised in Exhibit 5.

3.5 Effectiveness

Effectiveness is defined primarily within this research in terms of solutions per Synectics session. No one best style was found. The most effective sessions tended to be those where there were control-role style matches : the Shared-Control LEADERSHIP/Explicit CLIENTSHIP and Full-Control LEADERSHIP/Ambivalent CLIENTSHIP style combinations. They represent a balance between flexibility of process control (LEADER role) and clarity of content

EXHIBIT 5 : Stages in Synectics Group Development

Stage	Characteristics
Orientation	LEADER Style : Full-Control. CLIENT and PARTICIPANTS rely on LEADER for process control. Low level of group problem-solving competence.
Exploration	LEADER Style : Shared-Control. Partial reliance on LEADER for process control. Medium level of group problem-solving competence.
Autonomous	LEADER Style : Absent-Control. CLIENT and PARTICIPANTS are independent of LEADER for process control (except for adminstrative duties, such as the recording of solutions on large newsprint pads).

Increasing knowledge of, awareness of and practice in Synectics methods ↓

control (CLIENT role). The 5 PARTICIPANT role styles correspond as a whole to the reported characteristics of highly creative individuals.

3.6 Conclusions and Strategies

Problem-solving effectiveness is influenced by style. A high level of competence in a range of styles is desirable in order to optimise the problem-solving effectiveness of Synectics sessions. Synectics group members should adopt a contingency approach - altering their style(s) to achieve style matches.

Role strategies for improving problem solving, human group processes and related training may be derived from the identified styles. These strategies are summarised briefly in Exhibit 6.

.....

EXHIBIT 6 : Strategies for Improving Problem Solving, Human Group Processes and Related Training

Problem-Solving and Communication Strategies :

LEADER Role Strategies -

i) Should adopt the Full-Control style when interacting/ communicating with an Ambivalent CLIENT;

ii) Should adopt the Shared-Control style when interacting/ communicating with an Explicit CLIENT;

iii) Should adopt the Absent-Control style when operating within a highly competent Synectics group.

* The LEADER should achieve style matches with the CLIENT.

CLIENT Role Strategies -

i) Should adopt the Explicit style where specific ideas are wished for;

ii) Should adopt the Ambivalent style where he wishes to explore several problem-solving approaches.

Note : A CLIENT's style will depend much on his own interpretation of his own problem.

PARTICIPANT Role Strategies -

Should adopt the style(s) :

i) they feel is most suitable for themselves;

ii) instructed by the LEADER or suggested by the CLIENT.

Training Strategies/Methods :

The above strategies may be taught using :

i) (formal) lectures;

ii) demonstration;

iii) discussion (with videotape recordings);

iv) course literature.

A case study illustrating an application of these strategies is presented in Chapter Ten.

CHAPTER TWO

SYNECTICS METHODS

Summary

This is a description of Synectics history and the current Synectics Problem-Solving Scheme with its related elements. The effects of applying Synectics methods are examined, particularly at Ferodo Ltd., Chapel en le Frith, Stockport. Criticism of Synectics methods is given and areas for further research indicated.

Contents

1.0 SYNECTICS HISTORY

Synectics methods are a principal feature of this research. Synectics methods comprise :

i) 3 principal roles;
ii) a set of procedures and skills concerned with problem solving.

Put into use Synectics methods represent a style of working.

Synectics methods may be divided into two areas : those concerned with task-oriented aspects of problem solving and those concerned with the maintenance of group processes.

The name, Synectics, is derived from two Greek words, and means the 'the drawing together of diverse elements'. W. Gordon and G. Prince initiated in the early 1960's a kind of problem solving which was based upon a group composed of various backgrounds (an artist, a psychologist, a mathematician, etc.) working together on a problem (Gordon, 1961). Gordon and Prince had worked earlier with the Invention Design Group of Arthur D. Little Inc., an American consulting firm. The function of this group was to develop new or improved products and processes for client companies. As with other such groups they were sometimes successful and sometimes not. Unlike other groups they set about determining what procedures were leading them to success or otherwise. They observed themselves at work by

audio-recording and subsequently analysing their problem-solving sessions. Their objective was to identify the patterns and features of the activities that were leading them to successful conclusions. This provided a beginning for the Synectics technique. In the late 1950's Gordon, Prince and other members of group left Little Inc. to set up their own company - Synectics Inc. - devoted to invention, research into problem solving and teaching.

From 1960-1976 there have been three stages in the development of Synectics methods :

i) 1960-1965 :
Research into the application of fantasy to problem-solving activity.
ii) 1965-1968 :
Development and application of behavioural science (interpersonal communication) concepts.
iii) 1968-1976 :
Emphasis on the task-orientated aspects of problem-solving.

2.0 FEATURES OF SYNECTICS METHODS

Synectics methods are a set of skills, roles and procedures, which have been developed as a result of experience, research and demand. There are at present approximately 30 different elements taught during the Synectics Basic Course of training. The elements are summarised in Exhibit 1.

2.1. Role Definitions

There are three principal roles within a Synectics problem-solving session :

i) CLIENT : This is the problem owner. He controls the content of the session. The session is set up to assist him. Where several individuals share a particular problem, CLIENTSHIP is rotated in a series of Synectics sessions in order to achieve consensus on a course of action.

ii) LEADER : He controls the process of the session, and is not actively involved in the content. He records for the CLIENT the notes of the session on large newsprint pads.

iii) PARTICIPANT : He assists the CLIENT by offering ideas and opinions. He has a resource function, and has control of neither the process nor the content of the session.

Within any given Synectics group problem-solving session, there will be one LEADER, one CLIENT and one or more PARTICIPANTS.

There is the supplementary role of COACH. He is not involved actively in a Synectics session. His function is to observe and evaluate the problem-solving performance of the individuals in a Synectics session. His evaluation forms the basis for subsequent discussion of that performance.

EXHIBIT 1 : Elements Taught During the Synectics Basic Course

Element	Description	Purpose
Session Analysis	Identification of group-process and problem-solving issues.	To introduce Synectics methods.
Role Definitions	Distinction between CLIENT and LEADER, and responsibilities for for Content and Process respectively. Role of PARTICIPANT in working for the CLIENT. External role of COACH to evaluate performance.	To facilitate effective interpersonal interaction.
Listening	Understanding the dynamics of listening, including In-Out Listening, the Rehearsal Effect, and other barriers to effective listening.	To facilitate effective communication.
PARAPHRASE	Checking one's own understanding of what others have said to facilitate responding and developing ideas.	To facilitate effective communication.
HEADLINE	Stating the main elements of one's own contribution first, followed by the background thinking.	To facilitate effective communication.
ITEMISED RESPONSE (I.R.)	Identifying 3 or more positive (useful and helpful) aspects of an idea and one HOW TO STATEMENT, pointing the direction for idea development, followed by the background thinking.	To assist idea development.
Use of Note Pads	Constantly using note pads in Synectics sessions (In-Out Listening) to record ideas, opinions, etc.	To assist generally problem-solving activity.

EXHIBIT 1 Continued : Elements Taught During the Synectics Basic Course

Element	Description	Purpose
Use of large Newsprint (Pulp) Pads	Recording of session notes by LEADER.	To assist generally problem-solving activity.
Generation of HOW TO STATEMENTS	Rephrasing pieces of problem; initial period of speculation.	To investigate a problem.
Building	Listening carefully to the idea at hand and adding to it sequentially. This process calls for an ability to suspend one's own unrelated ideas and judgemental responses for the moment.	To assist idea development.
Crediting	Making verbal connections back to the ideas of individuals who stimulated one's own thoughts.	To encourage intra-group cooperation.
Questions	Understanding the general effect that questions appear to have; difference between intent and perception; practice stating reasons behind questions - "What I'm thinking is...."; familiarity in viewing questions as disguises for ideas.	To improve the efficiency of Synectics sessions.
IMAGING	Using mental pictures/ images to bring newness to problem-solving activity.	To stimulate novel solutions.
ABSURD SOLUTION/ CONNECTION	Creating initially an impossible solution that is stimulated by speculative material.	To link speculative thoughts with problem.

EXHIBIT 1 Continued : Elements Taught During the Synectics Basic Course

Element	Description	Purpose
FORCE FIT	Working the ABSURD SOLUTION into a practical one while maintaining the novelty and newness of the ideas.	To develop novel courses of action.
POSSIBLE SOLUTION	A course of action that is acceptable to the CLIENT, meeting the criteria of : appeal; feasibility; newness. CLIENT is able also to state his NEXT STEPS for implementing his POSSIBLE SOLUTION.	The objective of Synectics problem-solving sessions.
Idea	A suggested course of action, that may be in part acceptable to the CLIENT.	Component of POSSIBLE SOLUTIONS.
Skidding	Using videotape recording equipment to highlight certain points in a given Synectics session.	To discuss the Synectics session.
AGENDA MEETING	Summary listing of items for discussion.	To apply Synectics methods to non problem-solving meetings.
CONSENSUS MEETING	Rotation of CLIENT role to achieve a mutually-agreed course of action.	To apply Synectics methods to conflict situations and to problems which have one or more owners.
Informal Synectics Uses	Using Synectics methods when not officially called upon to conduct a Synectics session.	To apply informally Synectics methods.
ONE-ON-ONE MEETING	Synectics problem-solving session where the roles of CLIENT, LEADER and PARTICIPANT are shared between two individuals.	To apply Synectics methods in two-person situations.

EXHIBIT 1 Continued : Elements Taught During the Synectics Basic Course

Element	Description	Purpose
ONE-IN-ONE MEETING	Using Synectics methods in a paper-and-pencil session.	To apply Synectics method to individual problem-solving situations.
IMAGING EXCURSION	The stages of WORD ASSOCIATION, building an IMAGE, making an ABSURD CONNECTION/ SOLUTION, and then FORCE FITTING back to problem.	To apply fantasy in problem solving.
PROBLEM AS GIVEN (P.A.G.)	One sentence statement of problem.	To summarise a problem.
ANALYSIS	Background information about the problem.	To identify the salient aspects of the problem.
DECISION MAKING	Selection of one HOW STATEMENT by CLIENT.	To direct problem-solving activity.
SPLIT-SHEET I.R.	Written analysis of the strengths and weakness of a given problem-solving session.	To discuss how subsequent Synectics sessions might be improved.
COACHING	Evaluating a Synectics session by using the ITEMISED RESPONSE procedure.	To discuss how subsequent Synectics sessions might be improved.

3.0 SYNECTICS PROBLEM-SOLVING SCHEME

Exhibit 2 summarises the Synectics Problem-Solving Scheme. The Scheme has 4 stages :

i) Problem Definition;
ii) Problem Investigation;
iii) Idea Development;
iv) Problem Resolution.

i) Problem Definition

The CLIENT states his perception of his problem in terms of what he would like to do. Then he gives some background information to his problem.

ii) Problem Investigation

The PARTICIPANTS use this information to restate and reinterpret the problem as HOW TO STATEMENTS. These are quasi-questions which open up the problem. These might be speculative, challenging the CLIENT's perceptions, capturing ideas, etc. There is no evaluation at this stage. The CLIENT alone chooses the one HOW TO STATEMENT that identifies the most appealing area to him in which to develop ideas.

iii) Idea Development

Ideas are requested by the LEADER from the PARTICIPANTS

on achieving the chosen HOW TO STATEMENT. Every idea is PARAPHRASED by the CLIENT so that it is fully understood. The basis is then laid for idea development using ITEMISED RESPONSE : the CLIENT pinpoints the useful aspects of an idea and indicates where that idea needs developing into a solution.

iv) Problem Resolution

By concentration on idea development rather than on idea generation (as in Brainstorming sessions), the original idea is transformed into a POSSIBLE SOLUTION. This is a course of action which the CLIENT finds new, feasible and appealing. He is prepared to commit himself to its implementation.

3.1 Supplementary Procedure

If at any stage of the Scheme there is difficulty in generating and developing ideas the LEADER may introduce a supplementary procedure - EXCURSION - summarised in Exhibit 3. This procedure involves a deliberate departure into fantasy using mental images (IMAGING). The purpose is to create novel imaginative material which may be applied then to the problem. The Excursion procedure is inserted between the Problem Investigation and Idea Development stages of the Synectics Problem-Solving Scheme.

EXHIBIT 2 : Synectics Problem-Solving Scheme

Synectics Terminology	Explanation of Terminology
PROBLEM AS GIVEN (P.A.G.)	CLIENT gives one-sentence statement of his problem. Written up by LEADER on large newsprint pads.
ANALYSIS	CLIENT gives background information; why a problem for him; what has been tried and thought of to date; power to act; ideal solution/ what wished for from session.
GENERATION OF HOW TO STATEMENTS	CLIENT and PARTICIPANTS restate pieces of the P.A.G. and ANALYSIS as wishes, ideas, speculations, images, various approaches, etc. Written up by LEADER. - No Evaluation -
HOW TO STATEMENT SELECTION & MINI-ANALYSIS	CLIENT selects one HOW TO STATEMENT for PARTICIPANTS to focus upon. He says what is appealing about it, and where help is needed to develop it.
IDEA	A PARTICIPANT proposes one course of action.
PARAPHRASE	CLIENT gives his understanding of the idea; his understanding is checked with the PARTICIPANT who suggested that idea.
ITEMISED RESPONSE	CLIENT states 3 or more plusses for the idea, and indicates where the idea needs developing by a HOW TO STATEMENT.
IDEA-PARAPHRASE-ITEMISED RESPONSE PROCEDURES ARE REPEATED UNTIL A POSSIBLE SOLUTION IS ACHIEVED.	
POSSIBLE SOLUTION & NEXT STEPS	CLIENT states one course of action, which i) feasible; ii) appealing; iii) new (to him). CLIENT also states what he will do next to implement his POSSIBLE SOLUTION. Written up by the LEADER.

Flowsheet

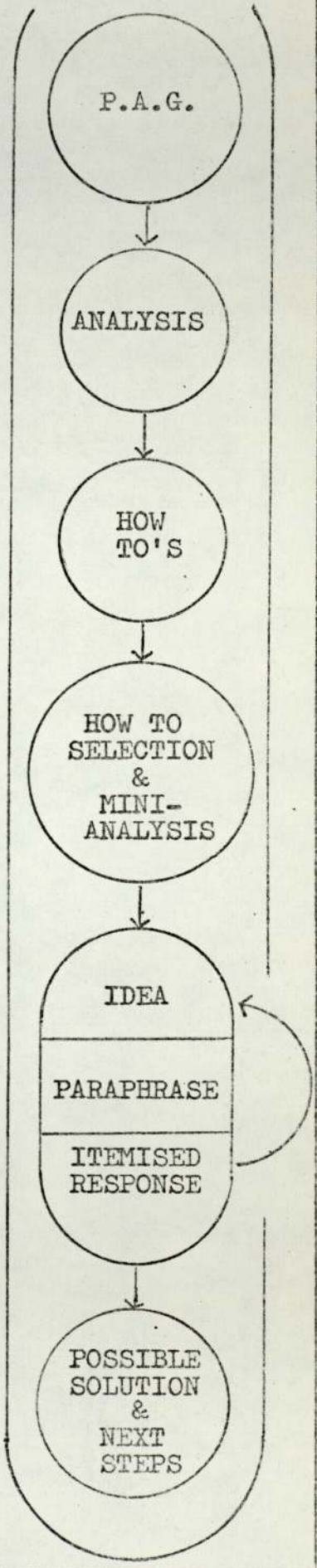
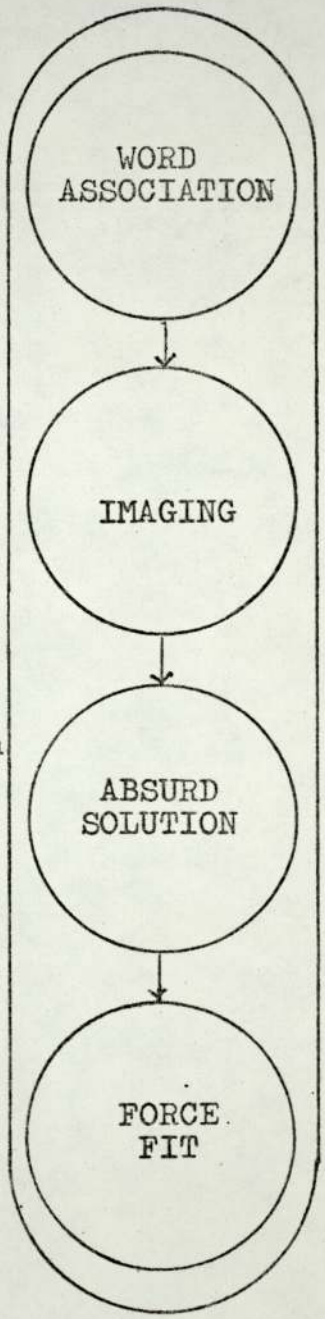


EXHIBIT 3 : Excursion Procedure

Synectics Terminology	Explanation of Terminology
WORD ASSOCIATION	LEADER asks CLIENT and PARTICIPANTS to write any ideas on their pads (Idea Purge). He clears large newsprint pads, and chooses a word from the selected HOW TO STATEMENT. He asks CLIENT and PARTICIPANTS to offer one-word connections to that word. Written up by LEADER. After 2-3 rotations he chooses another word which he perceives to be unconnected to the problem.
IMAGING	LEADER asks CLIENT and PARTICIPANTS to develop silently mental pictures around the newly-chosen word. Having developed their pictures, he asks for a PARTICIPANT to offer his IMAGES. CLIENT and PARTICIPANTS build. Written up by LEADER. He stops this exercise when he has 3-4 pages of notes.
ABSURD SOLUTION	LEADER asks CLIENT and PARTICIPANTS to develop silently from the IMAGING notes courses of action, which : i) defy reality; ii) are connected to the selected HOW TO STATEMENT; iii) resolve the problem, albeit ridiculously. LEADER asks for one ABSURD SOLUTION. CLIENT and PARTICIPANTS build.
FORCE FIT	CLIENT and PARTICIPANTS gradually introduce reality into the ABSURD SOLUTION. LEADER asks CLIENT for informal PARAPHRASE and ITEMISED RESPONSE.

Flowsheet



4.0 STYLES AND SYNECTICS ROLES

The primary focus of this research is upon Synectics group problem-solving sessions. The main objective is to develop strategies from the identified styles (patterns of behaviour) associated with the roles used within Synectics sessions. The strategies may be employed to complement current Synectics methods.

5.0 EFFECTIVENESS OF SYNECTICS METHODS

As with other educational and training programmes, there is the issue concerning the practical outcomes of applying Synectics methods. Examples of measures of outcomes might include :

i) CLIENT's immediate satisfaction with his solution;
ii) Number of ideas generated, which may be developed potentially into solutions;
iii) Number of solutions implemented;
iv) Value of implemented solutions.

The published information on the effects of applying Synectics methods is as follows :

Reilly (1970) described how Synectics methods were used successfully :

i) by Kimberly-Clark Inc. in developing its Kleenex space-saver box for paper tissues;
ii) by Sunoco Inc. in creating its dial-your-own petrol pump system;
iii) by Ford Car Company in developing a new suspension system.

Bujake (1969) and Farone (1971) also described Synectics applications to new product development. Both pointed to

benefits of using Synectics methods in fostering greater cooperation between individuals in any group situation. Bujake maintained :

" Though the emphasis has been placed on new product concepts, it should be stressed that this process can be applied to problem solving in almost any area.....This type of approach can be of assistance in meaningful long-range planning and can lessen wasted efforts in product development. By generating a large number of alternatives, effective decision making can be enhanced." (p.20)

Hughes (1972) reported on her survey of over 500 individuals from 36 American companies that have applied Synectics methods over ten years. She argued that the problem-solving aspects of Synectics methods were only "a small fraction of the total benefit which could be achieved." (p.101)

Two individuals in the survey concluded :

"Synectics could be of great value if used on a continuing basis."
"Anything we could do to internalise the process in order that it became a part of our everyday operating procedure would be extremely beneficial." (p.104)

Most of the difficulties of applying Synectics methods arose

from organisational characteristics, such as intense time pressures, formal atmosphere, absence of mutual intent and lack of trained LEADERS.

The mobility of individuals in the corporate organisations appeared to complicate continuing follow-up of solutions and to discourage the implementation of long-range solutions.

Nolan (1974) confirmed most of Hughes's findings in his review of applying Synectics methods from 1972-1974. Indicating the difficulty of evaluating the effects of applying Synectics methods, he listed the following benefits :

i) Understanding of the process issues which arise in problem solving;
ii) Appreciation of the rewards in finding value in all ideas, and the scope of transforming an imperfect idea into something more useful;
iii) Better communication skills;
iv) Value of defining roles and functions in any work situation.

5.1 Ferodo Study — Parker (1975)

The Ferodo study is highlighted here because it is the most systematic study on the effects of applying Synectics methods within the U.K. Ferodo Ltd. is a member of the Turner and Newall group of companies and manufactures brake linings and related products for the car industry.

Following an earlier study of the effectiveness of research in his department (Parker, 1971), Parker decided to investigate the application of specific problem-solving techniques to activities within the company.

He chose Synectics methods, and carried out 71 group problem-solving sessions over two years. 69% of the sessions achieved solutions. In the last 17 sessions solutions were reached in every instance, indicating that the probability of resolving a problem increases with continued use of the Synectics methods.

Although the number of successful Synectics sessions was judged to be satisfactory, confirmation of the effectiveness of Synectics methods was sought by running comparative problem-solving sessions, using a Synectics group and a control group (no training in Synectics methods). The control group was selected to match the Synectics group as closely as possible in terms of discipline, status, age and sex. Both groups were given identical problems and the same time to achieve a solution. Virtually identical ideas emerged from both groups. The first problem was scientific. Only the Synectics group developed ideas into a satisfactory solution. The second problem was managerial and the results were similar. However, the control group was deflected by high tempers.

In the third session, the control group attempted to resolve a serious management problem by advancing 10 different ideas, which received little acceptance. A parallel Synectics session contributed 48 ideas and a solution that was accepted enthusiastically.

Parker's two-year study confirms the need for further longitudinal research into the effectiveness of Synectics methods. Parker demonstrated that the Synectics technique is an effective group problem-solving approach. He concluded :

"It generates an atmosphere in which people are encouraged to participate to the utmost, and imposes a discipline that directs the group at a solution and stimulates new ideas. It also has great potential for dealing with problems that involve many sections of a company in that it fosters team commitment." (p.23)

Other studies involving the application of Synectics methods are reviewed appropriately throughout the thesis.

6.0 CRITICISM

6.1 Strengths of Synectics Methods

i) The Synectics Problem-Solving Scheme offers a framework in which new courses of action may be formulated. Synectics methods encourage cooperation and create a climate in which ideas may be developed into solutions.

ii) Synectics methods have wide application within management. Rickards (1974) listed 14 management functions where Synectics methods may be used.

iii) Synectics methods have been developed and improved to take into account new research findings from the field of psychology.

6.2 Weaknesses of Synectics Methods

i) There is little agreement as to the effectiveness of Synectics methods. This is conceded by Prince (1975). Little independent scientific evidence exists on their effectiveness.

ii) It is difficult to compare Synectics studies. The methods taught in the early 1960's are still in current use, but now only form a sub-set of total Synectics methods. This research is concerned with post 1968 methods.

Difficulties of comparison also stem from different Synectics practitioners using Synectics methods in different ways. The position is confused further by the existence of two separate companies in the U.S.A. teaching Synectics methods - Synectics Inc. and Synectics Learning Systems Inc.

Additional criticism of Synectics methods is presented appropriately throughout the thesis.

7.0 CONCLUSIONS

i) Synectics methods have wide application within management.

ii) Synectics methods offer a coherent problem-solving approach.

iii) More systematic research needs to be carried out into the effects of applying Synectics methods. Detailed case study evidence, similar to Parker's research, would be most useful. Such studies might be used to extend the range of Synectics applications. Ideally there should be comparative data on the application of Synectics methods to evaluate their effectiveness.

.....

CHAPTER THREE

LEADERSHIP AND MANAGEMENT STYLES

Summary

This is a review of theories and studies of leadership and management styles. Where possible, these are drawn together within a framework of task- and social-relations orientation. In Synectics groups problem-solving behaviour is characterised by style. The key functions of the LEADER and CLIENT are discussed in relation to traditional leadership requirements, of which style is an important aspect.

Contents

1.0 DEFINITIONS

1.1 Leadership

A dictionary definition of leadership is :

"The exercise of authority in a social group; the quality or qualities upon which such exercise of authority depends, varying with the nature of the social group, and the circumstances which leadership is displayed or established." (Drever and Wallerstein, 1964; p. 154)

From a broader perspective, the leader of a given group is the individual who influences the behaviour of other individuals in that group.

Because every group member influences the behaviour of others, each is to some extent a leader. However, if one individual tends to influence outstandingly the behaviour and activities of the other group members, he is the primary leader.

Leader and member behaviour have reciprocal influences. Haythorn (1956) studied the effects of varying combinations of authoritarian and egalitarian leaders and group members. He found that the behaviour of the leaders was a function of the attitudes of their members.

The formal leader of a group may or may not be its actual leader. The formal leader is the individual who is elected or

appointed to a position of authority. The actual leader is the individual who influences outstandingly the behaviour, activities, ideology and goals of the group members.

1.2 Style

Style is defined as a pattern of behaviour.

Leadership and management styles are considered within this research. The reasons are :

i) Synectics methods are concerned in part with leadership;
ii) Groups involved in Synectics training are composed generally of managers.

Style has been measured frequently in terms of task orientation and social-relations orientation. In pattern terms, these are known as 'Initiating Structure' and 'Consideration' (Fleishman et al., 1955).

