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

Volume II

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VOLUME II

RESEARCH PROCESS AND PRODUCT

Volume II of this dissertation is concerned with :

i) The development and application of the research instruments;

ii) The research results, with a discussion of related studies;

iii) The conclusions, strategies (with case study), recommendations and limitations.

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CONTENTS

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CHAPTER EIGHT

RESEARCH INSTRUMENTS

Summary

This is a description of the development and application of the instruments used within this research. The research instruments are T.A.F. A and B (Experimental Videotape Analysis Forms A and B) and the S.Q.S.Q. (Synectics Q-Sort Questionnaire). Previous related studies are reviewed, with a discussion of the research techniques of content, process and factor analysis.

Contents

1.0 DEFINITIONS

1.1 Effectiveness

Price (1968) defined effectiveness in terms of the degree of goal achievement by an individual or a group of individuals. Krech et al. (1962) listed the following measures of effectiveness :

i) productivity;
ii) level of satisfaction;
iii) number of outcomes.

They indicated that the measurement of group problem-solving effectiveness is complex because :

i) Effectiveness is a multi-dimensional variable;
ii) Measures used by researchers may have little meaning to the members of the group being studied.

Effectiveness should be examined in terms of - for whom? and for what? Within this research, problem-solving effectiveness is defined in real terms as the extent to which the CLIENT'S problem is resolved.

The approach to effectiveness used within this research is summarised in Exhibit 1.

Two categories of effectiveness may be distinguished : micro- and macro-. Micro-effectiveness is concerned with the outcomes of an individual Synectics session. Macro-

EXHIBIT 1 : Categories and Levels of Effectiveness

SECONDARY	Micro-Effectiveness (Individual Synectics Session)	high ↑ Effectiveness	Macro-Effectiveness (Series of Synectics Sessions)
	Results : the extent to which the CLIENT's own criterion of effectiveness is achieved		Results : the contribution to wealth, knowledge, technology, interpersonal relations, etc.
	Solution Implementation Interface		
PRIMARY	d) Problem Resolution : * Problem resolved completely * Problem resolved partially c) Idea Development b) Problem Investigation a) Problem Definition	↑ Increasing low	Solutions per session over time

effectiveness is concerned with the outcomes of a series of Synectics sessions.

Two levels of effectiveness may be identified : primary and secondary.

Primary effectiveness refers to :

i) The extent to which a given problem is resolved. This may be divided into :

* Problem Definition;
* Problem Investigation;
* Idea Development;
* Problem Resolution.

The 4 divisions refer to each of the four stages of the Synectics Problem-Solving Scheme, described in Chapter Two.

ii) Solutions per session over time, for example, from a given Synectics Basic Course of training.

Secondary effectiveness refers to the extent to which the implementation of a given solution or solutions achieve a result. The results achieved may be viewed in terms of :

i) the CLIENT's own particular criterion of effectiveness. It should be stressed that no two CLIENTS will have the same criterion of effectiveness : each will have his own bias and preferences as to what is important in resolving his problem.

ii) the contribution to wealth, knowledge, technology,

interpersonal relations, etc.

This research is concerned solely with the primary levels of effectiveness. Secondary levels are not examined because the time taken to implement solutions ranges enormously (days - years).

1.2 Efficiency and Competence

Effectiveness should be distinguished from efficiency. Chaplin (1968) defined efficiency as the "ratio of output to input; the ratio of the amount of energy expended to the effect or result obtained."(p. 153)

An aspect of efficiency is competence. Efficiency is reflected by the degree of competence. Competence is defined within this research in terms of the level of ability of using Synectics methods.

2.0 T.A.F. A AND B

(Experimental Videotape Analysis Forms A and B)

T.A.F. A and B are presented in Appendix 3 of Volume III.

They are used to investigate primarily LEADER and CLIENT styles through the application of process analysis. T.A.F. A is for examining Synectics sessions without the EXCURSION procedure. T.A.F. B is for examining Synectics sessions with the EXCURSION procedure.

2.1 Objectives

The specific objectives of T.A.F. A and B are to collect detailed data :

i) For systematic analysis of videotape recordings of Synectics sessions;

ii) To chart sociograms, illustrating the patterns of interaction of the LEADER, CLIENT and PARTICIPANT roles;

iii) Regarding PARTICIPANT role styles.

Also T.A.F. A and B may be used by Synectics trainers to COACH groups.

2.2 Hypotheses

T.A.F. A and B were used to test the following hypotheses :

i) That there are two LEADER role styles : a rigid and a flexible pattern of behaviour;
ii) That there are two CLIENT role styles : an explicit and an unclear pattern of behaviour.

2.3 Development of T.A.F. A and B