Initiating Structure refers to a leader :

i) Organising and defining the relationship between himself and the members of his group in a variety of ways which range from informal - formal, explicit - implicit, etc.
ii) Defining the role of each member;
iii) Endeavouring to establish characteristic patterns of organisation;

iv) Controlling the channels of communication, resources (human, technical and economic) and task activity.

Consideration refers to the behaviour relating to cohesiveness, mutual trust, respect and interpersonal interaction between the leader and his members.

Leadership style should be distinguished from management style and organisational style.

Leadership style refers to the particular pattern of behaviour of the leader relative to the behaviour of his group members.

Management style refers to the collective pattern of behaviour of a given group of managers.

Organisational style refers to the collective pattern of behaviour of an association of groups.

These categories of styles have been confused sometimes. For example, Halal (1974) put forward a useful framework of 5 models of leadership. He mixed studies on organisational style with those concerned with management and leadership style.

However, organisational style influences reciprocally leadership style by, for example, constraining a leader's freedom to act. Also a given leader may alter his organisation's structure and therefore influence its style.

Organisational style is considered within this research as appropriate.

1.3 Effectiveness

Effectiveness may be defined in terms of :

i) The degree of goal achievement (Price, 1968; 1972). This is the extent to which a leader is instrumental in achieving his group's agreed goal(s);
ii) The fulfillment of the requirements of a given leader's role (Reddin, 1970). A leader may be required to carry out certain functions and duties. The success with which he carries out his functions and duties is a measure of leadership effectiveness.

Both aspects of leadership effectiveness are considered within this research.

2.0 INTRODUCTION

Among social scientists there is no close agreement on :

i) the conceptual nature of leadership and its necessary characteristics;
ii) the theoretical significance of the leadership process;
iii) the characteristics of the highly effective leader.

Leadership appears to have at least 4 major meanings :

i) an activity in a role or situation;
ii) an attribute of a role;
iii) characteristics (physical/behavioural) of an individual;
iv) a category of behaviour.

Early studies which attempted to identify the (physical) characteristics of effective leadership have been revealed to be inadequate (Bird, 1940; Gibb, 1954; Mann, 1959).

Boring (1945) maintained that a leader exercises authority, is industrious, competent, confident, responsible, etc. Bird (1940) reviewed 20 studies on leadership. He listed 79 traits which were found to characterise leadership behaviour. There was little overlap between the studies.

Stogdill's (1948) review indicated that leadership may be viewed as a relationship existing between individuals in a social situation.

According to Stogdill, leadership is dependent upon :

i) Personal characteristics (personality traits and physical characteristics);
ii) Situational characteristics (time, place, the 'followers', environment, and nature of task).

Despite Stogdill's review, most researchers ignored until relatively recently situational characteristics and variables. Instead, leadership studies tended to centre upon dichotomous behavioural variables : Argyle et al. (1958) studied democratic v. authoritarian styles; Likert (1961) and Katz (1963) studied employee-centred v. job-centred styles; and Pelz (1956), Stogdill and Coons (1957) and Fleishman and Peters (1962) studied participatory v. non-participatory styles.

More recently effort has been directed towards contingency theories of leadership and management effectiveness. The general hypothesis of these theories is that different patterns of behaviour are required in different situations to achieve individual and group goals.

There have been several major reviews of leadership studies (Krech et al., 1962; Cartwright and Zander, 1962; Stogdill, 1974). The general findings of these reviews are summarised in Exhibit 1.

EXHIBIT 1 : General Findings of Leadership Studies - Krech et al. (1962); Cartwright and Zander (1962); Stogdill (1974)

1. Factor-analytic studies have shown that individual differences in leadership behaviour may be considered on two primary dimensions : 'Initiating Structure' and 'Consideration'.

2. Studies on Authoritarian/Democratic/Laissez-faire styles have revealed that the Democratic style encourages cohesiveness, member satisfaction and high acceptance of group goals. The Laissez-faire style has been shown to be the least effective, with the Authoritarian style being marginally more effective than the Democratic style.

3. Leaders must satisfy the individual expectations and wants of their members in order that the group is effective as a whole.

4. Research evidence on personality characteristics has been shown to be inconclusive; although certain traits such as high intelligence, dominance and ascendance appear to be common to highly effective leaders.

3.0 THEORIES

This is a review of the major theories of leadership and management styles.

Exhibit 2 summarises these theories.

Exhibit 3 summarises the theories that have been concerned directly or indirectly with Consideration and Initiating Structure.

3.1 Taylor's Scientific Management (1911)

Taylor (1911) put forward his postulates on 'Scientific Management'. He argued that individuals are motivated to work if rewards and penalties are tied directly to performance, using an external control system. In a series of informal experiments, he demonstrated that the most effective style of leadership was high task orientation (Aitken, 1935).

Criticism

i) Taylor demonstrated that systematic analysis of work and management processes was useful in improving effectiveness.

ii) Taylor instigated many modern management practices including work study, job evaluation, merit rating, and work simplification.

EXHIBIT 2 : Major Theories of Leadership and Management Styles

Date	Author	Base	Central Principle	Major Contention
1911	Taylor	Scientific Management	Engineering	High-task orientation is best
1931	Mayo, Roethlis-berger, Dickson	Human Relations	Motivation	High social-relations is best
1938	Lewin, Lippit, White	Michigan State University Studies	Participation	Democratic approach is generally best
1955	Fleishman, Harris	Ohio State Studies	Consideration and Initiating Structure	No one best style
1959	Herzberg	Job Satisfaction	Motivation	Use of 'satisfiers' leads to high motivation
1960	Bass	O.R.I. (Orientation Inventory)	Consideration and Initiating Structure	Style must fit situation (contingency approach)
1961	Likert	Comparative Management Systems	Participation	(Movement towards) System 4 is best
1961	Berne, Harris	Transactional Analysis	Psychotherapy; Interpersonal Behaviour	Style match (I'm O.K. - You're O.K.) is best
1962	McGregor	Comparative Management Systems : Theories X & Y	Participation	Theory Y is best

EXHIBIT 2 Continued : Major Theories of Leadership and Management Styles

Date	Author	Base	Central Principle	Major Contention
1964	Reddin	3-D Theory (Extension of Ohio State Studies)	Consideration and Initiating Structure	Style must fit situation (contingency approach)
1964	Blake, Mouton	Managerial Grid	Consideration and Initiating Structure	9,9 style is best
1965	Fiedler	Multi-observation using L.P.C. (Least Preferred Co-worker) Scale	Consideration and Initiating Structure	Style must fit situation (contingency approach)
1968	Adair	Eclectic	Action-Centred Leadership	Fulfillment of individual, group and task needs
1970	Argyris	Eclectic; Motivation	'Self-Actualisation'	Individuals are most effective when they achieve self-actualisation
1971	House, Dessler, Stinson	Path-Goal (Expectancy)	Motivation	Style must fit situation (contingency approach)

EXHIBIT 3 : Framework of Leadership and Management Styles

Initiating Structure / Task Orientation	Low Social-Relations Orientation / Consideration	High Social-Relations Orientation / Consideration
high	*Authoritarian (Lewin et al.) *Scientific Management (Taylor) *Theory X (McGregor) *Low L.P.C. (Fiedler) *Benevolent Autocrat/ Autocrat : Dedicated style (Reddin) *I'm O.K. - You're not O.K. (Harris) *O.R.I. task-orientated (Bass)	*Participative (Likert) *Managerial Grid 9,9 ideal style (Blake & Mouton) *Theory Y (McGregor) *Executive/Compromiser : Integrated style (Reddin) *I'm O.K. - You're O.K. (Harris)
		*Democratic (Lewin et al.)
	*Consultative (Likert)	
	*O.R.I. self-orientated (Bass) *Deserter/Bureaucrat : Separated style (Reddin) *Laissez-faire (Lewin et al.) *I'm not O.K. - You're not O.K. (Harris)	*O.R.I. interaction-orientated (Bass) *Human Relations (Mayo et al.) Missionary/Developer : Related style (Reddin) *High L.P.C. (Fiedler) *I'm not O.K. - You're O.K. (Harris)
low		

This is a detailed revision of the framework proposed by Gagné and Fleishman (1959). The framework offers an approach for integrating (apparently conflicting) theories of leadership and management styles.

iii) It is difficult for an external control system to encompass individuals' higher order needs of self-esteem and self-actualisation (Maslow, 1954).

iv) Tannenbaum (1964) maintained that certain rewards and penalties relevant to social needs are controlled by the informal organisation. These sanctions may work against the formal leadership structure, rendering ineffective the practice of Scientific Management principles.

v) Taylor's methods aroused hostility from trade unions. They resented particularly his time-study technique and the imposition of a set of standards they were not involved in formulating.

vi) Woodward (1965) pointed to the danger of viewing Taylor's 'principles' as if they were scientific laws. They are little more than administrative expedients which were found to be highly effective in certain circumstances, but have not been tested systematically.

3.2 Human Relations : Hawthorne Studies (1931)

Roethlisberger and Dickson (1931) argued that motivation is raised where work is carried out in small groups. Leaders should be high social-relations orientated. They should encourage their members to develop favourable views of their situation and avoid creating a sense of frustration or threat.

Criticism

i) Scientific Management in focussing upon 'Economic Man' failed to account for 'Social Man' - the concern of the Hawthorne studies. The Hawthorne studies illustrated the importance of both social-relations and task orientation for group effectiveness.

ii) Homans (1945) found that Human Relations procedures have not always had the desired effect upon on work motivation or productivity. Factors, such as communications, might be dependent rather than independent variables of group leadership structure.

iii) Kelly (1969) suggested that the Hawthorne Studies had inadequate theoretical foundations and that the results have been overgeneralised.

iv) Kelly argued that the Hawthorne Studies failed to take into account sufficiently the complexities of organisational structure.

3.3 Michigan State University Studies (1938)

In a series of experiments from 1938 onwards, Lippitt and White (1958) distinguished 3 styles of leadership. The characteristics of each style are :

i) Authoritarian

* Gives orders that he determines shall be obeyed;
* Determines policies for the group without consultation;
* Gives no detailed information about future plans, but simply tells the group what immediate steps they must take;
* Gives personal praise or criticism to members on his own initiative;
* Remains aloof from the group for the greater part of the time.

ii) Democratic

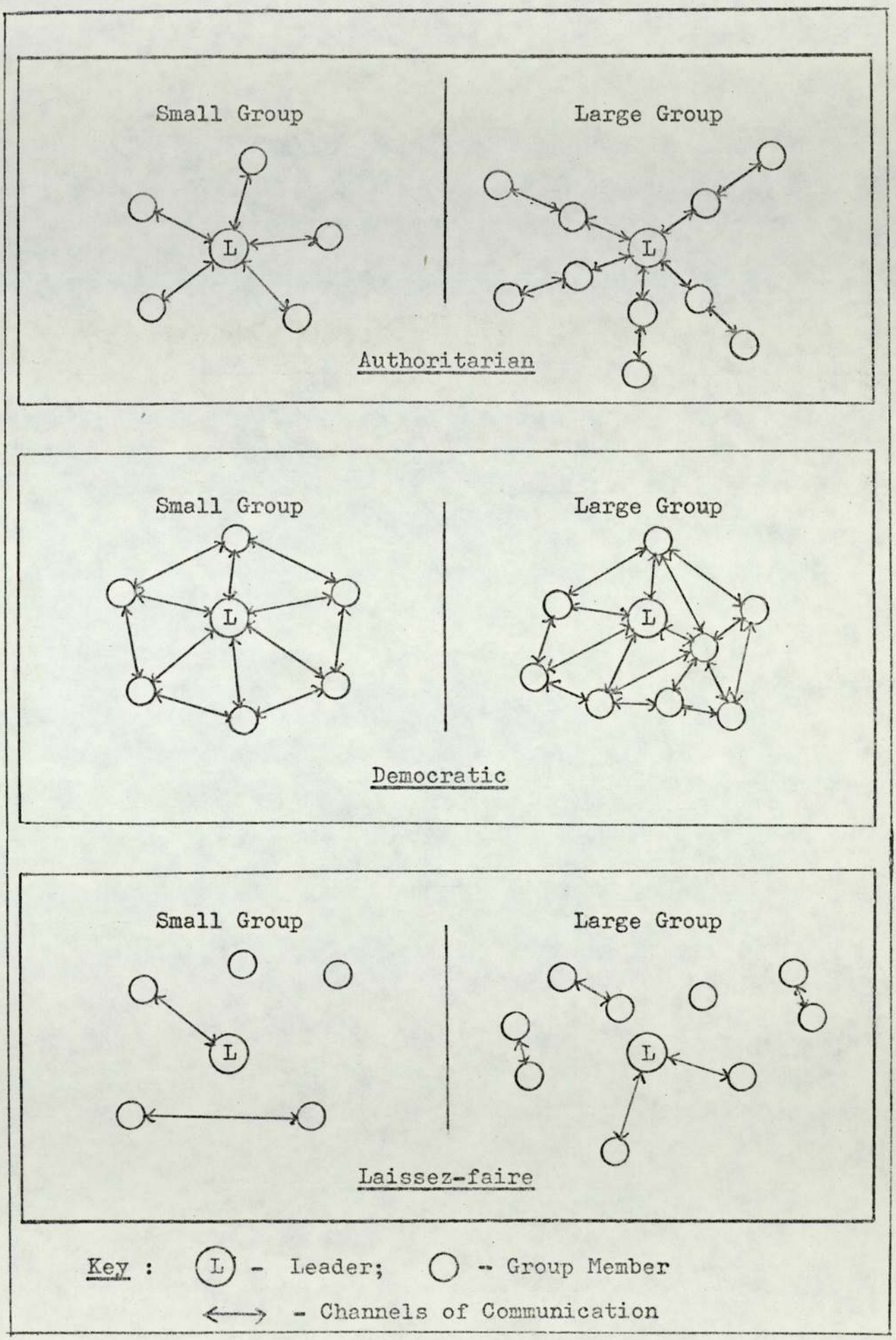
* Gives orders only after consulting the group;
* Ensures that policies are developed in group discussion and with the acceptance of the group;
* Never asks individuals to take action without sketching the long term plans on which they are working;
* Makes it clear that praise or criticism is a matter for the group;
* Participates in the group as a member.

iii) Laissez-faire

* Does not really lead;
* Leaves the group entirely to itself;
* Does not participate except when asked.

Exhibit 4 summarises the group structure associated with each style of leadership.

EXHIBIT 4 : Group Structures -
Lippitt and White (1958)



The main results of the studies were :

i) Authoritarian leaders were slightly more effective than Democratic leaders.

ii) Laissez-faire leaders were the most ineffective. Groups with Laissez-faire leaders tended to be chaotic in task activity. Little was achieved. There was a high degree of aggressiveness compared with groups which had Authoritarian or Democratic leaders.

Overall, the Democratic style was considered best because there was minimal aggression and frustration.

Certain members reported that they preferred working for Authoritarian leaders to working with Democratic leaders. Lippitt and White considered it significant that some of these members came from homes with Authoritarian parents.

Criticism

i) In a review of several leadership studies, Gouldner (1960) pointed out that Lippitt and White's studies ignored cultural differences.

ii) Style combinations and changes have been ignored.

iii) Lippitt et al. failed to investigate under what conditions

a given style is more effective than another.

iv) The studies may be suspected of political bias. The reasons for the marginal superiority of Authoritarian leadership on task activity were never investigated.

3.4 Ohio State Studies (1955; 1957)

Fleishman et al. (1955) and Halpin and Winer (1957) carried out several studies which suggested that leadership styles may be accounted for by two relatively independent dimensions :

i) Consideration : concerned with motivating group members to accept group goals and maintaining internal harmony and member satisfaction.

ii) Initiating Structure : concerned with specifying the ways and means for accomplishing the groups goals and coordinating activities.

Criticism

i) The Ohio Studies have been supported by numerous subsequent studies (Gouldner, 1960). They form the basis of the work of Bass, Fiedler, Reddin and other researchers.

ii) Korman (1966) criticised the Ohio Studies because they lacked a satisfactory conceptual base and failed to take into account situational variables.

3.5 Herzberg's Two-Factor Theory of Motivation (1959)

Herzberg et al. (1959) distinguished 'motivator' and 'hygiene' factors. Managers who use one or other of these groups of factors may be identified as employing specific styles.

Herzberg et al. conducted a survey of 200 engineers and accountants. In a series of interviews, these individuals were asked to remember when they felt exceptionally 'good' about their jobs. Their responses were classified by topic in order to identify what kind of events lead to either job satisfaction or dissatisfaction.

Motivator Factors

These factors lead to job satisfaction :

i) Achievement;
ii) Recognition;
iii) Attraction of the work itself;
iv) Responsibility;
v) Advancement.

Hygiene Factors

These factors are a possible source of job dissatisfaction :

i) Company policy and administration;

ii) Supervision;

iii) Interpersonal relations;

iv) Working conditions.

Herzberg et al. concluded that the two groups of factors are distinctly separate and not opposites.

Criticism

i) Herzberg (1968) replicated his original studies with similar and different groups of individuals, and confirmed generally the two groups of factors.

ii) Lupton (1971; 1975) criticised Herzberg's studies for :

a) lacking conclusive evidence;

b) being oversimple and incomplete;

c) having an inadequate research design.

iii) However, Herzberg (1959) expressed caution about applying and generalising the results of his studies. He indicated that a broader perspective needs to be taken in examining job satisfaction and motivation.

3.6 Bass's O.R.I. (1960; 1970)

According to Bass (1960; 1970), individuals differ in their orientation within groups. This affects their leadership style.

Bass identified 3 styles or 'orientations' :

i) task;
ii) interaction;
iii) self.

Bass developed the Orientation Inventory (O.R.I.) to measure style. This consists of 27 triads of statements : one task-, one interaction-, and one self-orientated statement. Individuals are asked to select the statement they least and most prefer.

The Task-orientated leader tends to describe himself as self-sufficient, resourceful, tough-minded and thoughtful. He persists until a task is completed and gains intrinsic satisfaction from the task activity.

The Interaction-orientated leader tends to concentrate on personal (social-relations) involvement with other group members and is less concerned with task activity. He concentrates on maintaining harmonious relationships between group members.

The Self-orientated is more concerned with his own personal success and recognition than either task- or interaction-effectiveness. He is unlikely to change his behaviour to meet changing group needs. His persistence to achieve a task is minimal. He tends to be dogmatic, disagreeable, in

fear of failure, excitable, and aggressive.

Bass maintained that the task-orientated style is ideal for all situations. He argued that there should be a greater emphasis on the task-orientated aspects of group activity and less on social-relations aspects.

Recently Bass and Valenzi (1974) put forward 5 styles of leadership : Direction, Negotiation, Consultation, Participation and Delegation. Each style is characterised in terms of the degree of authoritativeness. Bass employs now a contingency approach, using the facet analysis (multivariate) technique. He (1975) demonstrated that the frequency of a particular style of leadership is related to the aspects of the contingent situation.

Criticism

i) Bass's studies have an excellent research design.

ii) The results using O.R.I. have been encouraging for successful leadership training (Campbell et al., 1970).

iii) O.R.I. is biassed towards the favourable aspects of task-orientation. Bass appears to have ignored the possibility of negative aspects of task-orientation.

3.7 Likert's Management Systems (1961; 1967)

Likert (1961; 1967) identified four systems of management, with related leadership styles. Each system is presented as a profile, showing a different set of scores on 43 items.

System 1 : Exploitive-Authoritative

Leaders use fear and threat to achieve compliance from members. Leaders and members are psychologically far apart. Communication within management is predominantly downward. Most decisions are made at the top of the hierarchy.

System 2 : Benevolent-Authoritative

Leaders use rewards to achieve compliance from members. Attitudes are subservient to superiors. Policy decisions are taken at the top of the management hierarchy, although decisions within a prescribed framework may be delegated to to lower levels.

System 3 : Consultative

Leaders use rewards and occasional punishments to achieve compliance from members. Members are involved to a small extent in decisions. Communication is both upward and downward within the management hierarchy. Primary policy decisions are taken at the top of the hierarchy. Secondary decisions are taken at lower levels.

System 4 : Participative-Group

Leaders give economic rewards and make full use of group participation and involvement in setting high-performance goals. Communication is multi-directional. Subordinates and superiors are psychologically close. Decision making is carried out using group processes. Groups overlap with specific individuals acting as 'linking pins'.

Likert maintained that (a movement towards) System 4 is most effective for task activity.

Criticism

i) Likert supported with case-study evidence his contention that System 4 is the most effective.

ii) Likert reported studies which contradicted his contentions. The reasons for the contradictory evidence appeared to be the influence of technology and the rate of organisational change.

iii) His classification of management systems is over-simplified. He assumed, but failed to demonstrate, that the causal connections between variables are only one-way.

3.8 Transactional Analysis (1961)

Transactional Analysis is an approach for explaining the

interpersonal transactions that occur between individuals. Transactional Analysis has been developed by Berne (1961; 1965) and Harris (1967).

Berne and Harris distinguished 3 basic styles and 4 styles of interaction.

Basic Styles

These are summarised in Exhibit 5.

Styles of Interaction

i) I'm O.K. - You're not O.K.

This style involves a leader attempting constantly to prove that he is 'right' and others are 'wrong'. De Board (1975) maintained that managers who adopt this style gather around them subordinates who want to feel ill-treated. Eventually there is a great deal of staff movement to other departments. There is a low concern for task activity and a high concern for social relations.

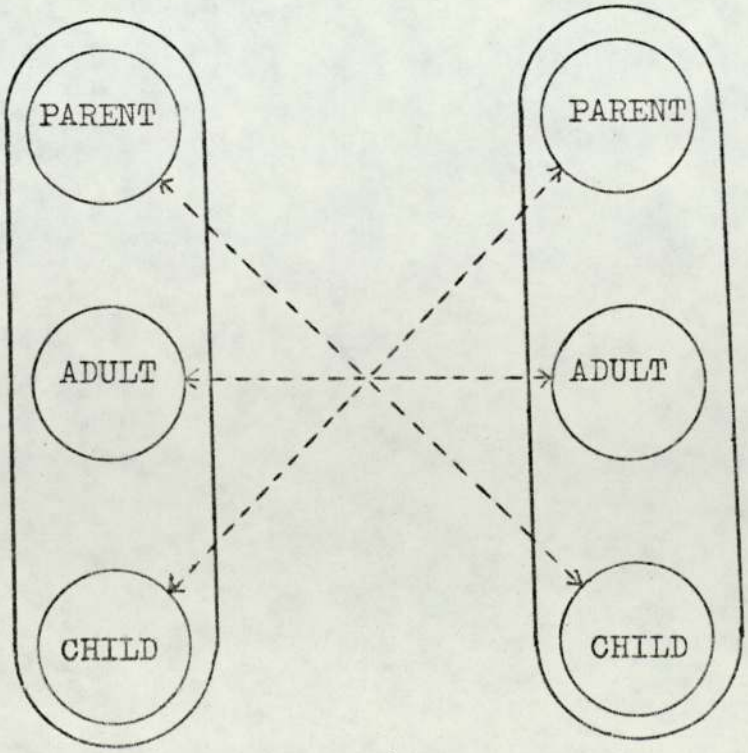
ii) I'm not O.K. - You're not O.K.

The leader exhibits low esteem for himself and for his group members. He feels incompetent and neglected, prefering to avoid interpersonal transactions. The leader is both low

EXHIBIT 5 : Basic Styles of Transactional Analysis - James and Jongeward (1973)

Individual Styles	Description
PARENT	Refers to the attitudes and behaviour incorporated from external sources, primarily parents. Often expressed towards other individuals in terms of prejudicial, critical and nurturing behaviour.
ADULT	Refers to rational and adaptable attitudes and behaviour, based upon realistic perspectives.
CHILD	Refers to infant-like attitudes and behaviour from early childhood experiences.

Possible Transaction Styles :



task- and low social-relations orientated.

iii) I'm not O.K. - You're O.K.

The leader devalues whatever he does and regards his group members as 'better' than himself. His group members treat him with contempt. He concentrates on maintaining harmonious relationships at the expense of task activity.

iv) I'm O.K. - You're O.K.

This is the ideal style. The principal characteristics are effective cooperation and team work. There is mutual respect and relationships are highly cohesive.

Synectics methods have strong connections with Transactional Analysis. In the U.S.A. Synectics Inc. and Transactional Awareness Inc. organise Problem-Solving Transactions Courses. No such courses are organised at present in the U.K. Because of the connections, the results of this research are considered from a Transactional Analysis perspective.

Criticism

i) Using case studies James and Jongeward (1973) demonstrated that Transactional Analysis offers a useful framework for interpreting attitudes and behaviour.

ii) Like Synectics methods Transactional Analysis is undergoing continued development, with many new applications

especially within management theory and practice.

iii) The main weakness of Transactional Analysis is that it lacks a satisfactory methodological base. It is not readily amenable to controlled experimentation.

iv) There is little independent or systematic evidence to support the contention that the 'I'm O.K. - You're O.K.' style is best.

3.9 McGregor's Theory X and Y (1962)

McGregor (1962) distinguished two styles of management which he called 'Theory X' and 'Theory Y'.

Theory X

*Individuals have an inherent dislike of work and will avoid it when possible.
* Individuals must be coerced, threatened and directed to achieve objectives.
* Individuals prefer to be directed, have little ambition and want security above all.

Theory Y

* Individuals enjoy physical and mental effort in working.
* Individuals exert self-direction in achieving objectives.
* Commitment to objectives is a function of the rewards

associated with their achievement.

Theory X implies an Autocratic style of leadership. Theory Y leads to a Participative leadership style. McGregor favoured the Theory Y approach to management practice.

Criticism

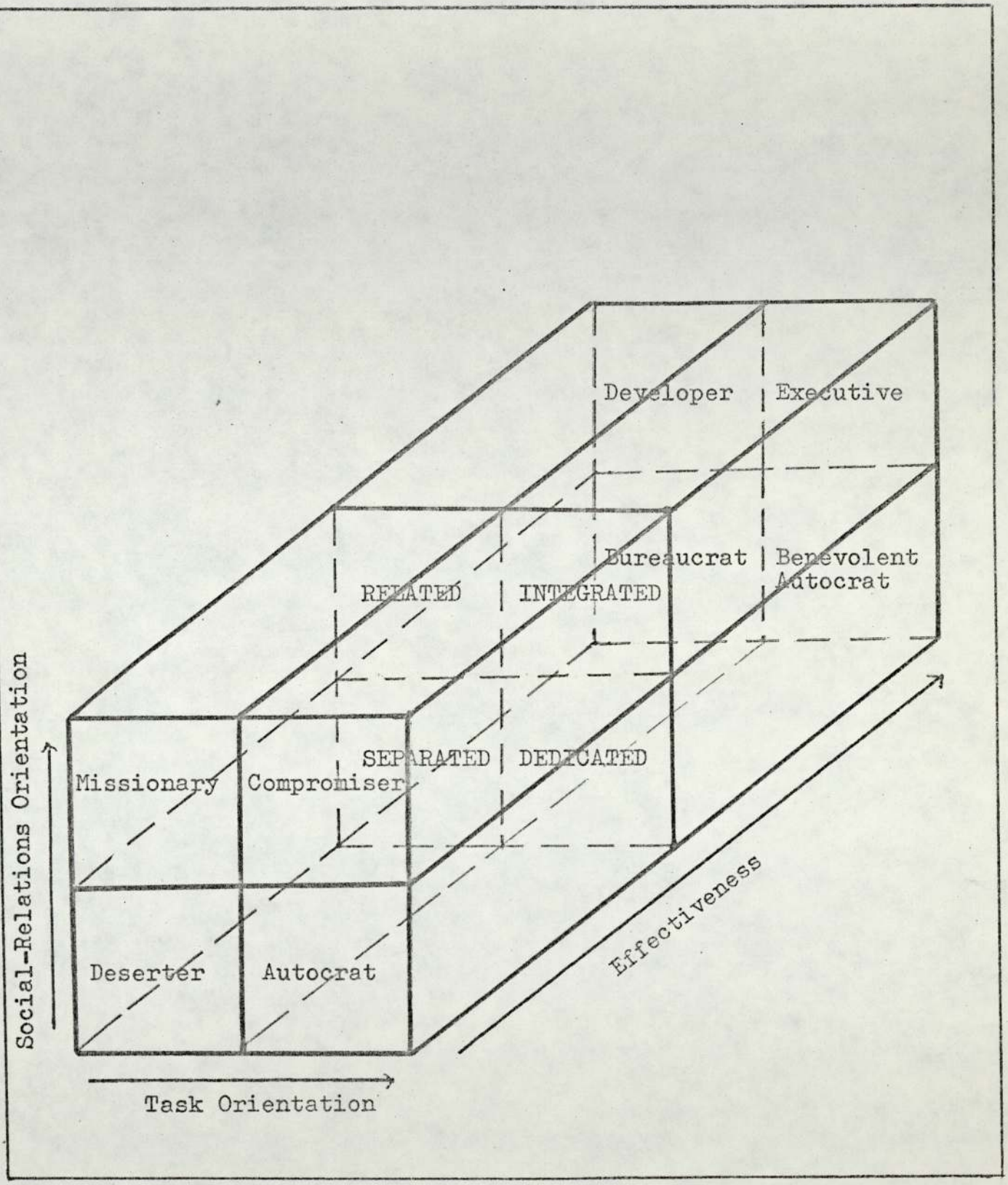
i) Much controversy has centred around McGregor's postulates (Tiffin and McCormick, 1970). Cleverly (1971) argued that McGregor's practical perspectives have been misinterpreted widely and overstated. McGregor intended to illustrate two extreme positions in order to stimulate rational discussion.

ii) Fox (1971) expanded upon Theory X and Y postulates. He indicated that both X and Y styles have their strengths and weaknesses for task activity. Fox argued for a pluralistic frame of reference in the study of leadership. He concluded that there was no one best style of leadership or of management.

3.10 Reddin's 3-D Theory (1964)

Reddin (1964; 1967; 1970) developed a 3-D theory of managerial effectiveness, summarised in Exhibit 6. He maintained that there are 4 more effective and 4 less effective styles of leadership. There is no one best style for every situation.

EXHIBIT 6 : 3-D Approach to Managerial Effectiveness - Reddin (1970)



The 4 more effective styles are : Bureaucrat, Developer, Benevolent Autocrat and Executive. The 4 less effective styles are : Deserter, Autocrat, Missionary and Compromiser. The 8 individual styles are summarised in Exhibit 7.

The 4 basic styles are :

i) Separated : low task orientation/low social-relations orientation;
ii) Related : low task orientation/high social-relations orientation;
iii) Dedicated : high task orientation/low social-relations orientation;
iv) Integrated : high task orientation/high social-relations orientation.

Style effectiveness depends upon the situation. A manager needs style flexibility to achieve maximum effectiveness.

Criticism

i) 3-D theory and related training has been popular with numerous companies. Reddin (1970) reported several successful applications.

ii) Reddin derived 3-D theory primarily from the findings of the Michigan and Ohio studies described above. The theory has therefore a strong foundation.

iii) Reddin offers a wider range of styles than most other theorists.

EXHIBIT 7 : Individual Leadership Styles - Reddin (1967)

Deserter : displays a lack of interest in both the task and relationships. He is ineffective not only because of his lack of interest, but also because of his effect upon morale. He may not only desert but may also hinder the performance of others through intervention or by withholding information.

Missionary : puts harmony and relationships above other considerations. He is ineffective because his desire to see himself and be seen as a 'good person'.

Autocrat : puts the immediate task before all other considerations. He is ineffective in that he makes it obvious that he has no concern for relationships and has little confidence in others.

Compromiser : recognises the advantages of being orientated to both task and relationships, but who is incapable of making effective decisions.

Bureaucrat : is not really interested in either the task or relationships. He is effective in that he follows the rules and appears to be concerned about his responsibilities.

Developer : places implicit trust in people. He sees his job as primarily concerned with developing the talents of others and of providing a work atmosphere conducive to maximising individual satisfaction and motivation. He is effective in that the work environment he creates is conducive to his subordinates developing commitment to both himself and the job.

Benevolent Autocrat : places implicit trust in himself and is concerned with both the immediate and long-run task. He is effective in that he is skilled in inducing others to do what he wants them to do without creating resentment.

Executive : sees his job as maximisisng the effort of others in relationship to the short- and long-run task. He sets high standards and recognises that, because of individual differences and expectations, he must treat everyone differently. He is effective in that his commitment to both task and relationships is evident to all.

3.11 Blake and Mouton's Managerial Grid (1964)

Blake and Mouton (1964) characterised style in terms of :

i) Concern for people (social-relations orientation);
ii) Concern for production (task orientation).

These factors form the basis of the 'Managerial Grid'. The Grid is a typological matrix of 81 divisions and shows the interactions between people, purpose (for example, production of goods) and management hierarchy.

There are 5 principal styles, shown in Exhibit 8. Blake and Mouton argued that the '9,9' style is the most effective.

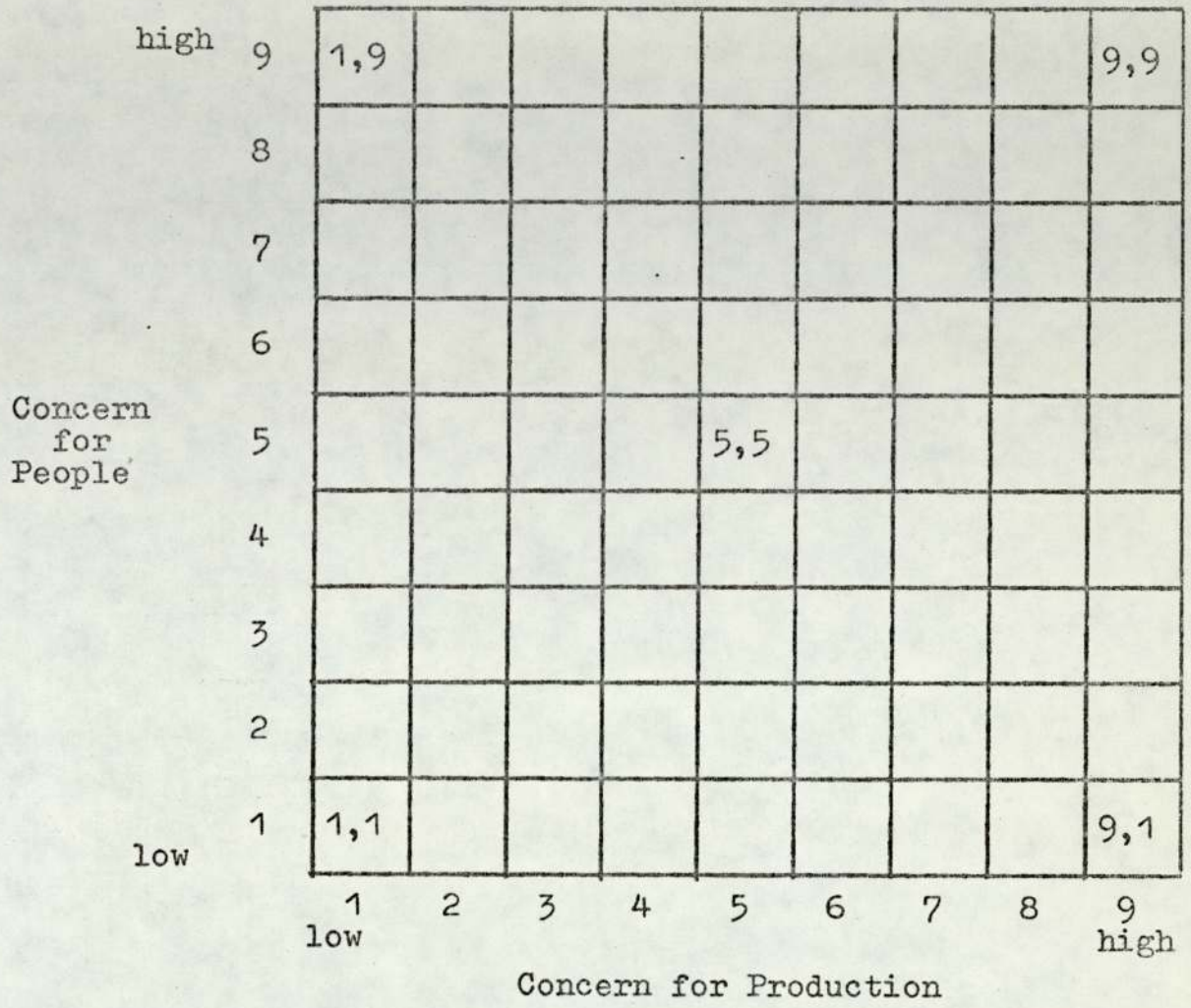
Criticism

i) Lichtman and Hunt (1971) criticised the Grid for its inadequate development. They described Blake and Mouton's 'over-protectivity' towards the Grid and the lack of systematic experimentation.

ii) Lupton (1975) criticised the Grid for general methodological deficiencies. In particular he indicated the failure :

a) to establish carefully defined measures of operating efficiency and job satisfaction;
b) to define adequately various aspects of style (for

EXHIBIT 8 : The Managerial Grid -
Blake and Mouton (1964)



Key :

1,1 : Minimum effort is exerted to achieve task objectives and to maintain harmonious relationships.

9,1 : Effort is directed towards task objectives at the expense of relationships.

5,5 : Performance is adequate because task and social-relations orientations are balanced.

1,9 : Effort is directed towards relationships at the expense of task activity.

9,9 : Tasks are accomplished by highly committed individuals; relationships are cohesive with a high level of respect and trust.

example, maturity of style);

c) to supply acceptable evidence in order to support the contention that the 9,9 style is best for all situations.

iii) Grid training and application has proved popular with management practitioners. Kreink and Colarelli (1974) reported success in using Grid training. They described improvements in productivity and morale at the Hastings State Hospital, Minnesota, directly as a result of Grid training.

3.12 Fiedler's L.P.C. Theory (1965; 1976)

Fiedler (1965) distinguished three primary variables as major determinants of effective leadership :

i) Leader - Member Relations : the degree to which a group trusts or likes its leader; and the extent to which they are willing to follow his guidance.

ii) Task Structure : the degree to which the task is defined.

iii) Positional Power : the formal authority given to the leadership position.

Fiedler used the Least Preferred Co-Worker (L.P.C.) Scale to measure style. This is a bi-polar 8-point scale, on which individuals rate their least-preferred co-worker on various personality characteristics. Respondents who rate high on the L.P.C. Scale are more social-relations than

task-orientated. Individuals with low L.P.C. scores are more task- than social-relations orientated.

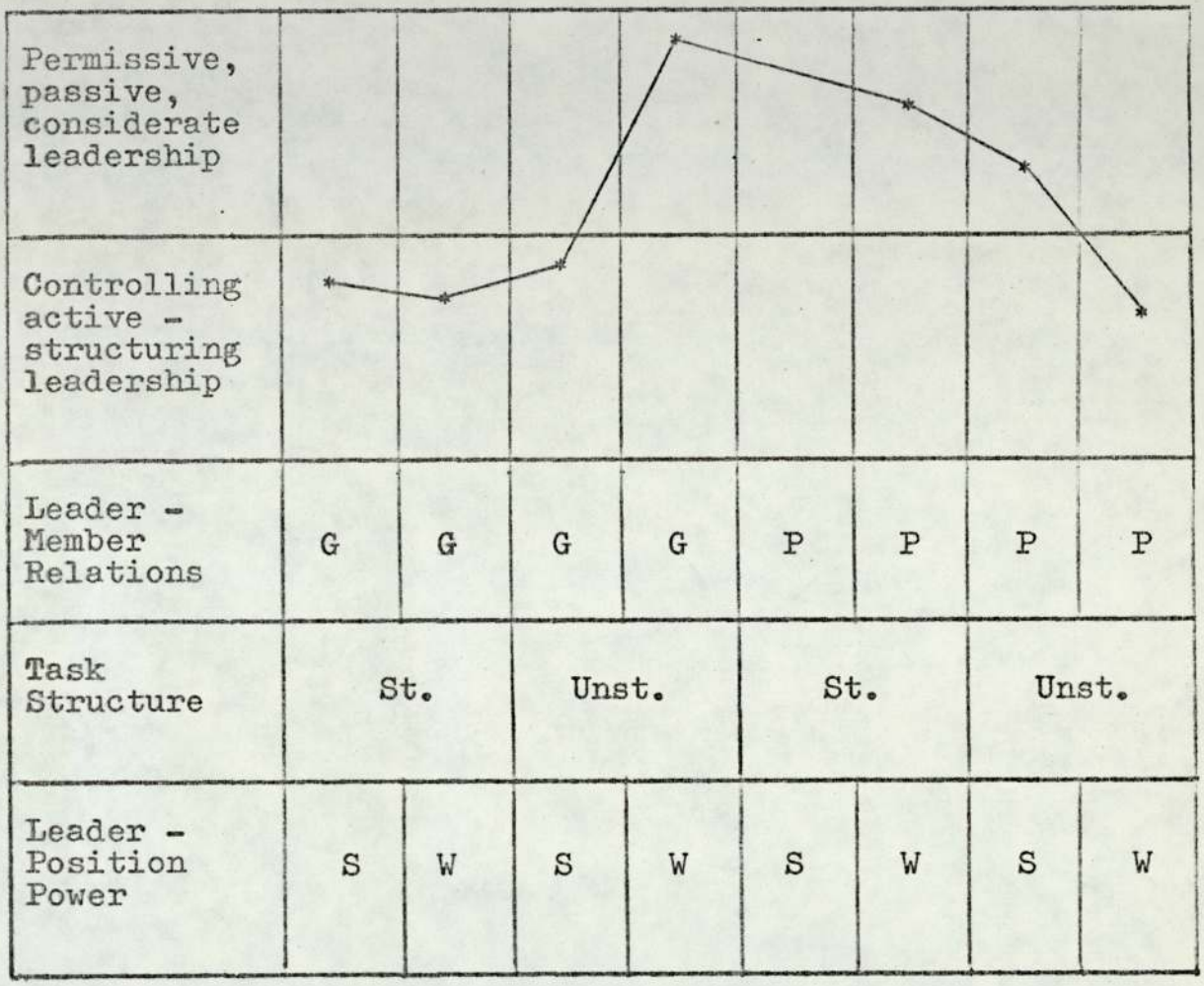
Fiedler maintained that leadership effectiveness is contingent upon the fit of the leader's style with the situation. He specified which leadership styles should operate under which conditions, shown in Exhibit 9. The task-orientated leader is most effective in conditions which are either very favourable or unfavourable for task achievement. The social-relations style is more effective for the intermediate situation.

Criticism

i) Fiedler's theory has been investigated comprehensively. This is demonstrated by Fiedler et al.'s (1974) detailed review of contingency-theory studies. His leadership research is the most systematic and of the highest academic standard.

ii) Mitchell (1970) criticised Fiedler's theory for over-simplification, as did Graen et al. (1970). The latter found deficiencies in Fiedler's research strategy and a limited number of statistically significant results. Their review revealed that different operational definitions had been used in different studies, making inter-study comparison difficult. However, since 1970 Fiedler (1972) has modified the L.P.C. Scale to take account of these criticisms.

EXHIBIT 9 : How Effective Leadership Style Varies with Situation - Fiedler (1967)



Key :

S : Strong; W : Weak

St. : Structured; Unst. : Unstructured

G : Good; P : Poor

iii) Fiedler's methodology is biassed towards his own contingency arguments rather than, for example, towards investigating a one-best-way style leadership.

3.13 Adair's Action-Centred Leader (1968)

Adair (1968) proposed an eclectic approach to the study of leadership, based upon 3 areas of needs :

i) Task Needs : these differentiate a group from a random crowd. The group has a common objective, which has its own set of requirements that must be fulfilled.

ii) Group Maintenance Needs : to achieve its objective the group must be held together.

iii) Individual Needs : although work is carried out in groups, the individual members have their own personal requirements.

The term 'Action-Centred Leader' arises because the leader must take action in order to fulfil these needs. The actions of the leader in one of these areas will have effects in one or more of the other areas of needs.

Criticism

The major contribution of Adair has been to put forward a coherent framework for comprehending leadership skills (Smith, 1969).

3.14 Argyris's 'Self-Actualisation' Style (1970)

Argyris (1970) maintained that the most effective style of management has the following characteristics :

* Groups are flexible and adaptive.
* Leaders and members pursue mutually-agreed goals.
* Relationships are highly cohesive.
* Individuals concentrate on self-actualisation.
* Managers are outgoing, frank and generous.
* Managers overcome interpersonal barriers which prevent high levels of cooperative effort.

Argyris drew attention to the effects of size and technology on management style. With increasing size and technological complexity, control becomes centralised with fewer opportunities for self-actualisation.

Criticism

i) Argyris offered an eclectic perspective of management style which appears to rely more on commonsense than systematic study.

ii) Argyris failed to put forward any prescriptions for overcoming the constraining influences of increasing size and technological complexity.

3.15 House's Path-Goal (Expectancy) Theory (1971)

House (1971) developed Path-Goal theory. It has been modified subsequently by House and Dessler (1974) and Stinson and Johnson (1975). The theory contains two principal propositions :

i) The primary function of the leader of a group is to provide his members with coaching guidance, support and rewards necessary for effective and satisfying performance.

ii) The secondary function of the leader is to enhance the psychological states of his members that result in motivation to perform or in satisfaction with task accomplishment.

House argued that the specific leader behaviour which accomplishes these functions is determined by the situation in which the leader operates. He suggested that there are two classes of variables which may moderate the relationship between leadership behaviour and other variables :

i) the characteristics of the members;
ii) environmental factors.

Criticism

i) Although Path-Goal theory is relatively new, it has been well supported and modified using systematic evidence.

ii) Nebeker and Mitchell (1974) studied leadership within

naval maintenance crews. They reported success in using Path-Goal theory to account for leader behaviour in a real life setting and to understand the antecedents of such behaviour.

iii) Path-Goal theory requires further development before it may be evaluated fully.

4.0 SYNECTICS LEADER

Synectics group problem-solving sessions have a formally appointed individual who is called LEADER. He fulfills a role which is more restricted than might be understood normally. He controls the group processes only. He is not involved in the content of the session. He has both task and maintenance specialist functions. His specific functions are shown in Exhibit 10.

Prior to this research there has been no systematic study on Synectics LEADER style. The only evidence has been anecdotal and unreliable.

However, there is evidence on Synectics-type leadership style.

Maier and Solem (1952) distinguished some of the behaviours of highly effective problem-solving leaders. They investigated the relative effectiveness of two different group problem-solving leadership styles. 64 groups were asked to elect a representative leader. 34 representatives were given the the role of discussion leaders. 30 representatives were instructed to act only as observers.

The discussion leaders (similar to the Synectics LEADER role) had the function of facilitating process. The observers were permitted to only listen. In neither instance were they allowed to be involved in the content of the problem-solving meetings. The group task was to resolve an arithmetic problem.

EXHIBIT 10 : Synectics LEADER Functions

i) To plan with the CLIENT his use of the Synectics Problem-Solving Scheme, with or without the EXCURSION procedure. The CLIENT briefs the LEADER on the problem during this Planning session.

ii) To start the session.

iii) To control during the session the use of the Synectics Problem-Solving Scheme (with or without the EXCURSION) and related skills.

iv) To influence the contributions of the PARTICIPANTS and CLIENT. For example, during the generation of HOW TO STATEMENTS stage of the Scheme, he may ask silent PARTICIPANTS to offer their thoughts.

v) To record on large pulp pads the P.A.G., HOW TO STATEMENTS, material from the IMAGING part of the EXCURSION, POSSIBLE SOLUTIONS, NEXT STEPS, and any other material he feels should be noted or is requested by the CLIENT to note.

vi) To control the use of time during the session.

vii) To end the session.

The groups with the discussion leaders were found to be more effective and efficient on task activity. This was attributed to the discussion leaders encouraging the participation of all group members, especially those with minority opinions.

5.0 STRATEGIES

This research is concerned in part with developing strategies for the LEADER, CLIENT and PARTICIPANT roles. Strategy is defined as the means adopted to achieve a specific objective. The current Synectics strategy is the Synectics Problem-Solving Scheme described in Chapter 2. The distinctions between the meanings of the terms 'style' and 'strategy' are shown in Exhibit 11.

Merei (1949) identified 3 leadership strategies in his study of group leadership. These strategies are summarised in Exhibit 12. He used 12 groups of nursery-school children, who were homogeneous in terms of age and sex. The groups spent 30 - 40 minutes per day in separate rooms over a week. Gradually these groups developed their own particular attitudes and norms regarding the order of seating, division of play objects among members, ownership of certain objects, rituals, expressions of belonging and group jargon.

After this norming stage, a leader was placed in each of the groups. Each leader was an individual judged by nursery-school teachers to have high initiative and directing ability. The leaders were older than their members.

Merei found that in all but one group the leaders accepted the attitudes and norms of their members. The exception was where 4 new leaders were placed within the group over 4 days. By the fourth day, the group members

EXHIBIT 11 : Distinctions between Style and Strategy

Styles are :	Strategies are :
i) not necessarily goal-directed;	i) employed to attain specific goals;
ii) predisposed to accept certain strategies and preclude others;	ii) used to focus behaviour;
iii) influenced by 'personal style'.	iii) used to reduce the complexity and randomness of behaviour;
	iv) influenced by and may be independent of 'personal style';
	v) simple (for example, 'Stop and Think') or complex (for example, Synectics Problem-Solving Scheme).

EXHIBIT 12 : Leadership Strategies
Merei (1949)

3 strategies were identified :

i) Order Giver : leader gives orders and makes suggestions.

ii) Proprietor : leader takes possession of the property of the group. The possessions are handed out to the members as rewards for compliance.

iii) Diplomat : leader accepts the group's norms in order to change them gradually. For example, he starts making minor changes to the group games and eventually makes major changes.

were so demoralised by the continual changes of leadership that they accepted without resistance the new rules of play introduced by the leaders.

6.0 CRITICISM

6.1 Similarities and Differences

The term 'style' has been over-used. Different researchers have labelled similar or identical styles with different names. In a review of leadership and management styles, Lupton (1971) maintained that :

"Whatever the detailed differences between McGregor, Blake and Likert, I believe their approach to management to be almost exactly similar." (p.98)

It would be better if such perspectives were rationalised in the interest of parsimony.

Greiner (1973) expressed further reservations :

"These differing interpretations are further clouded by such abstract labels as 9,9 management, Theory Y, and management by objectives. In addition, scholarly critics in the wings confuse the issue by arguing that managerial styles are idiosyncratic and are determined more by an executive's personality and early background experiences than by 'charm schools' in participative leadership."(p.28)

Greiner argued that leadership and management styles are best understood in terms of patterns of behaviour. This approach is adopted within this research.

6.2 Competence

Competence refers to the level of leadership skill. Several studies have indicated the importance of leadership competence for group efectiveness (Rosenbaum and Tucker, 1962; Chalmers et al., 1963; Baron, 1970).

Rosenbaum and Tucker demonstrated that incompetence has detrimental consequences on group effectiveness and learning because incompetent leaders are followed less frequently.

Justis (1975) studied leadership effectiveness and task competence. His results revealed that the level of leadership effectiveness is influenced significantly by :

i) the perceived task competence of the leader;
ii) the reward dependency of members upon the leader;
iii) the interaction of these two variables.

High levels of leader task competence facilitated the development of problem-solving skills, resulting in successful task achievement (sorting and separating 80 electrical components within a given time limit).

Few other researchers have considered the relationship between competence and leadership effectiveness. For example, Lippitt and White (1958), in their studies on Authoritarian/ Democratic/Laissez-faire styles, failed to take into account leadership competence. It may be hypothesised that a highly

competent Laissez-faire leader is more effective ceteris paribus than a low-competent Democratic leader. Although in the absence of systematic evidence, this remains mere contention.

Leadership competence is examined within this research as an aspect of group problem-solving competence.

6.3 Comparison Difficulties

It is difficult to compare the above theories and studies of leadership and management styles with the Synectics concept of LEADERSHIP. This is because the definition of leadership offered at the outset of this chapter implies control of both content and process.

The corresponding roles within Synectics methods are LEADER and CLIENT. Traditional leadership (or Chairman) functions are separated into two categories :

i) control of human group processes (LEADER);
ii) control of problem content (CLIENT).

Exhibit 13 summarises the functions of the CLIENT role.

Prior to this research there has been no systematic study on CLIENT style the only evidence has been anecdotal and unreliable.

EXHIBIT 13 : Synectics CLIENT Functions

i) To assist the LEADER plan his use of the Synectics Problem-Solving Scheme (with or without the EXCURSION procedure). He briefs the LEADER on the problem, and formulates with him the P.A.G. and ANALYSIS.

ii) To act as PARTICIPANT, offering HOW TO STATEMENTS and ideas.

iii) To select a HOW TO STATEMENT for the LEADER and PARTICIPANTS to focus upon for idea development. He also offers the MINI-ANALYSIS.

iv) To PARAPHRASE ideas offered by other PARTICIPANTS.

v) To give ITEMISED RESPONSES to those ideas.

vi) To decide when a POSSIBLE SOLUTION is reached and what constitutes that POSSIBLE SOLUTION. He also states his NEXT STEPS for implementing his POSSIBLE SOLUTION(S).

vii) To state when he has sufficient POSSIBLE SOLUTIONS so that the LEADER may end the session.

6.4 Style Combinations and Matches

Most studies of leadership and management style have ignored leader - member style combinations.

One exception is Lippitt and White's (1958) research. They identified certain 'style matches'. They found that Democratic followers tended to demand Democratic leaders. Authoritarian followers preferred to work with Authoritarian leaders.

Weed et al. (1976) investigated style combinations. They studied various combinations of leadership style, member attitude (to reflect style), task type and the relative effects on group problem-solving performance. The tasks involved unscrambling a variety of sentences. The tasks varied in ambiguity and difficulty. The 3 leadership styles were :

i) high social-relations and high task orientation;
ii) low social-relations orientation;
iii) high social-relations and low task orientation.

Member attitude was measured in terms of dogmatism, using the Short-Form Dogmatism Scale.

They found significant interaction effects of leader style/ member attitude/task type combinations. The most effective style-attitude combination was high task/high social-relations orientated leaders and low-dogmatic members.

The least effective combination was low task/high social-relations orientated leaders and high-dogmatic members. The researchers were unable to determine how much of the difference in performance was attributed to task type.

Stogdill (1974), in his detailed review of leadership studies, also suggested that the relationship between leadership style and performance depends in part upon the interactions of leader behaviour, task type and member characteristics and behaviour. Weed et al.'s study lends some support to this suggestion.

Various style combinations of the CLIENT, LEADER and PARTICIPANT roles are examined within this research.

6.5 Assumption of Need for a Leader

An underlying assumption behind the studies reviewed above is that it is useful for a group to have a formal or informal leader.

This assumption was investigated by Bales (1953). He demonstrated that where groups are headless (no formally appointed leader), two types of leader will emerge. His study involved 30 discussion groups (5 individuals). The task was to achieve a single mutually-accepted solution to a social-relations problem. 4 problem-solving sessions were used. There was no formal leader in any of the groups.

Bales found that over time two individuals emerged as

as informal leaders : a 'task specialist' and a 'socio-emotional specialist'. The task specialist is the individual seen by other members as having the best ideas and guiding the process of the sessions. The socio-emotional specialist is concerned with preserving unity and harmony.

Thibaut and Kelley (1959) confirmed these findings. They called the socio-emotional specialist the 'maintenance specialist'. This term is now widely used.

6.6 Style Changes

Few studies have examined style changes over time.

Singer and Goldman (1954) studied climate in group psychotherapy with chronic schizophrenics. They found that the effectiveness of group discussion increased if the therapy leader began by using a Directive style and changing gradually to a more Democratic style.

More recently style changes have been investigated in a series of international surveys by staff members of Ashridge Management College, Buckinghamshire (Sadler and Hofstede, 1972; Hughes and Shackleton, 1975). They adopted Tannenbaum and Schmidt's (1958) classification of styles. Leader behaviour varies along a continuum of 'Boss-centred leadership' - 'Subordinate-centred leadership'. Moving away from the Boss-centred style, the leader's authority diminishes and the subordinates' freedom to make their own decisions increases.

4 principal styles were derived from this continuum and are shown in Exhibit 14. Respondents to the surveys were asked to select which style they would prefer their own manager to adopt. The general findings of the surveys are shown in Exhibit 15.

Hughes and Shackleton concluded that there is no one best style for all situations/groups. Effective leadership involves being aware of the requirements of each situation. The effective leader must change his style to take into account differing situational requirements.

Style changes over time are examined within this research.

6.7 Teacher Style

In a study of teaching styles, Bailey (1955) found that students preferred an Authoritarian style to a Democratic style of group leadership. The students insisted generally that the leaders (teachers) should play a Directive role. The Authoritarian style was found to be a more effective teaching approach.

Similar results have been obtained by Bennett et al. (1976), who investigated the relationship between teacher style and pupil progress. Their broad style categories are shown in Exhibit 16. Questionnaires were sent to 1,500 teachers at 871 primary schools in Cumbria and Lancashire. 37 classes of children were tested at the beginning and end of the academic year 1973 - 1974. Traditional teaching procedures

EXHIBIT 14 : Leadership Styles -
Sadler and Hofstede (1972)

i) Autocratic : Leader makes his own decisions and announces them to his subordinates. He expects his subordinates to carry out his decisions without question.

ii) Persuasive : Leader makes his own decisions and tries to persuade his subordinates to accept them. He reduces any resistance to his decisions by 'selling' his ideas and opinions.

iii) Consultative : Leader does not make any decisions until he has presented the problem to his subordinates and listened to their advice and suggestions.

iv) Participative : Leader delegates to his subordinates the right to make their own decisions. His function is to define the problem and to indicate limits within which the decision must be made. The decision will reflect the majority opinion of the group.

EXHIBIT 15 : General Findings of Ashridge Surveys - Sadler and Hofstede (1972)

i) The 4 styles were meaningful to the respondents in that most were able to express a preference for one of them.

ii) The Consultative style was preferred most often.

iii) Different patterns of preferences were held by different categories of employees.

iv) Most respondents were able to describe their own managers in terms of one of the 4 styles. However, approximately 25% of the respondents felt that their managers did not correspond closely to any one of the styles. While 60% preferred the Consultative style, only 25% perceived their managers to be exercising this style.

v) In general, managers who were seen as exhibiting a distinctive style were considered to be more effective in promoting confidence and satisfaction among employees than managers who were seen as having no distinctive style.

vi) High job satisfaction was associated with perceiving being led in the way one prefers to be led.

vii) The lowest level of job satisfaction was among those who perceived their manager to be using the Autocratic style, together with those who felt that their manager displayed no particular style.

EXHIBIT 16 : Teaching Style Categories
Bennett et al. (1976)

Progressive	Traditional
i) Integrated subject matter.	i) Separated subject matter.
ii) Teacher as guide to educational experiences.	ii) Teacher as distributor of knowledge.
ii) Active pupil role.	iii) Passive pupil role.
iv) Pupils participate in curriculum planning.	iv) Pupils are not involved in curriculum planning.
v) Learning predominantly by discovery procedures.	v) Accent on memory, practice and rote.
vi) External rewards and punishments not necessary i.e. intrinsic motivation.	vi) External rewards used, e.g. grades, i.e. extrinsic motivation.
vii) Not too concerned with conventional academic standards.	vii) Concerned with academic standards.
viii) Little or no testing.	viii) Regular testing.
ix) Accent on cooperative group work.	ix) Accent on competition.
x) Teaching not confined to classroom base.	x) Teaching confined to classroom base.
xi) Accent on creative expression.	xi) Little emphasis on creative expression.

* Synectics teaching methods tend towards the Progressive approach.

and roles were found to achieve generally better results than the Progressive approach. The principal exception was a group of boys of relative low ability who achieved better scores when taught using a Progressive type of style.

This study has aroused much controversy. Professor Cox of Manchester University (Times, April 26 1976) called for a 'counter-revolution' in education with a move back towards the Traditional approach. Professor Eysenck of London University (Times, May 1st 1976) put forward a similar viewpoint. He attacked particularly the Plowden Report (1967), which supported greatly progressive methods of education.

However, Bennett et al. indicated certain limitations of their study, such as a relatively small sample. They emphasised that care should be exercised in interpreting their findings. Bennett identified 12 individual styles along a formal - informal continuum. These styles appear to have been ignored by the anti-Progressive critics, as has Bennett's argument that it is important to relate a particular style to given teaching situation so that pupil progress is optimised.

6.8 Overall Perspective

There is no fully developed or integrated theory of leadership and management styles. The principal contentions of the above theories appear to be derived from their original foundations and/or underlying assumptions. This

has resulted in conflicting findings. The differences between the one-best-way v. situational theorists have yet to be resolved, although the balance of systematic evidence is currently in favour of contingency approaches.

7.0 CONCLUSIONS

i) Recent major investigations have used a contingency approach. The general research perspective is now much broader compared with early studies of leadership traits.

ii) There is no conclusive evidence that there is one best way to lead or manage for all situations.

iii) Of the theorists and theories reviewed, Bass, Fiedler and House have assembled the most systematic evidence to support their contentions.

iv) There is a high degree of overlap in some of the leadership and management styles. This implies that several investigators have studied similar or identical patterns of behaviour.

v) Therefore, theories and studies of leadership and management styles should be rationalised in order to develop a coherent approach for further research. There have been steps in this direction by Halal (1974) and Stogdill (1974), with their detailed reviews and criticism of the confused state of the art.

One simple approach to rationalisation is offered above : to relate leadership and management styles within a framework comprised of continua of task and social-relations orientation. Whilst it is obvious that not all styles may be placed within such a framework, it permits systematic comparison.

.....

CHAPTER FOUR

PROBLEM SOLVING

Summary

Problem solving is reviewed in terms of the nature of problems, techniques, individual v. group applications, styles and strategies. The relationship between Synectics methods and problem solving is outlined.

Contents

1.0 INTRODUCTION

One of the objectives of this research is to develop problem-solving strategies. The strategies are derived from the identified problem-solving styles of the CLIENT, LEADER and PARTICIPANT roles.

Prior to this research there have been no systematic data on either individual or group Synectics problem-solving styles. The reason is that researchers have concentrated on studying :

i) Synectics methods as a creativity technique. For example, Korth (1971) and Frantz (1975) investigated the effects of Synectics training on creative thinking.

ii) Effects of Synectics practice. For example, Hughes (1970), Prince (1970) and Parker (1975) have reported the effects of using Synectics methods on in-company problems after training.

2.0 DEFINITIONS

2.1 Problem

Various definitions of the term 'problem' have been offered by researchers so that there is no one definition that is widely accepted. Several definitions of the terms 'problem' and 'problem solving' are listed in Exhibit 1. Drawing together these definitions, problems may be defined broadly in terms of goals, and problem solving refers to goal achievement. Problem-solving behaviour is goal-directed :

i) Where a blockage is preventing the problem solver from achieving his goal (desired end state);
ii) the problem solver does not know how to achieve this end state.

Blockages may be real or psychological. Psychological blockages result from set or habituation. Real blockages are physical.

Successful problem-solving activity involves :

i) the achievement of the desired end state;
ii) overcoming or circumventing the blockages.

This implies that goal achievement is partly dependent upon directed problem-solving activity. This was well demonstrated by Maier (1930). He studied the effects of varying instructions on 'pendulum problems'. The tasks included

EXHIBIT 1 : Definitions of 'Problem' and 'Problem Solving'

i) "A problem exists when the goal that is sought is not directly attainable by the performance of a simple act available in the animal's repertoire; the solution calls for either a novel action or a new integration of available actions." Thorndike (1898)

ii) "A problem arises when a living creature has a goal but does not know how this goal is to be reached." Dunker (1945)

iii) " Problem solving may be defined.....as the process of attempting to change a given situation into a known and desired new situation, the method of change being at the moment unknown to the S (subject), and the attempt to find it involving at least some activity within the S." Ray (1956)

iv) ".....a system has a problem when it has or has been given a description of something but does not have anything that satisfies the description." Reitman (1965)

v) "Problems exist when an individual operating under a need or drive faces a situation that he is unable to respond to in terms of past learning experiences."

"Solutions require a new response or a new combination of a series of previously learned responses." Heckel & Peacock (1966)

vi) "Problem solving is a set of events in which human beings use rules to achieve some goal." Gagné (1970)

having to join two strings hanging from a ceiling but too far apart to be reached at the same time. The solution to the problem involved tying a weight to one string, setting it swinging while the other string is reached for. Individuals who achieved successful solutions were those who were given directional hints. Those without hints failed to accomplish the task.

Within this research problems are defined operationally in terms of major goal statements, each of which is linked with a particular individual (CLIENT).

2.2 Problem Situations and Areas

Problem Situation : a problem occurs within a particular environment, which has its own boundaries. A given problem situation interfaces with other problem situations.

Problem Areas : these are sub-problems (secondary goals). A given secondary goal will be of primary importance at a particular moment in time to the problem solver.

2.3 Problems and Solutions

Problems should be considered in relation to solutions. A problem may be regarded as an 'initial state'. A solution is a 'terminal state' (Reitman, 1965).

2.4 Problems and Decisions

Decisions should be distinguished from problems. Decisions may be problems. Decisions involve :

i) selecting a course of action to pursue;

ii) selecting a specific direction in problem solving.

3.0 NATURE OF PROBLEMS

3.1 Taxonomies

Several authors have attempted to classify problems.

Shaw (1963) studied various aspects of numerous experimental problems. Using factor analysis he identified 6 problem dimensions :

i) Level of difficulty;
ii) Relative multiplicity of possible solutions;
iii) Needed group member cooperation;
iv) Intellectual v. manipulative requirements;
v) Familiarity of the problem to the problem solver;
vi) Intrinsic motivational properties.

Maier (1955; 1963) classified problems in terms of :

i) Quality (Q) - the degree to which objective facts have been utilised and evaluated;
ii) Acceptance (A) - the degree to which the commitment of those who must carry out the decision/solution is required.

Maier proposed 4 categories of problems, summarised in Exhibit 2.

Newstrom (1972) put forward evidence to support Maier's classification. He investigated the ability of individuals

EXHIBIT 2 : Categories of Problems - Maier (1955; 1963)

Problem Type	Description
A/Q (High acceptance requirement; low quality requirement)	Problems involved have more than one solution/decision of equal value. Success of the solution/decision depends primarily upon whether it is liked and can gain support.
Q-A (Both high quality and acceptance requirements)	Quality of solution/decision cannot be compromised and its acceptance is essential.
Q/A (High quality requirement; low acceptance requirement)	Problems demand solutions/decisions that respect facts, although acceptance is relatively unimportant or easy to achieve.
Q-A (Both low quality and acceptance requirements)	Solutions/decisions to these problems are not of critical importance, and may be easily resolved, for example, by a flip of a coin.

to distinguish brief descriptions of simulated problems, which varied in quality and acceptance. He found that :

i) Individuals can distinguish between quality and acceptance, and are able to recognise clearly different degrees of the priority of the two elements in problem situations.

ii) Scores were highest on technical (Q/A) problems and lowest on behavioural (A/Q) problems.

iii) There was wide variation among the individual accuracy scores.

Steiner (1972) classified problems in terms of 3 dimensions, summarised in Exhibit 3. He demonstrated that problem type and process influence task performance of problem-solving groups.

Johnson (1972) indicated the need to establish a taxonomy of problems. He classified problems in terms of :

i) complexity;
ii) familiarity;
iii) abstractness;
iv) embedding (pattern perception);
v) specific difficulties (e.g. time constraints).

McKenney (1973) put forward a taxonomy of problem solving. His classification of problems is summarised in Exhibit 4.

EXHIBIT 3 : Categories of Problems - Steiner (1972)

Problem Type	Description
Divisible v. Unitary	Divisible tasks can be subdivided; unitary tasks cannot be subdivided.
Maximising v. Optimising	Success on maximising tasks depends upon how many units of the outcome (solution) are produced or how rapidly they are produced. Optimising tasks involve reaching a best or preferred value.
Permitted Process	Tasks differ in terms of the ways their individual products may be combined.
Disjunctive Tasks	Total weight is assigned to the contribution of any member, but cannot be distributed among members.
Conjunctive Tasks	Total weight is assigned to the least productive member(s).
Additive Tasks	Members' contributions are weighted equally and are summed.
Discretionary Tasks	Individual contributions may be weighted and combined in any manner.

EXHIBIT 4 : Categories of Problems -
McKenney (1973)

Type 1 : The problem involves planning. The problem solver knows what data are relevant and what mental operations and analysis are required to deal with the data. He merely has to arrange the data into a form which may be used as inputs to a defined sequence of evaluation.

Type 2 : The required operations and methods are known, but not the data.

Type 3 : The problem solver understands the data, but does not know how to manipulate them to achieve a desired end.

Type 4 : Both the information and the operations are unknown. The problem solver must search for cues, generate explanatory concepts and develop a method for manipulating the data once they are organised.

Problems may be regarded as open or closed (Rickards, 1974). The characteristics of open and closed problems are summarised in Exhibit 5.

3.2 Criticism

The above classifications are useful in offering different ways of studying problems. However, there is at present no fully developed taxonomy of problems and problem-solving. The development of such a taxonomy is beyond the scope of this research. But it is recommended that a detailed taxonomy of problems should be established in order to understand better the nature of problems.

EXHIBIT 5 : Characteristics of Open and Closed Problems - Rickards (1974)

Open Problems	Closed Problems
Boundaries may change during problem solving.	Boundaries are fixed during problem solving.
Process involves the production of novel ideas.	Process marked by predictability of final solution.
No one correct solution.	Solutions may be demonstrated to be logically correct.
	Procedures are generally known.

Examples of Open Problems :

* Inventing new products;
* Resolving communications problems;
* Resolving economic problems;
* Resolving conflict.

Examples of Closed Problems :

* Solving a jigsaw puzzle or crossword;
* Linear Programming - dependent generally on Operational Research procedures : usually one correct solution;
* I.Q. tests;
* Mathematical problems.

4.0 SYNECTICS PROBLEMS

4.1 Course Problems

Each course member was requested by the Abraxas staff to prepare 4 problem statements for one of the 6 Synectics Basic Courses of training studied within this research. The guidelines given were :

i) The problems should be task- and/or social-relations orientated.
ii) The problems should be expressed as goal-directed statements.
iii) The course members should own the problems, i.e. be the CLIENTS.

The specific instructions given to the course members are shown in Appendix 1 of Volume III.

Synectics methods are concerned with resolving open problems.

Otherwise no attempt has been made to classify course members' problems within this research. This is because within Synectics practice such aspects as problem complexity and size are regarded as CLIENT value judgements. The CLIENT's perception of his problem is accepted initially in Synectics sessions, although it may be challenged by PARTICIPANTS during the HOW TO STATEMENT generation procedure.

Each of the problems studied within this research is different in content. The exception is the Thermos Problem, shown in Exhibit 6. This problem is introduced at the start of the Synectics course so that the Abraxas staff may discuss with the course members various problem-solving issues, such as process v. content, roles, methods, etc.

4.2 Limitations

Synectics methods are limited to open problems. This is indicated by Parker (1975), who studied the effects of Synectics training and application at Ferodo Ltd. This study is described in Chapter 2. Parker maintained that :

"Synectics isn't the answer to all problem situations. Those involving vast amounts of data, and in-depth knowledge of one discipline, e.g. statistics, are best left to an individual or to O.R. methods, according to how many activities are involved." (p.21)

EXHIBIT 6 : Thermos Problem

Course members are asked to resolve the following problem as a group. A time limit of 20 minutes is allowed.

" You are probably familiar with the wide-mouth thermos bottle. The wide mouth is to permit the entrance of a spoon for eating stews, etc. Imagine that you are employed as a group to invent a new closure for this product to replace the stopper. The new closure must fall within the following specification :

i) should be loss-proof and integral so that the top does not have to be removed to reach the contents;
ii) there should be no strings, chains and hinges;
iii) cup top should be retained in a useable form;
iv) must not add more than 25 p. to retail cost;
v) must be easily cleaned;
vi) must be thermally effective for 10 hours;
vii) must hold up to 1.5 pounds per sq. inch;
viii) thermos bottle itself must not be altered;
ix) wide mouth must be retained."

5.0 PROBLEM-SOLVING AND RELATED TECHNIQUES

Numerous problem-solving and related techniques have been developed in addition to Synectics methods. Several of these of these techniques are summarised briefly in Exhibit 7.

5.1 Combinations of Techniques

Each of the above techniques may be combined with Synectics methods to offer new procedural options.

Examples :

i) Synectics and Brainstorming Methods : Brainstorming idea generating procedures may replace the Synectics idea-PARAPHRASE-ITEMISED RESPONSE procedure.

ii) The P.A.B.L.A. technique may replace the ANALYSIS.

Thus the techniques are not necessarily mutually exclusive.

5.2 Similarity of Techniques

There is a high degree of similarity between Synectics and Brainstorming methods. In many ways Synectics methods are a developed form of the Brainstorming technique. Their specific similarities are shown in Exhibit 8.

EXHIBIT 7 : Problem-Solving and Related Techniques

Date	Author	Technique	Summary Description
1945	Kohler	Gestalt Methods	Perception-based procedures, relying on the use of insight.
1948	Zwicky	Morphological Analysis	The form and structure of the problem is examined in detail. The soluion is a system which comprises : i) a set of properties; ii) a set of constituents; iii) the relationship between the constituents (the morphology).
1954	Crawford	Attribute Listing	Specialised form of Morphological Analysis.
1957	Osborn, Parnes	Brainstorming Methods	Idea generating procedures and roles.
1962	Small	Bionics	System design procedures based upon the study of the structure, mechanisms and functions of plants and animals.
1965	Kepner, Tregoe	Kepner-Tregoe	Logical and precise interrogation procedures, involving Problem Analysis, Decision Analysis and Potential Problem Analysis.
1965 1968	Latham; Terry	P.A.B.L.A.	Critical analysis of problem requirements, using a set of charts to develop ideas and record information.

EXHIBIT 8 : Similarities between Synectics and Brainstorming Methods

Brainstorming Element	Synectics Element
Leader	LEADER/CLIENT
Restatements	HOW TO STATEMENTS
Idea generation procedures	HOW TO STATEMENT generation procedure
Group members	PARTICIPANTS
Use of Newsprint and small pads	Use of Newsprint and small pads
Wildest idea procedure	EXCURSION procedure

5.3 Evidence

With the exception of Brainstorming methods, there is little independent evidence of the effectiveness of the above techniques. Most supporting evidence comes from their authors, who (obviously) tend to report success and to present sometimes their technique as an all-embracing panacea. This criticism is particularly applicable to Gordon's (1961) description of early Synectics methods and Osborn's (1963) description of Brainstorming methods.

6.0 INDIVIDUAL V. GROUP PROBLEM SOLVING

6.1 Research Evidence

This is summarised in Exhibit 9.

Early studies demonstrated that groups were generally more effective than individuals for task activity. Shaw (1932) compared individual v. group performance on a complicated puzzle. Only 14% of individuals working alone solved the problem. 60% of groups were successful. Shaw attributed the superiority of groups to interaction effects.

Lorge and Solomon (1955) criticised Shaw's study. They argued that the probability of achieving a solution increased as the number of group members increased, ceteris paribus. They attempted to refute the effects of group interaction by developing a mathematical model to substantiate their argument.

More recently the Brainstorming technique has been used widely to compare individual v. group problem-solving performance.

Gibb (1951) used groups of 1, 2, 3, 6, 24, 48 and 96 people on a series of idea generating tasks. He found that the number of ideas generated per person declined as group size increased. Groups operating under 'low threat' conditions were more effective than those under 'high threat' conditions. Gibb concluded that the 'Deferred Criticism' procedure was

EXHIBIT 9 : Summary of Research Findings on Individual V. Group Problem Solving

Date	Author	Findings
1932	Shaw	Groups more effective than individuals.
1951	Gibb	Increased group size leads to decrease in number of ideas generated per person.
1955	Lorge et al.	Groups more effective than individuals.
1958	Taylor et al.	'Nominal' groups (individuals working alone, then pooling ideas) more effective than 'real' groups (individuals working together).
1961	Weiskopf & Eliseo	Support for Brainstorming 'Deferred Criticism' procedure.
1963	Dunnette et al.	Individual Brainstorming sessions more effective, especially when preceded by group practice.
1969	Davis	Groups faster in producing ideas; nominal group performance superior.
1974	Bouchard et al.	Working in sub-groups and then pooling ideas superior to either nominal or real groups.
1974	Lamm & Trommsdorf	Real group inferiority due to 'social inhibition'.
1975	Lewis et al.	Support for Brainstorming 'Deferred Criticism' and 'Free-wheeling' procedures; nominal groups more effective than real groups.

useful for stimulating the rate of idea generation and novel ideas.

Weiskopf and Eliseo (1961) supported the 'Deferred Criticism' procedure. They found that groups of 7 students working under deferred criticism conditions produced more ideas than groups working under conditions of severe criticism. However, the ideas of the former groups were of a lower quality.

In their oft-quoted study Taylor et al. (1958) compared the performance of 'real' groups (individuals working together) with that of 'nominal' groups (individuals working alone, then pooling their ideas). The nominal groups were superior both in terms of the quantity and quality of ideas. Taylor et al. concluded that group participation when using the Brainstorming technique inhibits creative thinking.

Dunnette et al. (1963) carried out a similar study using an industrial sample. They compared performance under two conditions : individual followed by group Brainstorming sessions, and vice versa. Individual Brainstorming sessions were found to be more effective, especially when preceded by a group session.

However, Davis (1969) found that groups produced ideas faster than individuals. He concluded that there is an optimal match between subject preference, assignment and problem type. Similar evidence came from Street (1974), although again nominal groups were superior to real groups.

Bouchard et al. (1974) reviewed several Brainstorming studies. They concluded that :

i) Nominal groups are superior to real groups in terms of the number of ideas generated.
ii) Working in small sub-groups and later pooling ideas is preferable to working in either nominal or real groups. The reason is that, although a sub-group may produce ideas similar to those of real or nominal groups, they tend to explore ideas in greater depth.

Lamm and Trommsdorf (1974) reviewed a series of Brainstorming experiments. They ascribed the real group inferiority of the number of ideas generated in part to 'social inhibition' : the fear of appearing foolish by offering wild ideas.

Lewis et al. (1975) used Brainstorming procedures to resolve real-life engineering problems. Individuals worked alone and in groups (2, 4 and 6 individuals), with time periods of 50 and 90 minutes. They found that :

i) The 'Free-wheeling' and 'Deferred Criticism' procedures aided idea generation;
ii) Nominal groups were more effective than real groups.

They concluded that the Brainstorming technique is ineffective for problem solving in engineering, at least as a one-off device. Although they did indicate that Brainstorming procedures might be used effectively by individuals or groups skilled in the technique.

6.2 Individual V. Group Applications of Synectics Methods

Synectics methods may be used for individual and group problem solving. Specifically, the following applications of Synectics methods are examined within this research :

i) Individual : one individual problem solving alone, acting as CLIENT, LEADER and PARTICIPANT;
ii) Small (real) group : two individuals problem solving together, acting as CLIENT/PARTICIPANT and LEADER/PARTICIPANT.
iii) Full (real) group : 3 or more individuals problem solving together, with a clear distinction of roles.

Applications involving sub- or nominal groups and other two-person role mixes are not investigated because they were not used during the 6 Synectics Basic Courses studied within this research.

Whilst several studies (described in Chapter 2) have reported on the effects of Synectics group problem solving, prior to this research there have been no systematic data on Synectics individual problem-solving applications. This is because Synectics methods have tended to be regarded by researchers (outside Synectics trainers) as only a group problem-solving technique. For example, Rickards (1974) presented Synectics methods as a group problem-solving technique, and ignored its application by individuals working alone.

7.0 PROBLEM-SOLVING STYLES

Problem-solving style is defined as a goal-directed pattern of behaviour. Problem-solving styles may be employed either by individuals or groups of individuals.

7.1 Individual Problem-Solving Styles

Adamson and Taylor (1954) explained style in terms of rigidity using the Water Jar Test (W.J.T.) to measure problem-solving performance. The W.J.T. is a set of water-jar problems, such as :

"If you have a 7-quart jar and a 4-quart jar, how can you get exactly 10 quarts of water?"

They observed that unsuccessful problem solvers missapplied their ideas and repeatedly made the same mistakes. This is the Einstellung or set effect. Set is "a readiness to respond in a certain way to some stimulus situation" (Sanford, 1967; p. 577). In comparison, successful problem solvers experimented with and adapted their ideas until the correct solution was achieved.

Levitt (1956) cast doubt on the rigidity concept. Reviewing more than 30 W.J.T. experiments, he found disagreements as to whether there is a general trait of rigidity and whether rigidity comprises several factors.

Taylor and McNemar (1955) reviewed several studies on problem-

solving styles. They concluded that functional-fixedness and rigidity may restrict inefficiently problem-solving activity. They mentioned particularly that the traits of ethnocentrism and concretemindedness appear to be related to set and rigidity.

Bruner et al. (1956) suggested that past experience is an important influence on the way individuals make decisions. Past experience provides the basis for making optimum decisions. It may also make an individual over-rigid in his problem-solving approach. This is termed 'persistence forecasting'.

Individuals use past experience and current information to establish expectancies. Bruner et al. call this process 'style'. An individual's cognitive style may restrict his problem-solving flexibility, limiting him to reproduce existing ideas, rather than explore novel ideas.

Witkin et al. (1962) identified two cognitive styles, referred to as 'field independence' and 'field dependence'. Each is defined in terms of the ability to overcome an embedding context - to experience an item dependently or independently of an organised field of which it is a part.

Field independence was found to be related positively to scores on performance tests of intelligence, to assertiveness and to certain modes of personality adjustment. Field dependence appeared to be related to personality dependence.

Gardner (1959) and French (1965) developed the focussing v. scanning dimension of problem-solving style identified by Bruner et al. (1956). French described the dimension ('styles') as :

i) a reasoned or systematic approach, related to field independence;
ii) a less-orderly scanning and visualising approach, related to field dependence.

Kagan et al. (1963) studied the problem-solving behaviour of children, who were required to sort an array of objects. 3 'grouping principles' were found :

i) Analytical : grouping in terms of some common selected element;
ii) Inferential - Categorical : grouping in terms of a common category to which all objects belong;
iii) Relational : grouping in terms of functional relationships.

The analytical grouping is similar to field independence and focussing. The relational mode is similar to visualising.

Rorer (1965) stressed the importance of the effects of set in problem-solving activity. He defined set as a conscious or unconscious desire on the part of an individual to produce a certain picture of himself. Set forms the basis of Rorer's 'response style'. This refers to the tendency to select some response category a disproportionate amount of the time

independently of the item context.

Porteus (1965) investigated style differences in maze performance. In a series of experiments, he demonstrated differences in :

i) speed of achieving a solution;
ii) correctness of solution;
iii) meticulousness of solution.

Porteus concluded that individual problem-solving styles are personalised and stable over time.

Newell and Simon (1972) developed a complex model of problem solving. They identified 6 problem-solving styles, which are summarised in Exhibit 10. These styles form the basis of a set of corresponding problem-solving strategies.

Johnson (1972) reviewed and classified several style studies. His review and classification are summarised in Exhibit 11.

EXHIBIT 10 : Problem-Solving Styles -
Newell and Simon (1972)

i) Individual generates clear plans, working both backwards and forward.

ii) Individual plans less, works forward, searching the rules when necessary, scans the new expressions as he generates them, and reformulates the problem with the new information obtained.

iii) This style is similar to the second, except that the individual is less resourceful in generating new expressions that give him new insights as he proceeds.

iv) Individual generates plans and works backwards, but sometimes persists with a single sub-goal, and sometimes searches through the rules for an applicable one.

v) This style is similar to the first and fourth, in characterising the problem broadly and in planning, except that the individual becomes preoccupied with a sub-goal and does not return to the main goal.

vi) The individual concerns himself with the detail rather than the broad structure of the problem, and spends much time in searching for rules he can apply, but does not apply them unless the outcome has an obvious use.

EXHIBIT 11 : Problem-Solving Styles -
Johnson (1972)

Style	Principal Findings
Flexibility - Rigidity (Extent to which direction during problem solving is varied)	1940's and 1950's studies indicate little generality of rigidity trait across problems. Cognitive flexibility is a more substantial factor : Open-minded individuals are generally more effective problem solvers on open and closed problems than closed-minded (dogmatic) individuals.
Information Seeking (Extent to which data are sought)	Open-minded individuals are likely to seek more information (of a higher quality) than dogmatic individuals, who tend to 'protect' information in order to maintain their belief system.
Conceptual Differentiation (Extent to which relations between items are distinguished)	Studies involving free-sorting tasks tend to indicate that individuals have generally a stable style of cognitive control, independent of general intelligence and ability to abstract.
Reflective Style (Extent to which the rapidity of attack on a problem is varied)	This style is in part attributed to the control of impulsivity, which allows for inhibition of incorrect solutions and reflection over alternative possibilities. Increased control over impulsivity increases generally problem-solving effectiveness.
Cognitive Complexity (Extent to which the structures of a problem are distinguished)	No unitary factor of cognitive complexity has been identified. Rather it comprises several relatively independent conceptual dispositions, and is not the same as conceptual differentiation.

EXHIBIT 11 Continued : Problem-Solving Styles - Johnson (1972)

Style	Principal Findings
Analytical Field Approach (Extent to which individual problem elements are examined)	Individuals who use this style tend to achieve a high performance on Maier's 'pendulum problems' (described above).
Abstract Approach (Extent to which a problem is examined independently of its attributes)	'Abstract thinkers' have a more complex differentiated system of concepts for categorising data than 'concrete thinkers'. The latter tend to make absolute evaluations and have a greater need for cognitive consistency.

7.2 Group Problem-Solving Styles

Shaw (1964) described two group problem-solving styles :

i) a 'centralised' pattern of behaviour, where communication is channelled through one individual;
ii) a 'decentralised' pattern of behaviour, where communication is more diffuse and no one individual controls the communication channels.

Shaw used problems involving the identification of symbols and varied the equality of distribution of information among members.

In general, centralised groups solved relatively simple problems faster than decentralised groups, but were slower for relatively complex problems. Satisfaction was higher in decentralised groups. Shaw accounted for this higher level of satisfaction through :

i) 'independence' : through which an individual obtains satisfaction by operating under more open conditions;
ii) 'saturation' : by which effectiveness of a pattern is fixed because communication channels achieve full capacity.

Other aspects of group functioning are discussed in Chapter 5.

8.0 STRATEGIES

Problem-solving strategy is defined as the means adopted to achieve a terminal state (solution).

Goodnow and Pettigrew (1955) studied the operation of problem-solving strategies. Individuals were required to learn how a laboratory slot machine paid out, and if possible to develop successful strategies. It was found that :

i) Individuals developed specific strategies over time;
ii) Individuals will persist with a strategy that proves successful.

Major research on strategies has been conducted by Bruner et al. (1956). They defined strategy as a pattern of decisions in the acquisition, retention and utilisation of information that serves to meet certain objectives - to ensure certain forms of outcomes and to ensure against certain others.

In a series of experiments individuals were asked to identify a concept of classification in a set of cards, each containing two figures that may be categorised on the basis of colour, shape, size and number.

They demonstrated that individuals develop 4 distinct strategies, summarised in Exhibit 12.

Individuals tended to be more effective using the

EXHIBIT 12 : Problem-Solving Strategies -
Bruner et al. (1956)

i) Simultaneous Scanning

An individual investigates which of his hypotheses of how to solve the problem are tenable and which should be refuted. In order to be effective the individual must plan carefully each step so that his decisions are maximally informative. After each decision the individual must remember which hypotheses have been disproved until the problem is successfully resolved.

ii) Successive Scanning

This involves testing a single hypothesis at a time. Having selected a given hypothesis, the individual restricts his decisions to those problem areas that directly affect his his hypothesis. The individual does not need to remember eliminated hypotheses as for Simultaneous Scanning, and consequently there is no cognitive strain. However, this strategy does not permit maximum informativeness of each decision. Nor is the individual able to regulate the risk associated with each decision.

iii) Conservative Focussing

The individual concentrates on one attribute of the problem at a time. Decisions are made cautiously. There is low cognitive strain and high informativeness of each decision. All decisions are low risk.

iv) Focus Gambling

The individual attempts to manipulate more than one aspect of the problem at a time. The individual guesses which decisions should be made, despite the high risk of failure. Cognitive strain is low. The individual may maximise the informativeness of each decision. Although his decisions are made generally on little information.

Conservative Focussing strategy. The superiority of the Focussing strategies increased as the individuals were required to remember and assimilate increasing amounts of information.

Individuals also changed their strategies from problem to problem. Those who were initially successful gradually changed to the Focus Gambling strategy. Those who were relatively unsuccessful tended to later pursue the Conservative Focussing strategy. Thus, experience influenced their choice of strategy.

Bruner et al. concluded that :

i) Individuals adopt several different kinds of strategy, which might be said to characterise their problem-solving style;
ii) A given problem may be solved using more than one strategy.

Bruner et al.'s study was extended by Wason (1959) and Huttenlocher (1962). They found that individuals have more difficulty in making inferences from negative instances.

Glanzer et al. (1963) also developed Bruner et al.'s study. They criticised Bruner et al.'s experiments in so far as the strategies adopted by individuals could only be determined by experimenter inference. Using a wider range of problems, they found a non-linear relationship between concept complexity and success in attainment. This led

them to infer that Focussing is generally more effective than Scanning.

Bourne (1963) investigated 'Wholist' and 'Partist' strategies. Partist strategies involve focussing on certain attributes and ignoring others. Wholist strategies require examination of all attributes of a problem. Partist strategies were found to be relatively ineffective. The optimum approach was the Conservative Focussing/Wholist strategy. Although individuals were increasingly reluctant to use a wholist strategy as problem complexity was increased.

Gagné (1970) indicated the importance of the learning of problem-solving strategies, which he defined in terms of 'self-instructions'. Gagné viewed strategies as governing an individual's approach to listening, reading, storing and retrieving information, and making decisions. In order to be an effective problem solver, an individual must have a wide range of strategies to select from.

Newell and Simon (1972) summarised several problem-solving studies. Their summary was used to develop the Newell, Simon and Shaw General Problem Solver computer programme. The objective of the programme is to solve problems in the same way that individuals do. When there is no obvious routine (algorithm), the programme uses heuristic search strategies, which involve testing out different ways of dealing with the problem.

Johnson (1972) reviewed several studies on 4 strategies,

summarised in Exhibit 13. Johnson indicated that specific strategies are restricted generally to specific problems.

8.1 Synectics Problem-Solving Strategies

The Synectics methods examined within this research incorporate one problem-solving strategy. This is the Synectics Problem-Solving Scheme, described in Chapter 2. This research is concerned in part with developing associated problem-solving strategies for the LEADER, CLIENT and PARTICIPANT roles.

EXHIBIT 13 : Problem-Solving Strategies - Johnson (1972)

Strategy	Principal Findings
Stop and Think	The performance of individuals who are given time to consider a problem before actively attempting to resolve it tends to be superior to those who immediately attack.
Questioning	Questions may be used successfully as information-seeking strategies. Individuals may be trained to improve the quality of information sought through the use of questions.
Hypothesis Testing; Gambling	These strategies have been taught successfully to children of varying ability. Highly intelligent children tend to prefer and are more successful using the Hypothesis Testing strategy. Children of lesser intelligence tend to prefer the Gambling strategy and are more successful using the Gambling than the Hypothesis Testing strategy.

9.0 CRITICISM

9.1 Criterion Problem

Criteria used to measure efficiency and effectiveness in the above studies have included :

i) number of ideas produced;
ii) rate of idea generation;
iii) quality of ideas produced;
iv) variety of ideas produced;
v) uniqueness of ideas produced.

The first two criteria are objective, allowing studies to be compared readily. The latter criteria are subjective and are susceptible to experimenter bias in terms of personal value judgements. Evaluating the quality of ideas is particularly subjective in the absence of systematically established measures of value.

9.2 Equivalence

Solem (1965) reviewed several Brainstorming studies. He maintained that to assume equivalence of the Brainstorming technique and problem-solving was entirely unwarranted. Specific criticisms were :

i) Full group problem-solving potential was rarely optimised;
ii) Leader functions and contributions tended to be either misused or ignored;
iii) Frequently experimenters utilised no real problem.

He concluded that a broader perspective needs to be employed in evaluating the effects of Brainstorming practice. His conclusion is put in practice within this research : the effects of Synectics training are examined from several viewpoints.

9.3 Semantics

The term style has been missapplied occasionally within problem-solving research. For example, in Rorer's (1965) study mentioned above, he referred to response bias as style. This is confused with cognitive style. Cognitive style is an individual variable. In contrast, response bias is determined primarily by the nature of a given problem situation or area.

9.4 Competence V. Performance

Most studies on problem-solving have focussed upon performance. Competence has been ignored largely as a variable. Competence refers to the level of problem-solving skill (Chomsky, 1968). Greene (1975) has emphasised the importance of competence. She indicated that :

"So far no completely satisfactory reconciliation has been found between the need to analyse the competence necessary for a person to solve a problem and how he actually does it." (p.39)

Two of the few experiments on competence were carried out by Maier (1950) and Maier and Hoffman (1960).

Maier investigated the effects of leader competence for problem-solving tasks. His study involved an assembly line simulation, using the Parasol Assembly problem. Experimental role-playing groups were controlled by highly skilled discussion leaders, who acted as foremen. These leaders asked exploratory questions regarding problems their members might be encountering in carrying out their tasks. Control groups had no discussion leaders. Experimental groups achieved solutions of a higher quality than the control groups.

Maier and Hoffman studied the effects of varying leader competence in using discussion techniques to solve the Viola Burns problem. The problem is a case history task, involving whether a girl - Viola Burns - should be promoted. Promotion is a poor quality decision. Groups led by individuals with increasing levels of skill achieved increasingly higher quality solutions and decisions.

10.0 CONCLUSIONS

i) There is a need to establish a satisfactory taxonomy of problems and problem-solving processes in order to understand better the nature of tasks and task activity.

ii) Research evidence on the relative value of individual v. group problem-solving performance is contradictory. Using the Brainstorming technique, working in sub-groups and then pooling ideas appears to be superior, in terms of the number and quality of ideas generated, than either nominal or real group applications.

iii) A wider range of objective measures of problem-solving effectiveness is required. There is a need for a satisfactory measure of problem-solving competence.

iv) There is no close agreement as to what are the major dimensions of problem-solving style. Different results from style studies may be attributed in part to the use of different methodological approaches, and in particular to the use of different types of problems requiring different types of skills.

v) In general, any given problem may be resolved by more than one strategy. The strategy selected reflects an individual's problem-solving style. Particular strategies appear to be applicable to given types of problem.

.....

CHAPTER FIVE

HUMAN GROUP PROCESSES

Summary

Research studies on group effectiveness are drawn together and discussed within a framework. Specific mention of Synectics problem-solving groups and sessions is made within this context.

Contents

1.0 DEFINITIONS

1.1 Groups

Groups may be divided into two categories : psychological groups and social organisations.

Psychological Group : consists of two or more persons whose :

i) Member relations are interdependent : each individual's behaviour influences strongly the behaviour of the other individuals;
ii) Members share an ideology : a set of beliefs, norms and values which regulate their behaviour. An ideology is developed as a group carries out a task. Each group tends to have its own ideology.

Social Organisation : consists of an integrated system of interrelated psychological groups, which attempt to achieve a mutually agreed goal.

This research is concerned with the operation of psychological groups.

1.2 Group Goals

These are the mutually agreed or majority supported objectives of a group. Group goals are either primary or accessory.

Primary Goal : is the principal objective of a group.

Accessory Goal : is the secondary objective(s) of a group. Accessory goals develop as a group leader attempts to satisfy the changing wants of his members.

Group goals may change over time. Blau (1955) and Sills (1958) studied bureaucracy, and put forward the concept of 'displacement' or 'involution' of goals. This is where primary goals are superceded by secondary goals.

Within Synectics sessions, the primary goal is to resolve the CLIENT's problem. Accessory goals include to use time and resources (PARTICIPANTS) efficiently. Other accessory goals vary from session-to-session, and are dependent in part upon the bias of the group members.

2.0 FRAMEWORK OF GROUP EFFECTIVENESS

Krech et al. (1962) offered an excellent framework of group effectiveness, summarised in Exhibit 1. Group effectiveness is defined in terms of the degree of primary/secondary goal achievement by a collection of individuals. The framework is updated and modified to take account of problem-solving and related activities. Studies relating to the framework's variables examined within this research are discussed below. Research evidence on the variables not investigated within this research is summarised as Exhibits.

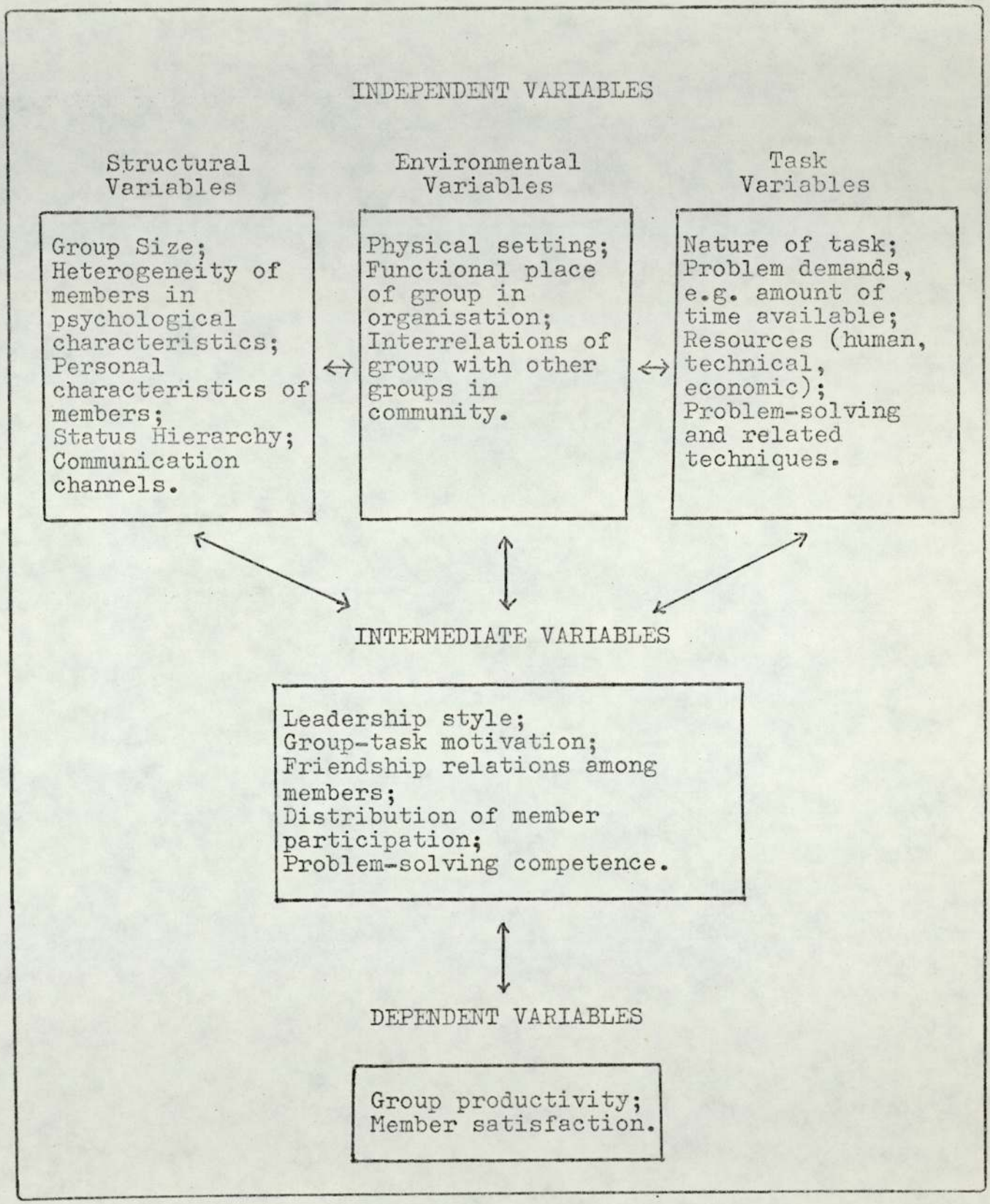
2.1 Group Structure

This is the system of positions and roles of a group. Group structure regulates the interpersonal interactions of group members. Group structure may vary in terms of rigidity and centralisation.

Rigidity : is the degree to which roles are defined. High rigidity is where roles are defined precisely and idiosyncratic behaviour is discouraged. Low rigidity occurs where roles are defined loosely and behaviour is influenced little by rules.

Centralisation : is the degree to which control is concentrated. High centralisation involves concentration of control (power) within a small elite. Low centralisation occurs where control is diffused widely throughout a group.

EXHIBIT 1 : Framework of Group Effectiveness - After Krech et al. (1962)



Within Synectics problem-solving groups there is high rigidity and high centralisation. The Synectics roles of CLIENT, LEADER and PARTICIPANT are well defined. Control of content and process reside solely with the CLIENT and LEADER respectively, although there may be as many as 8 group members within a Synectics session.

2.2 Group Size

Thelen (1949) suggested that groups should be the smallest possible size, encompassing all the skills required to accomplish a given task.

Hemphill (1950) compared leader behaviour in groups of 30 individuals or less with leader behaviour in groups of 31 or more. In the larger groups the demands upon the leader were greater, and leader-centred behaviour was tolerated more by members.

Similar findings were obtained by Carter et al. (1951; 1956). They investigated leadership style and group size. They found that the correlation between authoritarianism and group size increased as group size expanded from 4 to 8 members.

Marquis et al. (1951) studied decision-making processes within conferences. They found that :

i) Individuals valued more the opportunity to participate than actual participation in group discussions;

ii) Satisfaction of a given member was greater if he did speak, even though his ideas were not accepted or included in the final group product.

Bales and Strodtbeck (1951) and Stephen and Miscler (1952) studied the distribution of participation within discussion groups. They found that :

i) The most frequent contributor assumed an increasingly prominent role in discussions;
ii) The larger the group, the greater was the difference in the amount of participation of the most frequent contributor and that of other members;
iii) The number of members who contributed less than their proportionate share increased as group size expanded from 2 to 7 individuals.

Gibb (1951) studied the effects of varying group size and of threat reduction upon problem-solving activity. They found that :

i) The total number of ideas produced increased with expanding group size, although not in proportion to the number of members. This was attributed to inhibition. As group size expanded, members became more inhibited and therefore participated less;
ii) The number of ideas contributed decreased when group problem-solving procedures became more formalised.

Taylor and Faust (1952) compared the efficiency of problem-solving groups (2-4 individuals), using the '20 questions'

task. They found that :

i) Overall performance of groups of 4 individuals was approximately equal to that of groups of 2 individuals;
ii) Groups of 4 individuals had fewer failures in finding the answers.

Slater (1958) studied the effects of varying group size in a research involving 24 groups (2-7 individuals). The groups held meetings to discuss human-relations problems. The members were asked then if they felt that their group was too small or too large to accomplish the task. He found that :

i) 5 member groups : these reported complete satisfaction;
ii) Groups of more than 5 members : members felt that their groups were disorderly, too aggressive and too competitive. Some members wished for more control in order to accomplish their tasks. Others felt that certain individuals had been over-domineering in the discussions;
iii) Groups of less than 5 members : members complained that their groups were too small. Some members were inhibited from expressing their ideas freely through the fear of alienating one another and of destroying the group.

Osborn (1963), writing on the Brainstorming technique, suggested that the optimum size for Brainstorming groups is 12 members, although he did not support his suggestion with evidence.

Some support for Osborn's suggestion came from Thomas and Fink (1963). They studied group size and task complexity, and found that on more complex tasks larger groups (9-12 individuals) did better than smaller groups (3-4 individuals).

However, Kidd (1958) studied social influence in task-orientated groups, and found no significant differences in idea production among groups of 2, 4 and 6 members.

Renzulli et al. (1975) studied fluency, flexibility and originality as a function of group size (3, 6 and 12 individuals). Using 3 idea generation tasks, they found that as group size increased the contribution per person decreased. The value of the group problem-solving sessions was affected by :

i) how the sessions were conducted;
ii) nature of task;
iii) amount of prior practice in problem solving;
iv) age and educational background of the members.

Synectics problem-solving sessions are operated by individuals or by groups of two or more individuals. On the basis of their experience, staff members of Synectics Inc. recommended a maximum of 8 individuals for a Synectics problem-solving group, with an "optimum" size of either 5 or 6 individuals. LEADER control becomes increasingly difficult when the group size is more than 8 individuals. This recommendation was made during the April 1975 Synectics Basic Course, organised by Synectics Inc., Cambridge,

Massachusetts, U.S.A. Their recommendation is lent some support by the findings of Slater's (1958) study cited above.

Experimental evidence on Synectics problem-solving group size came from Korth (1971), who investigated the effects of Synectics training. He used groups of 13 individuals and found this size to be too large :

"This many people diffuses the intensity of the Synectics experience and saps the individual member's sense of participation." (Chapter 5, p.5)

2.3 Group Development

Tuckman (1965) investigated the developmental stages in group formation. He found 4 stages, which are summarised in Exhibit 2.

This research attempts to identify the stages in Synectics group development during the 6 Synectics Basic Courses studied. Parker's (1971) study described in Chapter 2 is the only other detailed research on Synectics group development.

2.4 Group Composition

Composition refers to the individual characteristics and pattern or combination of group members. The general findings

EXHIBIT 2 : Stages in Group Formation - Tuckman (1965)

Stage	Group Structure	Task Activity
Forming	There is anxiety, dependence upon the leader; testing to find out the nature of the situation and what behaviour is acceptable.	Members find out what the task is, what the rules are, what methods are appropriate.
Storming	Confict between sub-groups; rebellion against the leader; opinions are polarised; resistance to the leader's control.	Emotional resistance to demands of task.
Norming	Development of group cohesion; norms emerge; resistance is overcome and conflicts are resolved; group cohesion begins to develop.	Open exchange of views and feelings; cooperation develops.
Performing	Interpersonal problems are resolved; roles are flexible and functional.	Emergence of solutions to problems; constructive attempts at task completion; energy is now available for effective work; this is the stage for effective task activity.

of studies relating to group composition effects are summmarised in Exhibit 3.

The general recommendations regarding the composition of Synectics problem-solving groups are :

i) It is preferable to have group members of diverse backgrounds in order to stimulate a wide variety of contributions.
ii) Groups should be composed of individuals who are involved in the problem situation (for example, other CLIENTS) and of individuals who are in no manner involved in the problem content. The latter are assumed to bring a fresh approach to the task activity.
iii) Groups might include usefully individuals who have expertise in the problem situation. These individuals are able to provide highly skilled assistance.

These recommendations were made during the Synectics Basic Courses of November 1974 and January 1975 by the Abraxas staff members on the basis of their problem-solving experience.

Little systematic research has been carried out on the composition of Synectics problem-solving groups. Korth (1971), in his study noted above, found no evidence to indicate that certain personality types function "best" in Synectics sessions. The measures he used were the California Personality Inventory, the Tennessee Self-Concept Scale and the Personal Orientation Inventory.

EXHIBIT 3 : Group Composition : General Findings - Adapted from the reviews of McGrath and Altman (1966) and Davis (1969)

i) Traits of cooperativeness, efficiency and insight correlate positively with effective group functioning. Traits such as aggressiveness, suspiciousness and coolness towards other group members tend to be dysfunctional for effective group problem-solving activity.

ii) Heterogeneous groups are generally more productive than homogeneous groups, at least where novel solutions to problems are required.

iii) Homogeneous groups are more cohesive and have a higher morale than heterogeneous groups.

iv) Using the F.I.R.O.-B (Fundamental Interpersonal Relations Orientation) Scale to measure interpersonal compatibility, compatible groups tend to be more cooperative than incompatible groups. Compatible groups demonstrate greater productivity than incompatible groups because of 'Assembly Effects'. Assembly effects occur "when the group is able to achieve collectively something which could not have been achieved by any member working alone or by a combination of individual efforts" (Collins and Guetzkow, 1964; p. 58).

2.5 Status Hierarchy

Status refers to the prestige or rank of an individual within a group. The general findings of studies relating to status hierarchy effects are summarised in Exhibit 4.

In theory, every member of a Synectics problem-solving group has equal status, regardless of Synectics role. This assumes rational behaviour. In practice, organisation roles may influence problem-solving efficiency and effectiveness. The effects of differing status levels on Synectics group performance has never been investigated systematically.

2.6 Communication Patterns

Communication is the transmission and reception of ideas, information, knowledge, feelings and attitudes which produce a response. Stewart (1968) described communication as a pattern of interpersonal relationships. He emphasised commonly meaningful information. Mutual understanding must occur if communication is to be effective.

Extending the studies of Bavelas (1950), Dubin described communication patterns in terms of 'linkage systems', shown in Exhibit 5. From his interaction analysis studies, he concluded that the circular pattern promotes open communication and maximum participation.

In earlier studies Shaw (1954) and Leavitt (1951) found that radial groups required less time than circular groups

EXHIBIT 4 : Status Hierarchy : General Findings - Adapted from the reviews of Burnstein and Zajonc (1965) and Argyle (1969)

i) Groups which have a stable status hierarchy are more effective and efficient in problem solving than groups in which members are struggling to improve their status.

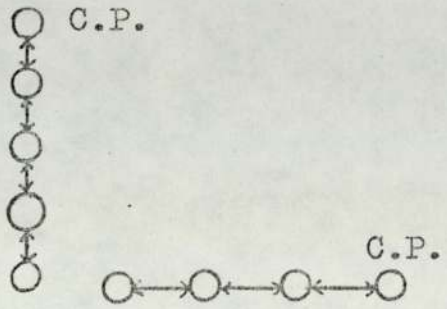
ii) Status hierarchy may result in restraints on the communication content. In mixed status groups high-status members tend to address few criticisms to low-status members.

iii) The number of communications irrelevant to task activity is greater generally among low-status groups compared with high-status groups. This 'irrelevant talk' of members serves often as an escape from their low-status position and from the task activity.

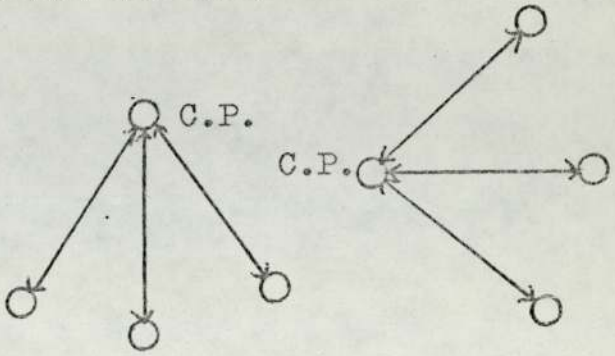
iv) 'Status incongruence' results where the status level and tangible rewards given by a group are not related proportionately to performance. In this situation a group is ineffective. Members will attempt to improve the alignment of the different aspects of their status.

EXHIBIT 5 : 'Linkage Systems' -
Dubin (1959)

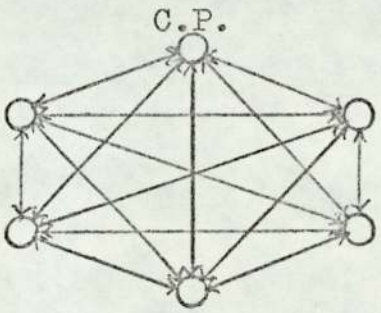
Serial Linkage



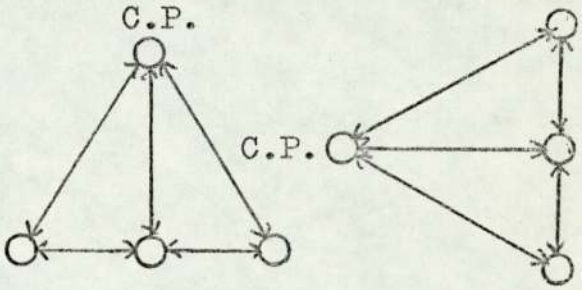
Radial Linkage



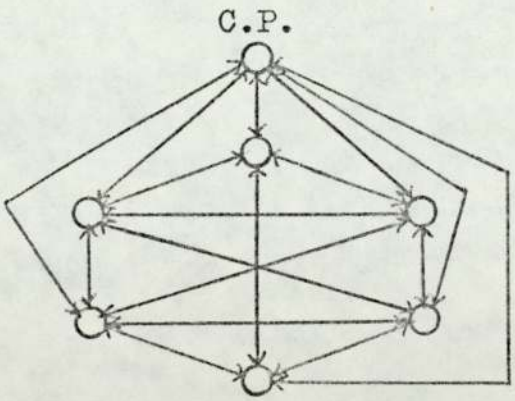
Circular Linkage



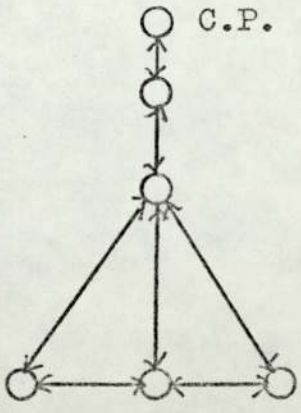
Radial and Serial Linkage



Radial and Circular Linkage



Serial-Radial-Serial Linkage



Key :

○ : Group Member

⟷ : Channel of Communication

C.P. : Central Position (leader)

to solve simple problems. Circular groups were more effective than radial groups on complex problems.

Shaw gave the following reasons for these results :

i) On simple problems the radial pattern had the effect of designating one individual to coordinate the task activity;
ii) On complex problems the contribution of all members was more important. In radial groups the 'central position' became saturated and the optimal performance level is exceeded. The individual who occupies the central position controls the communication channels.

Christie et al. (1952), Gilchrist et al. (1955) and Shaw et al. (1957) studied problem-solving groups which had either radial or circular or both linkages. In each study groups with both linkages were faster in solving their assigned tasks and made fewer errors than radial or circular groups. Shaw et al. concluded that in groups with both linkages free communication is encouraged. The greater connectivity stimulates a higher level of member satisfaction compared with either the radial and circular pattern.

Davis (1969) reviewed several studies on communication patterns and effectiveness. He indicated conflicting evidence on what is the most effective communication pattern. However, his review may be reinterpreted. The superiority of groups with both radial and circular linkages appears to be because of :

i) The greater flexibility of the combined linkages compared with other linkage systems;

ii) The combined linkages incorporate all other linkages : at any moment in time a particular linkage may predominate within the overall radial-circular linkage system.

Synectics problem-solving groups of 2 individuals have a serial linkage pattern. Groups of 3 or more individuals have potentially a radial and circular pattern. Exhibit 6 shows this latter pattern for a Synectics group of 8 individuals : 1 LEADER, 1 CLIENT and 6 PARTICIPANTS. This research investigates the various ways the communication channels of a Synectics problem-solving group are used during a series of Synectics sessions. This is the first systematic research on the communication linkage patterns of Synectics problem-solving groups.

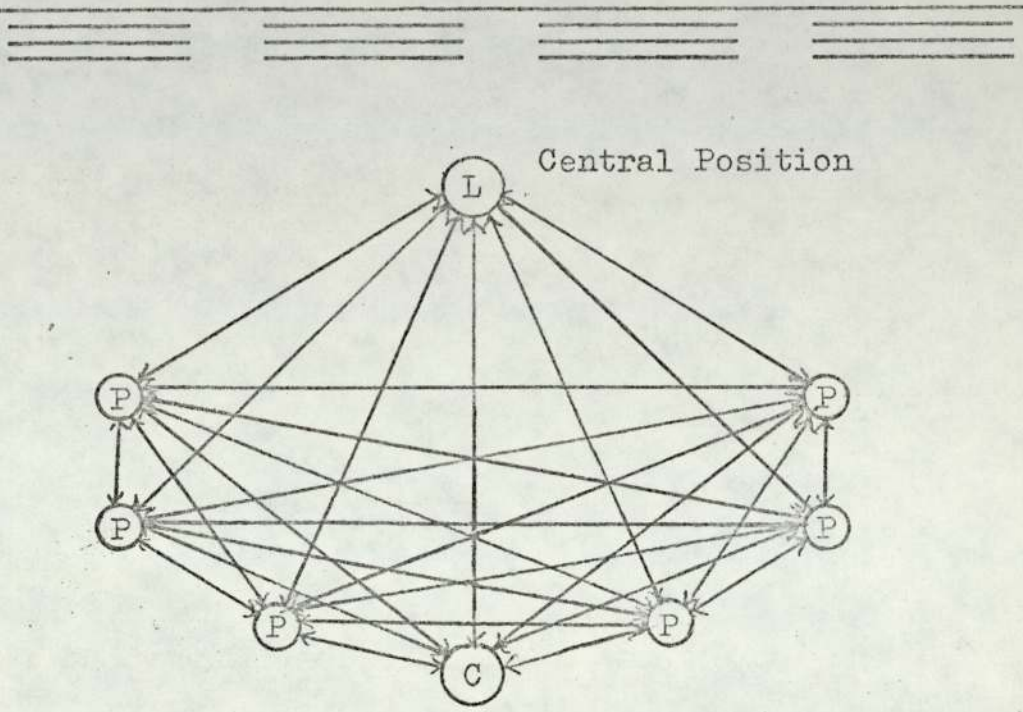
2.7 Group-task Motivation

Broadly defined a motive is a disposition to be satisfied by a specific set of circumstances. Motives may be regarded as goals. The general findings of studies relating to group-task motivation are summarised in Exhibit 7.

No systematic research has been carried out on the individual or group motivational aspects of Synectics problem-solving sessions and training. It is recommended strongly that research be conducted into this important variable of group effectiveness.

EXHIBIT 6 : Potential Linkage Pattern of a Full Synectics Problem-Solving Group

Large Newsprint Pads Mounted on a Wall or Easels



Key :

(L) : LEADER

(P) : PARTICIPANT

(C) : CLIENT

⟷ : Channel of Communication

Notes :

i) Having authority over process, the LEADER has control of the communication channels, and therefore occupies the central position.
ii) The CLIENT and PARTICIPANTS are seated in a semi-circle. The Leader stands in front of the other group members in order to record on the large pads the P.A.G., HOW TO STATEMENTS, SOLUTIONS, etc.

EXHIBIT 7 : Group-task Motivation : General Findings - Adapted from the review of Cartwright and Zander (1968)

i) Group goals are more acceptable where members are involved in their formulation.

ii) Cooperative groups tend to be more effective, with a higher degree of member satisfaction, than competitive groups.

iii) Communications are more efficient in cooperative groups, which put a greater emphasis on coordinating individual members' contributions.

iv) There tend to be strong pressures to achieve objectives in cooperative groups. In competitive groups achievement of a solution is mainly dependent upon one individual's contributions.

v) Group members will strive for success and attempt to avoid failure where :

a) They perceive themselves to be members of that group;
b) They percieve that the group has its own identifiable task.

2.8 Cohesiveness

Cohesiveness is defined in terms of the closeness of friendship relations. The general findings of studies relating to cohesiveness are summarised in Exhibit 8.

The effects of varying levels of cohesiveness within Synectics problem-solving groups have never been investigated systematically. The only evidence is anecdotal and is similar to the summarised findings.

EXHIBIT 8 : Cohesiveness : General Findings -
Adapted from the reviews of Krech et al. (1962) and Davis (1969)

i) Highly cohesive groups are more effective than low-cohesive groups.

ii) Highly cohesive groups are more likely to agree upon a common goal than low-cohesive groups.

iii) Cohesiveness increases in a cyclic manner with success on problem-solving tasks. In general, task failure or imperfect goal attainment tends to reduce cohesiveness.

iv) Task failure may increase cohesiveness where the cause of that failure is attributed to individuals outside the group or to factors not within the control of the group.

3.0 CRITICISM

The framework has the following strengths and weaknesses :

3.1 Strengths

i) The framework establishes a common system for ordering and examining a wide variety of studies on human group processes.

ii) The dimensions relating to group effectiveness may be classified as either independent, intermediate or dependent variables.

iii) The framework makes coherent apparently conflicting studies.

3.2 Weaknesses

i) Covariation of variables : independent variables may covary inter se. For example, group size may covary with nature of the task. For a given task the size of the group may need to be larger than for another task.

ii) Reverse flow difficulties : feedback of influence may occur within the independent - intermediate - dependent variable sequence. Changes in independent variables may lead to changes in the intermediate and independent variables. For example, reduced member satisfaction may influence negatively friendship relations. In turn individuals may leave the group, reducing its size.

iii) Nature of variables : it may be difficult to identify whether a given variable is either independent, intermediate or dependent.

The nature of a given variable may change over time between groups and between researchers' perceptions. For example, group cohesiveness may be a dependent variable in a particular social group, although it will be generally an intermediate variable.

Similarly, the POSSIBLE SOLUTION(S) to a CLIENT's problem is regarded within this research as the dependent variable. However, close friendship relations may be the dependent variable for a given PARTICIPANT of a Synectics problem-solving group.

iv) Omissions : Krech et al. failed to examine several variables. These include age and sex. There appears to be no conclusive evidence concerning these two variables. They warrant further investigation and are considered within this research.

Group norms are also omitted. A norm is a standard of behaviour against which the appropriateness of behaviours is to be judged. The general findings of studies relating to group norms are summarised in Exhibit 9.

Within Synectics sessions the group norm is to adhere relatively closely to the Synectics Problem-Solving Scheme.

EXHIBIT 9 : Group Norms : General Findings -
Adapted from the review of Davis (1969)

i) Norms vary in the degree of formality and the degree to which they are shared by group members.

ii) Group norms pervade individual judgements.

iii) Wide deviation from group norms tends to be discouraged. Tolerable limits of deviation are established within groups. Deviations outside these limits result in negative sanctions, such as disapproval, rejection and expulsion.

iv) Norm conflict may result in mixed-norm groups. In such groups there is a tendency towards establishing mutually-shared norms.

Wide deviation is discouraged generally by Synectics trainers, unless the Synectics session is 'experimental'. This explains to some extent the lack of new practical developments of Synectics methods within recent years compared with the rapid expansion duing the 1960's. In the mid-1960's standardisation of Synectics methods and training procedures was necessary to teach effectively. However, this very standardisation appears to have hindered the general development of Synectics problem-solving practice, although not of theory (Prince, 1975).

iv) Chance Factors : the framework does not take into account chance factors. For example, the correct solution to a problem may result because of an individual's guess rather than group problem-solving activity. These unique influences tend to limit the utility of the framework.

vi) Prediction difficulties : problem-solving performance is almost impossible to predict accurately. Effectiveness is a multi-dimensional variable. Success or failure cannot be attributed to any one variable.

3.3 Interim Conclusions

There is strong support for the use of such frameworks in the study of human group processes. In his excellent review of studies on organisational effectiveness, Price (1968) has used a similar framework. He argued that the overwhelming advantage of these types of framework is that they allow research evidence to be presented in a "compact, systematic and precise fashion." (p.2)

4.0 COMMUNICATION STRATEGIES

King (1975) reviewed several studies on communication (social influence) strategies. He put forward the following definitions :

Strategy : is a general plan of action designed to accomplish a specific goal.

Tactics : is the mode of implementing a strategy.

Social Influence : is the "process by which the behaviour of an individual or collection of individuals induces change in the state of another individual or collection of individuals." (p.6)

There are two types of social influence :

i) Informational Social Influence (I.S.I) : this occurs when an individual uses the behaviour of other individuals to assist him in arriving at a solution or decision.

ii) Normative Social Influence (N.S.I.) : This occurs where an individual accepts influence in order to gain a goal.

Communication : is the assignment of meaning to behaviour.

The relationship between social influence and communication is summarised briefly in Exhibit 10.

EXHIBIT 10 : Relationship between Social Influence and Communication - King (1975)

i) Social influence cannot occur without communication.

ii) Social influence is the inevitable result of communication.

iii) Both social influence and communication are :

* transactional processes;
* inevitable;
* context-bound processes.

According to King, successful social influence strategies are based upon 3 factors. The influencer must :

i) understand social influence processes;
ii) recognise the basic conditions of social influence;
iii) determine a strategy and select appropriate tactics based upon an adequate situational analysis.

This research is concerned in part with developing both I.S.I. and N.S.I. strategies. The current Synectics social-influence strategy is the Synectics Problem-Solving Scheme. The LEADER and CLIENT formulate their tactics during the Planning session prior to the Synectics problem-solving session. The objectives of the Planning session are summarised in Exhibit 11.

Using King's terminology, the objectives of this research may be stated as :

i) To develop CLIENT I.S.I. strategies. This implies that the manner (style) in which the CLIENT presents his problem to the LEADER and PARTICIPANTS influences the outcome(s) of a given Synectics session. Specifically the strategies must relate to the manner in which the CLIENT describes his problem situation and areas, and the manner in which he interprets and evaluates the contributions of his other group members.

ii) To develop LEADER N.S.I. strategies. This implies that the manner (style) in which the LEADER uses his control of

EXHIBIT 11 : Synectics Planning Session

The objectives of the Synectics Planning session are for the LEADER and CLIENT :

i) To formulate the P.A.G.;

ii) To formulate the ANALYSIS;

iii) To agree on whether the EXCURSION procedure is to be used;

iv) To establish the CLIENT's 'criteria of success', i.e. what the CLIENT wants from the subsequent Synectics problem-solving session : for example, several novel concepts or a well-developed and precise course of action.

During the 6 Synectics Basic Courses studied during this research, Planning sessions were restricted by the Abraxas staff to 5 minutes.

process influences the behaviour and contributions of the CLIENT and PARTICIPANTS as well as the outcome(s) of a given Synectics session. Specifically the strategies must relate to the manner in which the LEADER uses the Synectics Problem-Solving Scheme in response to the CLIENT's control of content.

iii) To develop PARTICIPANT N.S.I. strategies. This implies that the manner (style) in which the PARTICIPANTS offer their contributions influences the behaviour and contributions of the LEADER and CLIENT as well as the outcome(s) of a given Synectics session. Specifically these strategies must relate to the manner in which the PARTICIPANTS offer their HOW TO STATEMENTS and ideas, and to the manner in which they use the EXCURSION procedure.

5.0 CONCLUSIONS

As a broad generalisation, the above research evidence suggests that highly effective problem-solving groups have the following characteristics :

i) Group size is appropriate with the nature of the task;
ii) Group members are more heterogeneous than homogeneous in terms of personality characteristics;
iii) The group has a stable status structure;
iv) The group operates at Tuckman's (1965) Performing stage of group development;
v) The group has both a radial and circular linkage pattern of communication;
vi) Behaviours are cooperative within the group and competitive between the groups;
vii) The group is highly cohesive.

These characteristics should be regarded as general rather than specific. No two problem-solving groups have identical characteristics and, therefore, will not achieve the same level of effectiveness. Burgess (1968) maintained that this explains to some extent the inconsistencies found in studies on human group processes.

.....

CHAPTER SIX

TRAINING

Summary

This is a description of current Synectics training practice and a review of related research studies. Criticisms of Synectics training are offered, and areas indicated for further research.

Contents Page

1.0 TRAINING SYSTEMS

Training is defined as the "systematic development of the attitude/knowledge/skill behaviour pattern required by an individual in order to to perform adequately a given task or job. This is often integrated or associated with further education. The use of learning experience to integrate the concept of training and education is increasingly common." (D.E.P., 1971; p.29)

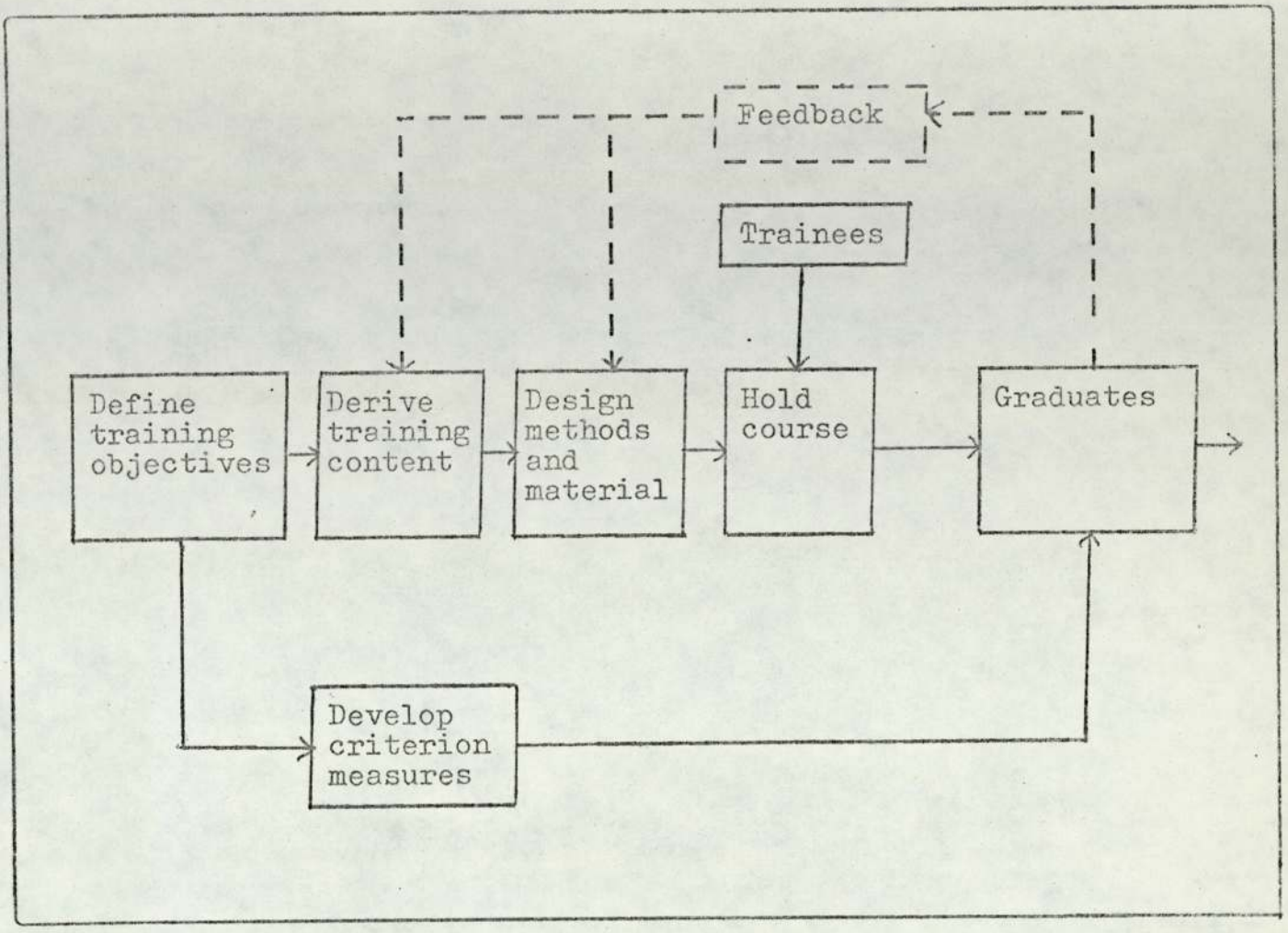
The systems approach to training involves examining :

i) the different functions of components of a given process;
ii) the interrelationship of the components;
iii) the interrelationship of the process with other processes.

Eckstrand (1964) developed a relatively simple training system, which is summarised in Exhibit 1. He proposed the following stages :

i) Training objectives are defined;
ii) Criterion measures are developed to indicate whether the trainees have achieved the objectives;
iii) Training methods and training equipment are devised in order to present information to the trainees;
iv) Training course is held : the trainees and materials (methods and equipment) are brought together for training;
v) Trainees are evaluated against the criterion measures and graduate from the course;
vi) Any necessary modifications are made to the training

EXHIBIT 1 : The Training System -
Eckstrand (1964)



content, methods and equipment.

More complicated systems have been offered by Mager and Beach (1967) and Annett (1968). Their training systems are summarised in Exhibits 2 and 3.

EXHIBIT 2 : System of Instructional Development - Mager and Beach (1967)

Preparation Phase

Define and establish :

* Target population of trainees;
* Course prerequisites;
* Prerequisites tests (criterion measures);
* Job description;
* Task analysis;
* Course objectives;
* Criterion examination (application of measures).

Development Phase

Define and establish :

* Each unit of course;
* Sequence of units;
* Content of course;
* Materials required.

- Hold Course -

Improvement Phase

Compare and revise :

* Performance with objectives;
* Course content, structure and materials.

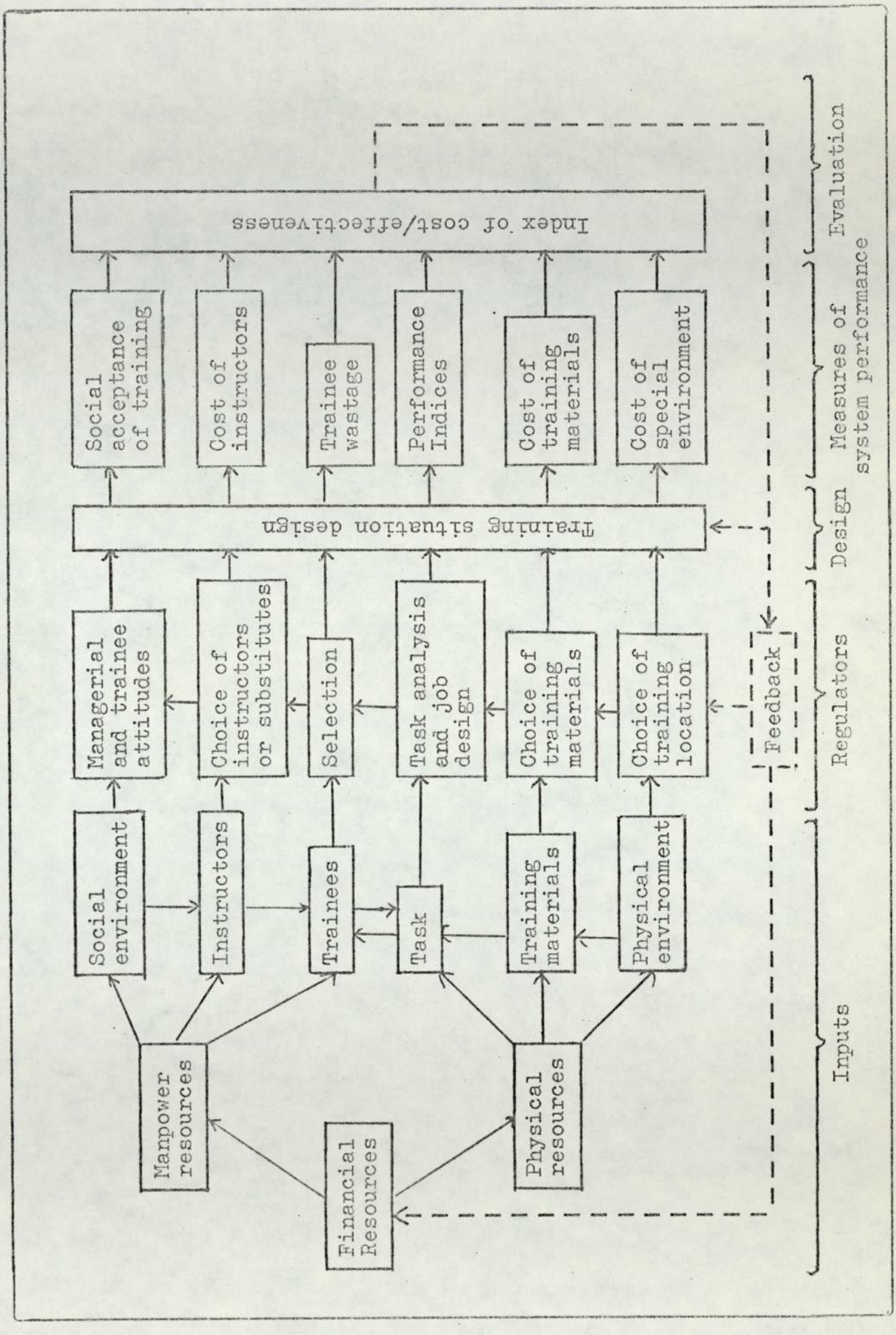


EXHIBIT 3 : The Training System - Annett (1968)

2.0 SYNECTICS TRAINING

Synectics training incorporates elements of the systems described above. It has been developed from the experience of Synectics trainers. As such there is no theory or model of Synectics training.

2.1 Training Objectives

Tiffin and McCormick (1965) argued that training has one or more of three purposes :

i) developing knowledge and skills;
ii) transmitting information;
iii) modifying attitudes.

The Synectics Basic Course is concerned directly with :

i) developing problem-solving knowledge and skills;
ii) transmitting information regarding Synectics methods.

No explicit attempt is made to modify the attitudes of course members.

2.2 Training Strategies

Training strategy is defined within this research as the means adopted to achieve training objectives. Synectics training incorporates the following strategies :

i) Lectures : Abraxas staff members describe the Synectics methods and their development to the course members.

ii) Modelling : Abraxas staff members demonstrate the Synectics methods to the course members.

iii) Practice with feedback : course members practice the Synectics methods. Their performance is evaluated by both the course members themselves and the Abraxas staff members, and discussed with the objective of improving subsequent Synectics sessions.

iv) Group discussions : Abraxas staff and course members discuss with the use of videotape recording equipment the Synectics methods and sessions.

v) Written material : course members are given course manuals, which contain written material on the Synectics methods.

Emphasis is placed upon practice with feedback during the Synectics Basic Course. There is a minimum amount of lectures.

These strategies were not evaluated during this research. The reason is that Synectics trainers have their own particular approach for evaluating and improving their training programmes. This involves applying highly specialised COACHING skills to the individual elements of their training programmes. Rather, this research is concerned in part with developing strategies to supplement the above existing procedures.

2.3 Course Members

The Synectics Basic Course is limited to 8 course members. This ensures a high level of involvement, participation and individual tuition.

Course members are given opportunities to practice the roles of LEADER and CLIENT at least twice, and the roles of PARTICIPANT and COACH several times. Each CLIENT uses a real-life problem for the content of his problem-solving session.

2.4 Staff Members

The Synectics Basic Courses studied within this research were organised by 3 or 4 Abraxas staff members, one of whom is Course Captain. His role is to make decisions on who will conduct the lectures and discussions, the length of time allotted to the various sections of the course, etc.

2.5 Training Materials

These are :

i) closed circuit television (C.C.T.V.) equipment;
ii) large newsprint (pulp) pads with crayons;
iii) A4 note pads with pencils;
iv) course manual, containing written material on Synectics methods;
v) two adjoining rooms with comfortable chairs and ancillary equipment (small tables, ashtrays, etc.)

2.6 C.C.T.V. as a Training Aid

During recent years there has been much growth in the use of videotape recording equipment, especially closed circuit television (C.C.T.V.), as a training aid. So much so that Clay (1971), in a study involving pupil participation and learning from C.C.T.V, pointed to lack of systematic evaluation of its contribution to learning. He described its use as a training aid being haphazard, with much of its original promise failing to be fulfilled.

C.C.T.V. research has been of two types : an investigation of the value of C.C.T.V. per se and its value relative to other instructional aids. Clay (1974), in a similar study to his 1971 research, criticised this latter approach because of the "....difficulty, even impossibility of controlling the large numbers of independent variables involved in, and intruding between two very different forms of instruction, makes such attempts at evaluation hazardous in the extreme."(p.24)

However, Ryan (1969) argued against evaluating C.C.T.V. per se, prefering to compare the relative merits of different forms of educational aids, such as audiotape recording equipment v. videotape recording equipment. He suggested also that research should be carried out on how educational aids might be used to complement each other.

Recent research on the effectiveness of C.C.T.V. as a training aid is summarised in Exhibit 4.

EXHIBIT 4 : Recent Research on C.C.T.V. Effectiveness

Date	Author	C.C.T.V. Use	Results
1972	Walter & Miles	Modelling	Significant improvement in group performance.
1974	Walter & Miles	Modelling and Feedback	Significant but small improvement in group performance.
1974	Dillon et al.	Modelling	No significant effect on group performance.
1975	Walter	Modelling	Significant improvement in performance.
		Modelling and Feedback	Significant but small improvement over Modelling alone.
		Feedback	No significant improvement in performance.
1975	Grindea	Feedback Modelling	More consistent learning. Expensive.

Grindea (1975) studied the effects of C.C.T.V. on piano teacher training. She found the following advantages and disadvantages. The advantages were :

i) In playing back the recorded videotape, a "very pleasant atmosphere" was created in the classroom.
ii) The students were able to hear how they were playing and at the same time to see whether they were making the correct movements. This led to more consistent learning, compared with a control group (no videotape feedback) whose learning was more erratic.

The disadvantages were :

i) The C.C.T.V. equipment was expensive. The videotape cassettes were particularly expensive so that it was difficult to build up a videotape library to which students might refer for private study.
ii) The C.C.T.V. equipment had certain technical limitations "mainly due to the inability to move the camera at a moment's notice to emphasize a particular aspect." (p.12)
iii) "Also, watching a group of people in the same position, for half an hour or so, makes rather monotonous viewing." (p.12)

Walter (1975) carried out several experiments to investigate the effects of C.C.T.V. training using the Brainstorming technique. 135 university students were assigned randomly to groups operating under 5 experimental conditions. The objective was to examine the effects of videotape training

inputs on group performance for an idea generation task. Groups which were exposed to videotape training inputs performed significantly better than did control groups. In particular, videotape model presentations resulted in significant performance improvement; and the addition of videotape feedback to modelling resulted in significant although relatively small incremental improvement. Videotape feedback alone did not result in significant performance improvement.

In an earlier study Walter and Miles (1972) studied the effects of training in group-task participation with videotape feedback. They demonstrated that modelling through videotape presentations produced a significant increase in the number of ideas (the performance measure) from the problem-solving groups. Walter (1975) and Walter and Miles (1974) studied the effects of videotape feedback and modelling on the behaviours of task group members. They found that combining videotape feedback with modelling inputs yielded a significant although again small additive effect.

However, Dillon et al. (1972) found no significant increase in the performance attributable to videotape model inputs on a Brainstorming task. They pointed to the effects of individual expectations of inferior performance because of viewing the presentation of the 'perfect' group.

The above studies tend to confirm the value of C.C.T.V as a training aid. Specifically, it would appear to be most

valuable when used for modelling alone and for modelling with feedback. The results for feedback alone are inconclusive.

C.C.T.V. equipment was used extensively by the Abraxas staff members during the Synectics Basic Courses studied within this research. Each of the Synectics problem-solving sessions was recorded and discussed by a staff member with the course members. The videotape recordings supplied part of the data for this research.

No systematic research has been carried out on the effects of using C.C.T.V. equipment within Synectics training, where it is used primarily for feedback. Therefore it is recommended that detailed research should be carried out into the effects of using C.C.T.V. equipment within Synectics training, in terms of modelling, feedback, and modelling with feedback.

3.0 EFFECTIVENESS AND EVALUATION

Training effectiveness refers to the extent to which training objectives are met. Various criterion measures are used to evaluate effectiveness. These include :

i) trainer ratings of trainees' performance;
ii) psychological tests;
iii) measures of on-the-job performance;
iv) trainees' evaluations.

Evaluation is the assessment of training. Super and Bohn (1970) defined evaluation of training as any attempt to obtain feedback on the effects of a training programme and to assess the value of that training.

Evaluation of training may be carried out at 4 distinct levels : Reactions, Immediate Outcomes, Intermediate Outcomes and Ultimate Outcomes. These levels are summarised in Exhibit 5.

3.1 Reactions Level

This level of evaluation involves the collection and use of information about trainees' expressed reactions so as to improve training. Criteria employed include trainees' attitudes and behaviours.

On the Synectics Basic Course the reactions of course members are obtained by using the Participant Feedback Sheet, shown in Appendix 2 of Volume III. Each course member completes

EXHIBIT 5 : The Process of Evaluation - Thorley (1971)

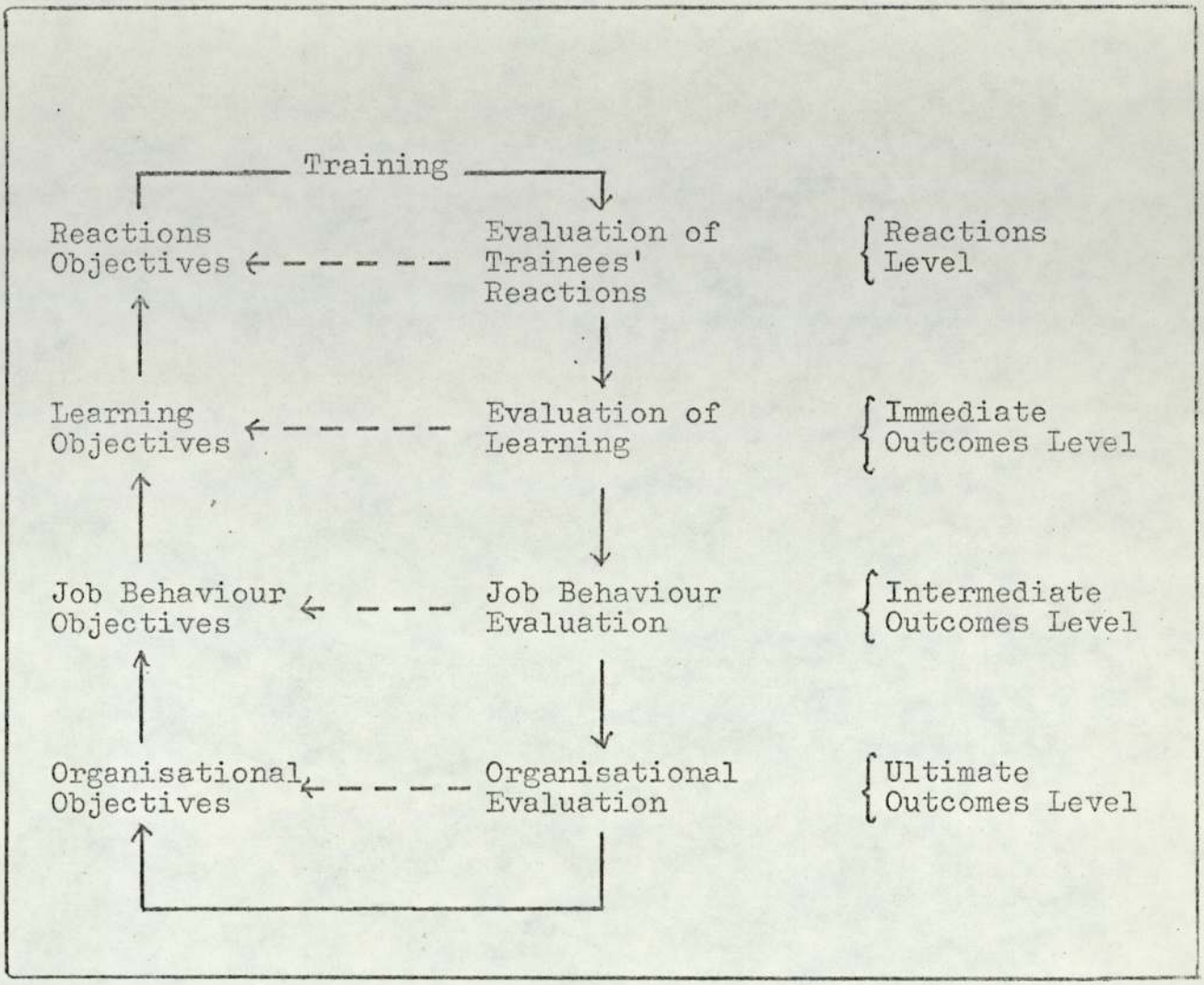


EXHIBIT 6 : Examples of Reactions of Course Members (January 1973 - December 1974)

Positive Comments

* The whole process is designed to encourage a constructive and positive approach to problem solving.

* It has been a marvellous morale booster and confidence builder for me.

* The use of video was particularly useful as an aid for changing my behaviour in meetings.

* The concept of CLIENTSHIP is a valuable one beyond the problem-solving situation.

* I liked the rotation of tutors so that I received different shadings of the picture being painted.

* A better understanding of other individuals' reactions both verbal and non-verbal.

* I am convinced that the Synectics structured approach is better than the kind of random methods used typically in industry.

* Valuable instruction in communication between individuals and in the group.

* Small numbers of people give opportunities for practice : changes in LEADERSHIP keep the meetings fresh.

* Opens up a whole new concept of looking at many facets of one's working environment.

* I learnt a great deal about communications, especially the importance of checking out my understanding of what others say.

* EXCURSIONS are much more novel compared with the use of logic.

* The sessions are well timed : a relaxed and helpful atmosphere.

* The 1 x 1 (2 person) use of Synectics will be of great use to me in O. & M. work.

* Very good lectures : lively, interesting, clear, well handled.

* Synectics is more fun than other methods.

* The course tutors skilfully stimulated group participation.

* Good video feedback technique used well to navigate course participants through their difficulties.

EXHIBIT 6 Continued : Examples of Reactions of Course Members (January 1973 - December 1974)

Negative Comments

* More written handouts at the end of the course.

* A Synectics Newsletter/Tie/Club.

* To have a follow-up day to review experiences of using Synectics and to develop our newly acquired skills.

* Some time spent on applying Synectics to other kinds of meetings.

* More time and opportunity to take the role of LEADER.

* More information on Pre-Planning for Synectics meetings.

* More personal tuition during the week.

* More emphasis on personal applications of Synectics.

* Some experience in dealing with people not familiar with Synectics; e.g. an untrained CLIENT.

* Some personal difficulty in turning into the EXCURSION.

* Too much jargon.

* Video is a bit inhibiting at times : smacks of Big Brother.

* More individual practice of the particular skills, e.g. ITEMISED RESPONSE, PARAPHRASE.

* The course was not disciplined enough at times.

These reactions were sampled randomly from the end-of-course Participant Feedback Sheets.

daily these Sheets, which are used by the Abraxas staff members to improve subsequent courses. Most of the evaluation of Synectics training is carried out at this level. Examples of the reactions of course members of January 1973 - December 1974 are shown in Exhibit 6.

3.2 Immediate Outcomes Level

The criteria used at this level include changes in knowledge, skills and attitudes immediately following training. Blumenfield and Holland (1971) maintained that learning should be measured in a quantitive manner, with a before-and-after approach to ensure that learning might be related to the training course.

No systematic research into Synectics training has been carried out at this level.

3.3 Intermediate Outcomes Level

The criteria used at this level are job behaviours. The purpose is to find out whether trainees' behaviour on the job has changed as a result of training. Kirkpatrick (1967) suggested that the time span for evaluation should be 3 or more months after training, and that control and experimental groups should be used.

No systematic research into Synectics training has been carried out at this level.

3.4 Ultimate Outcomes Level

The purpose of evaluation at this level is to examine the effects of training on organisational effectiveness. As such the criterion behaviours are those of the organisation. They include changes in departmental output, labour turnover, accident frequency, etc. Morano (1975) argued that it is often impracticable to evaluate at this level because it is difficult to separate individual contributions to the achievement of an organisation's objectives.

The only systematic research into Synectics training in the U.K. that has been carried out at this level is Parker's (1975) study, which is described in Chapter Two.

Therefore, it is recommended that systematic research should be conducted into Synectics training, especially at the Intermediate Outcomes level, in order to improve the effectiveness of applying Synectics methods.

4.0 CRITICISM

4.1 Laboratory V. Field Training and Learning

In a review of several training studies, Gagné (1962) demonstrated that many laboratory established principles of learning are of little value when applied to real-life training problems. The general findings of laboratory studies of learning are summarised in Exhibit 7. Gagné argued that a contingency approach is necessary to ensure that training and learning are effective.

Synectics training tends to have the following characteristics of learning :

i) Synectics trainers use both the 'whole' and 'part' methods of learning : Synectics methods are taught as individual elements and as a unified whole in the form of the Synectics Problem-Solving Scheme.

ii) Learning is primarily under intrinsic motivation.

iii) Course members establish their own learning goals.

iv) There is a high level of course and staff member participation in group activities rather than passive lecture-based learning.

v) All tasks are meaningful in so far they are drawn from real-life situations.

EXHIBIT 7 : Laboratory Studies of Learning : General Findings - Adapted from the reviews of Hilgard (1956) and Gagné (1974)

i) Whole V. Part Learning :

* The more intelligent the individual, the more likely that the whole method will prove advantageous.
* The advantage of the whole method increases with practice in using it.
* The whole method is more useful when the learning material is meaningful and unified.
* Trainers need to consider the nature of the material to be learned, the length of the material, the actual size of the parts and the number of parts in deciding which method to use.
* The methods are not mutually exclusive.

ii) A motivated learner acquires what he learns more readily than an individual who is not motivated. The relevant motives include a desire to learn, the need for achievement, the desire for a certain reward or to avoid punishment.

iii) Excessive motivation may be less effective than moderate motivation for learning some kinds of tasks, especially those involving difficult discriminations.

iv) Learning under the control of reward is usually preferable to learning under the control of punishment. Correspondingly, learning motivated by success is preferable to learning motivated by failure.

v) Learning under intrinsic motivation is more effective than learning under extrinsic motivation.

vi) Individuals should set realistic goals for themselves : this leads to a more satisfactory improvement in learning, compared with low-goal setting or too high goal setting.

vii) The personal history of the learner, for example, his reaction to authority, may hamper or enhance his and others' ability to learn from a given trainer.

viii) Active participation by the learner is more effective than passive reception when learning, for example, from a film.

ix) Meaningful materials and tasks are learned more readily than nonsense materials and tasks that are not understood.

x) Repetitive practice is neccessary to learn effectively certain skills, such as piano playing.

xi) Information about the nature of good performance, and knowledge of mistakes and successful incidents assist learning.

xii) Transfer to new tasks is more effective where the learner can discover new relationships for himself.

vi) There is low reliance on rote (memory) learning.

vii) There are no testing procedures used on the Synectics Basic Course.

viii) There is a great deal of repetitive practice in using the Synectics methods, with emphasis on the course members discovering new relationships for themselves.

There has been little research into Synectics learning principles. Such research by Abraxas Management Research has been spasmodic and inconclusive.

4.2 Taxonomies

More comprehensive taxonomies of behaviour for training are required. Training taxonomies are useful aids to understanding skilled performance. Annett and Duncan (1967) reviewed several taxonomies of training. They maintained that the utility of any taxonomy is dependent upon the relevance of the categories for training objectives.

The training taxonomies of Miller (1967) and Gagné (1970) are summarised respectively in Exhibits 8 and 9.

Synectics training is concerned with each of the categories of both taxonomies, although emphasis is placed upon problem solving and decision making.

Such taxonomies require detailed evaluation and further

EXHIBIT 8 : Training Taxonomy - Miller (1967)

Categories

i) Concept of purpose : a function which may be programmed so that an individual might discriminate relevant from irrelevant cues, responses and feedback.

ii) Scanning function : active or passive search for cues.

iii) Identification of relevant cues function : a function whereby an individual identifies or differentiates a pattern of cues as a pattern either from a background or noise or from other patterns of cues.

iv) Interpretation of cues : interpretation according to the meaning or implication apart from the physical nature of the cue itself.

v) Short-term memory : for holding together, during a task cycle, the fragments of information that will be acted upon later or combined.

vi) Long-term memory : refers to recallable associations between and among stimuli and responses.

vii) Decision making and problem solving : refers to techniques which may be divergent or convergent, computational or strategic, etc. Problem solving requires information provided by the above functions and a processing strategy.

viii) Effector response : the outputs that do work on the environment.

Miller emphasised in his taxonomy the kinds of activity being performed and their demands on the human operator. Different activities have different implications and requirements for training.

EXHIBIT 9 : Training Taxonomy -
Gagné (1970)

Hierarchical Categories

i) Signal learning : individual learns to make a general, diffuse response to a signal.

ii) Stimulus response learning : individual acquires a precise response to a discriminated stimulus.

iii) Chaining : individual acquires a chain of two or more stimulus-response connections.

iv) Verbal association : the learning of chains that are verbal.

v) Discrimination learning : individual learns to make different responses to different stimuli, which may resemble each other to varying degrees.

vi) Concept learning : individual acquires a capability of making a common response to a class of stimuli that differ from each other.

vii) Rule learning : a rule is a chain of two or more concepts.

viii) Problem solving : this is a kind of learning that requires the internal events, usually termed 'thinking'. Two or more previously acquired rules are somehow combined to produce a new capability that may be shown to depend on a 'higher-order' rule.

Gagné related categories of behaviour to both learning requirements and the sequence of learning. For example, he demonstrated that concept learning is generally more effective if the necessary discrimination learning precedes it.

development to cover a wide range of tasks. In particular, there is a need for a satisfactory taxonomy of problem-solving training.

4.3 Transfer of Training

Transfer of training refers to the extent to which what is learnt in one situation is carried over or applicable to another situation.

Abraxas staff members have been active in encouraging the transfer of Synectics training through the Synectics Development Programmes, which commenced in May 1975. These are monthly one-day training sessions for individuals who have attended the Basic Course. The intention is to develop their skills and knowledge of Synectics methods and to assist the transfer of Synectics training to work, home and other situations.

To date there has been no systematic research into the effectiveness of the Synectics Development Programmes.

4.4 Synectics Theory

Synectics training and problem-solving skills, roles and procedures have been developed directly from the experience of the staff members of Synectics Inc. and their international affiliates. As such, there is no adequate theory of Synectics training and problem solving. Continued changes in Synectics training and the Synectics problem-solving technique over

the past 16 years have meant that there is no close agreement among Synectics practitioners (as opposed to Synectics trainers) as to what comprises Synectics methods and training. Some practitioners are only aware of the early 1960's methods, described by Gordon (1960), while others know only how to use the post-1968 methods, described in Chapter Two.

Further, there is at present no comprehensive published text of Synectics methods. To overcome this difficulty, a Synectics Problem-Solving Handbook has been derived in part from the content of this research. The Handbook - Volume IV of the thesis - covers the Synectics methods from 1960 - 1976.

5.0 CONCLUSIONS

i) The following aspects of Synectics training should be investigated in depth :

a) Synectics learning principles;
b) evaluation of Synectics training effectiveness, especially at the Intermediate Outcomes level;
c) effects of using C.C.T.V. equipment as a training aid;
d) the effectiveness of the Synectics Development Programmes.

More attention should be paid by Synectics Inc. and Abraxas Management Research to training and problem-solving theory. This would permit more systematic research into the effects of applying Synectics methods.

ii) A comprehensive taxonomy of problem-solving training needs to be developed in order to understand better skilled performance.

.....

CHAPTER SEVEN

CREATIVITY

Summary

Creativity is of interest in this research because Synectics methods are used in creativity training and for creative problem solving. This review is restricted to definitions, theories and characteristics. The relationship between Synectics methods and creativity is outlined.

Contents Page

1.0 DEFINITIONS

There is no generally accepted definition of creativity. For example, Gregory and Monk (1972), in a discussion of creativity and engineering, cited 15 different definitions concerned with products, processes, people, places and periods. The numerous definitions in use have led to much disagreement as to what creativity is and how it should be measured. In a review of several creativity studies, Barzun (1960) indicated that the effect of this disagreement has been to devalue the study of creativity.

MacKinnon's (1967) definition of creativity is used often, and is employed within this research. Creativity is a process involving :

i) a novel response adapted to reality;
ii) sustaining an original insight by evaluation;
iii) elaboration and development of that insight.

Therefore, creativity is viewed by MacKinnon as having 3 elements : originality, adaptiveness and realisation.

From a broader perspective, Guilford (1967) and Torrance (1962) linked creativity with problem solving, as did Newell and Simon (1972) who argued that creative activity is a special class of problem solving.

2.0 THEORIES

Theories of creativity may be divided in to 6 main areas : Association, Gestalt, Trait, Interpersonal, Perceptual and Psychoanalytic and Neo-Psychoanalytic.

2.1 Association Theory

Association as a method of producing novel ideas is very old. In a modern approach, Mednick (1962) defined creative thinking as the forming of associative elements into new combinations which meet specified requirements and are useful. The more remote the elements of the new combinations are, the more creative is the process or solution.

Mednick summarised associationism as the linking of ideas which are derived from experience relative to frequency, recency and vividness. New ideas are made from old ones by trial and error. Creative thinking becomes the activation of mental connections. It continues until the right combination is achieved. The more associations an individual has acquired and learnt, the more ideas he will be able to draw upon, and the more creative he will be.

Mednick maintained that more common associations of ideas are high in a hierarchy of possible responses to a problem situation. More unique associations are low in the hierarchy. Low-creative individuals are able to offer only stereotyped responses. In contrast, highly creative individuals offer unique associations in addition to stereotyped associations.

Mednick's Remote Associations Test (R.A.T.) is used frequently to measure associative creativity. Individuals are asked to supply a fourth word to three preceding wordings. For example, the correct response to 'rat', 'blue' and 'cottage' is 'cheese'.

Wallach and Kogan (1965) developed their own association theory of creativity. They argued that unique and original associations will be generated only within a supportive and free environment.

Criticism

i) Houston and Mednick (1963) supported the above postulates. They demonstrated that highly creative individuals preferred remote associations of ideas to stereotyped associations.

ii) However, Datta (1964) found low correlations between R.A.T. scores and the rated creativity of groups of engineers and physicists. Significant correlations were found for a group of design students.

iii) Davis and Belcher (1971) criticised R.A.T. as a measure of creativity. They found that R.A.T. measured verbal intelligence more than creativity. Because R.A.T. has right and wrong answers, novel responses tend to be penalised.

iv) Kneller (1965) criticised associationism :

"Yet associationism hardly fits the known facts of creativity.

Novel thinking means that previous ideas are torn from context and recombined to form an original thought. Such thinking ignores established connections and creates its own. The novel ideas of the creative child can hardly be attributed to the connections between ideas derived from past experience, since in a non-creative child similar experiences may fail to produce a single original idea. Indeed one would expect reliance on past associations to produce not originality but responses that are dull and predictable." (p.26)

Despite Kneller's criticism, associationism offers a useful perspective of creativity, although it has more relevance to creative problem solving.

2.2 Gestalt Theory

According to Wertheimer (1945), creative thinking is a reconstruction of gestalts, or patterns, that are structurally deficient. Creativity involves action that produces insight and novel ideas. These complete perceptual gaps of a problem situation until an equilibrium is attained.

Criticism

i) Gestalt theory has been difficult to investigate systematically because of its high level of abstraction.

ii) There is little evidence to refute Gestalt theory, and the only supporting evidence comes from Gestalt psychologists.

2.3 Trait Theory

Guilford (1959; 1967) proposed a 3-D model of intellect, shown in Exhibit 1. The model has 5 kinds of operation, 4 types of content, and their interaction gives 6 kinds of products. The model has 120 cells which represent factors of intellect.

One of the most important processes for creativity is divergent thinking. Divergent thinking is required for open problems where there is no one correct solution. Divergent thinking is contrasted with convergent thinking. The latter relates to closed problems where there is one correct response, and is more related to intelligence than creativity. There are 24 cells for divergent production. The main factors for creativity are 2 kinds of flexibility and 4 kinds of fluency, originality and elaboration.

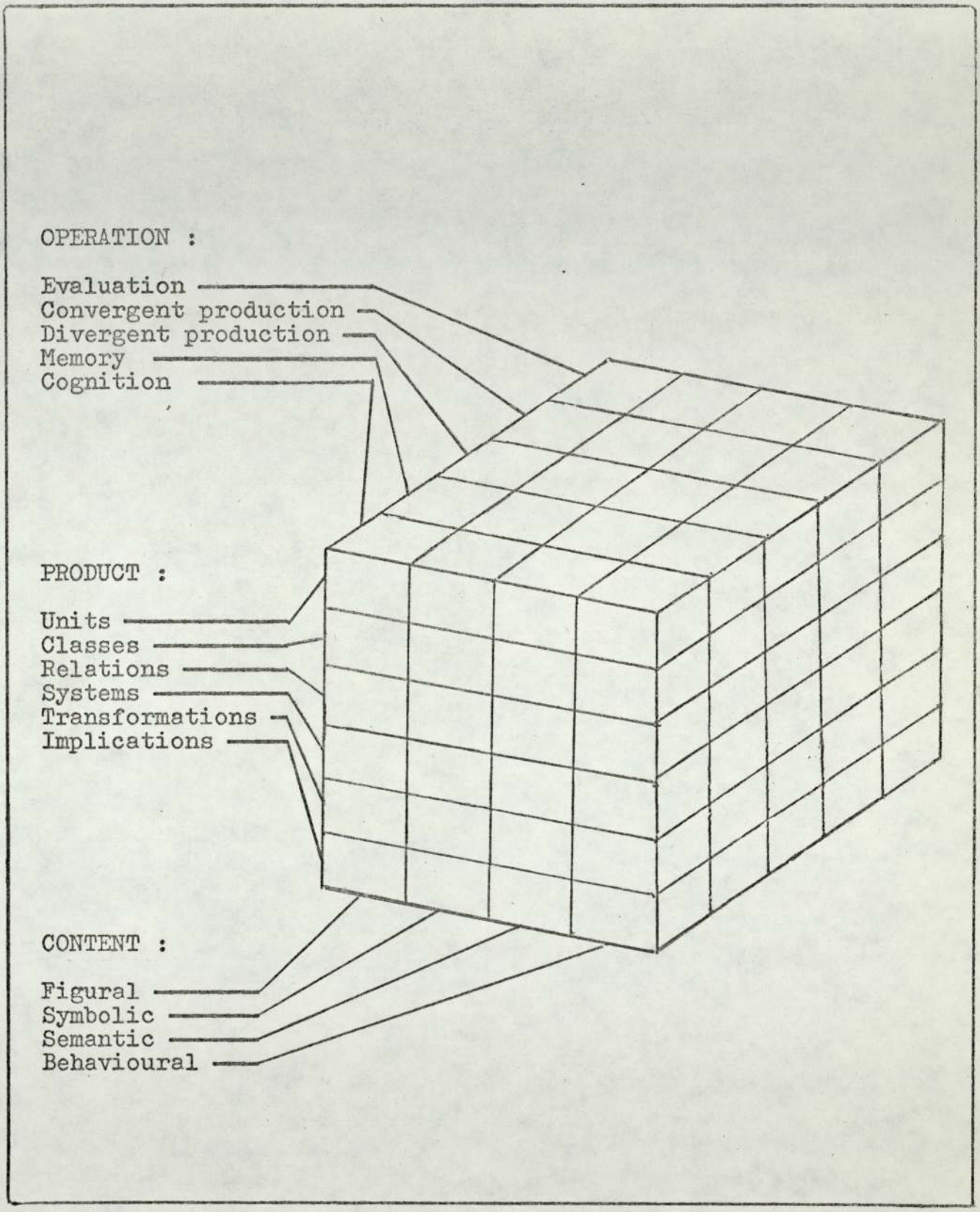
Criticism

i) Getzels and Jackson (1962) criticised Guilford's model for being unnecessarily complicated. They claimed that creativity is largely independent of intelligence.

ii) Guilford's model is incompletely investigated. Nevertheless, it has been researched systematically, and has been modified to take account new evidence.

iii) Torrance (1965) criticised Guilford's factor-analytic

EXHIBIT 1 : 3-D Model of the Structure of Intellect - Guilford (1959; 1967)



approach for ignoring individual differences. However, he confirmed the divergent production abilities of originality, flexibility and fluency. Torrance indicated that other aspects of the model, such as memory, were as important as divergent production for creativity.

2.4 Interpersonal Theory

Interpersonal theory is concerned with motivation. Creativity is viewed as the self-realisation and self-actualisation of abilities. Maslow (1959) and Rogers (1959) maintained that the need for self-actualisation is the primary cause of creativity.

Rogers regarded certain traits as important for creativity. These are :

i) an openness to experience;
ii) an internal locus of evaluation;
iii) an ability to play with problem-solving elements.

The environmental conditions necessary for creativity include :

i) unconditional acceptance of the individual;
ii) lack of critical evaluation;
iii) psychological freedom.

Like Rogers, Maslow believed that creativity arises from innate abilities which decay as individuals progress from childhood

into adulthood. Self-actualising individuals are highly creative because their abilities have not decayed.

In a review of interpersonal theories, Torrance (1962) suggested 5 conditions for creativity :

i) absence of threats and a willingness to take risks;
ii) self-awareness and an appreciation of one's own feelings;
iii) self-differentiation - an awareness of distinctiveness;
iv) openness to the ideas of others, together with confidence in one's own ideas and perceptions of reality;
v) mutuality of interpersonal relations, or a balance between sociability and asociability.

Criticism

i) Maslow's (1954) hierarchy of motives, shown in Exhibit 2, forms the basis of interpersonal theory. It has been well supported by McGregor (1960). He argued that efforts to create conditions under which the higher motives can become activated have beneficial effects for the level of and quality of productivity.

ii) Sanford (1967) was less enthusiastic. He considered that, while interpersonal theory is plausible, it may only be regarded as tentative in the absence of experimental data.

EXHIBIT 2 : Hierarchy of Motives - Maslow (1954)

i) Physiological Needs : hunger, thirst, etc.

ii) Safety Needs : the need for freedom from threat or danger; the need to ally oneself with the familiar and the secure.

iii) Belongingness and love needs : the need for affiliation and acceptance.

iv) Esteem needs : the need for achievement, strength, competence, reputation, status and prestige.

v) Need for Self-Actualisation : the need for self-fulfillment and to realise potentialities.

vi) Cognitive Needs : the need to know and understand (curiosity) and the need to understand the unknown.

vii) Aesthetic Needs : the need for symmetry, order, system and structure.

2.5 Perceptual Theory

Schactel (1959) put forward a perceptual theory of creativity, based upon the receptivity to experience. He distinguished between two modes of perception : autocentric (subject-centred) and allocentric (object-centred) perception. The highly creative person is allocentric, being perceptually open to new experiences. The low-creative person is autocentric and tends to be closed to new experiences.

Criticism

Schactel's theory has never gained popular currency with psychologists. But Coleman (1960) stated that it is a useful extension of interpersonal theory.

2.6 Psychoanalytic and Neo-Psychoanalytic Theory

Freud (1908) explained creativity in terms of a process called 'sublimation'. Getzels and Jackson (1962) summarised Freud's position on creativity :

"a) Creativity has its genesis in conflict, and the unconscious forces motivating the creative 'solution' are parallel to the conscious forces motivating the neurotic 'solution';

b) the psychic function and the effect of creative behavior is the discharge of pent-up emotion resulting from conflict until a tolerable level is reached;

c) creative thought derives from elaboration of the 'freely rising' fantasies and ideas related to day dreaming and

childhood play;

d) the creative person accepts these 'freely rising' ideas, the non-creative person suppresses them;

e) it is when the unconscious processes become, so to speak, ego-syntonic that we have the occasion for 'achievement of special perfection';

f) the role of childhood experience in creative production is emphasised, creative behavior being seen as 'a continuation and substitute for the play of childhood'."

(pp. 91-92)

In contrast to Freud's stress on unconscious processes, Kubie (1961) emphasised the 'preconscious' as the source of creativity, because of its freedom to gather, compare and rearrange ideas. Kubie suggested that if the unconscious does operate in creativity it probably has a harmful effect. He agreed with Freud on the value of fantasy within creativity.

Criticism

i) Substantiating evidence for psychoanalytic and neo-psychoanalytic theory comes from studies using projective tests. Pine and Holt (1961) found the Rorscach Ink Blot Test to be a useful measure of creativity. Test scores correlated significantly with fluency and flexibility scores on Guilford's Brick Uses and Consequences Tests.

ii) Benne (1963) criticised this type of theory for being over-rigid and forcing behaviour into psychologically abstract categories, which are difficult to investigate experimentally.

3.0 CHARACTERISTICS OF CREATIVE INDIVIDUALS

In a review of several creativity studies, Davis (1975) characterised highly creative individuals as :

i) energetic, spontaneous and adventurous;
ii) willing to take risks and make mistakes;
iii) curious and attracted to complex problems;
iv) not necessarily of above average intelligence;
v) determined to pursue their own goals;
vi) open to themselves and to other individuals.

In a summary of the consistent findings on creativity, Gough (1964) considered personality, environment and processes. He concluded that :

i) Perceptions and associations of highly creative individuals tend towards the less common;
ii) Highly creative individuals show a concern for elegance and form that carries beyond mere correctness and accuracy;
iii) Highly creative individuals perceive much from their environment before taking action and enjoy novel problem-solving approaches.

Gough maintained that an individual's creative contribution depends upon his abilities and traits. Achievement of that contribution depends itself upon environmental factors and the processes employed.

Dellas and Gaier (1970) classified the characteristics of

creative individuals into 5 principal categories :

i) intelligence;

ii) cognitive complexity;

iii) cognitive flexibility;

iv) dominance, self-acceptance and ascendancy;

v) introversion, non-conformity and asocial attitude.

Several studies relating to each of the categories are summarised briefly in Exhibit 3.

EXHIBIT 3 : Categories of Characteristics of Creative Individuals : Summary Findings - After Dellas and Gaier (1970) .

Category	Date	Author	Principal Findings
Intelligence	1960	Torrance	Found low-moderate correlations (0.31-0.39) between measured creativity and intelligence.
	1962	Getzels & Jackson	Found creativity to be largely independent of intelligence.
	1962	MacKinnon	Suggested that intelligence is important for creativity up to an I.Q. of 120.
	1963	Barron	Found zero correlations between measured creativity and intelligence (120+ I.Q.)
	1965	Wallach & Kogan	Criticised Getzels et al.'s (1962) study for methodological deficiencies. Using a more rigorous methodology, they found : * low correlations between measured creativity and intelligence; * low correlations between creativity test scores; * high correlations between intelligence test scores.
Cognitive Complexity	1959	Welsh	Demonstrated that highly creative individuals tend to prefer relatively complex problem-solving activities; low-creative individuals tend to prefer relatively simple problem-solving activities.
	1963	Barron	Found that highly creative individuals prefer activities that permit self-expression, high risk involvement and an integration of skills and abilities.

EXHIBIT 3 Continued : Categories of Characteristics of Creative Individuals : Summary Findings - After Dellas and Gaier (1970)

Category	Date	Author	Principal Findings
Cognitive Flexibility	1959	Myden	Found that highly creative individuals demonstrated fewer signs of repression than low-creative individuals; highly creative individuals were higher on open-mindedness and lower on dogmatism.
	1967	Razik & Mooney	In a review of several creativity studies, they described highly creative individuals as aware of self, outgoing, optimistic and self-disciplined.
Dominance, Self-Acceptance and Ascendancy	1967	Stein	Found that highly creative scientists reflected a higher degree of social assertiveness and autonomy of self than their low-creative counterparts.
	1970	Helson	Found that highly creative mathematicians were more self-confident, aggressive and self-accepting than low-creative mathematicians.
Introversion, Non-Conformity and Asocial Attitude	1967	Barron	In a review of several creativity studies, he described highly creative writers as medium to highly introverted, impulsive, avoiding group activities and showing a lack of concern for social restraints.
	1968	Bloom	In a review of several creativity studies, he described highly creative individuals as having difficulty in relating to other individuals and being psychologically withdrawn.

4.0 CRITICISM

Creativity is not a unitary trait. From the above studies, it appears to take numerous forms, and therefore requires a wide variety of research instruments.

In a scathing discussion of creativity tests, Davis (1971) condemned the inadequate criterion measures used currently in creativity tests. He pointed to the resultant difficulties in validating the tests. Davis supported his attack by citing several studies. These included Taylor et al.'s (1961) study, where zero correlations were found for Guilford's test scores and real-world creative productivity.

Davis's viewpoint is supported by Callister (1970) :

"The nature of creativity appears to depend mainly on the theoretical inclination of the investigator." (p. 6)

Schaefer and Anastasi (1968) demonstrated that creativity studies are difficult to compare. Difficulties arise from :

i) the different criterion measures employed in different researches;
ii) highly creative individuals in one study may be considered low-creative in another study;
iii) researchers frequently failed to specify the nature of the variables being studied, i.e. whether they have one-way or reciprocal influences.

5.0 SYNECTICS METHODS AND CREATIVITY

Synectics methods may be regarded as a creative problem-solving technique because they incorporate :

i) a word association procedure for stimulating new approaches for examining a problem situation;
ii) the IMAGING procedure for applying fantasy to a problem in order to generate and develop novel ideas and solutions;
iii) 'set breaking' procedures, such as the generation of HOW TO STATEMENTS and the EXCURSION.

5.1 Synectics Creativity Studies

Korth (1971) studied the application of Synectics methods and their effects on training in creative thinking. He found that individuals who received Synectics training improved their performance on such measures as the Welsh Figure Preference Test, the Unusual Uses and Consequences Tests from the Guilford Creativity Battery. Synectics training did not have any measurable effect upon the personalities of the trainees.

Frantz (1975) assessed the relative effects of training in 3 creative problem-solving techniques. The techniques were Brainstorming methods, Physiognomic Response and Synectics methods. Physiognomic training involves teaching individuals :

i) to attribute humanlike form or aspects to inanimate objects;

ii) to empathise with the different materials and objects in their environment.

The objectives of this technique are to stimulate novel ideas, and to break the rigid categorisation of objects (functional fixedness) that restricts the ways they are perceived conventionally.

Using a sample of fifth-grade students (15-16 years), he found that :

i) Individuals receiving training in each of the techniques outscored the control group (no training) on the Torrance Tests of Creative Thinking;
ii) Synectics training was the most effective for improving test performance; Physiognomic Response training was next, and training in the Brainstorming technique was the least effective.

Criticism

It is difficult to compare and evaluate the Korth and Frantz studies, because :

i) each researcher used different Synectics methods : Korth used early 1970's procedures and Frantz used the early 1960's technique;
ii) the Synectics methods in both studies are variations of the techniques taught by Synectics Inc. and Synectics Learning Systems Inc.

6.0 CONCLUSIONS

i) There is no widely accepted definition of creativity, causing difficulties in systematic measurement and evaluation.

ii) Each of the creativity theories adds insight into the nature of creativity and its relationship with problem-solving. But to date there is no fully developed theory of creativity.

iii) There is little agreement as to what are the principal characteristics of creative individuals. Different researchers have tended to emphasise different characteristics as being important for creative problem-solving performance.

iv) Synectics methods have been shown to be of value in creativity training. But more systematic research should be directed to explain exactly how Synectics methods contribute to creative problem solving.

.....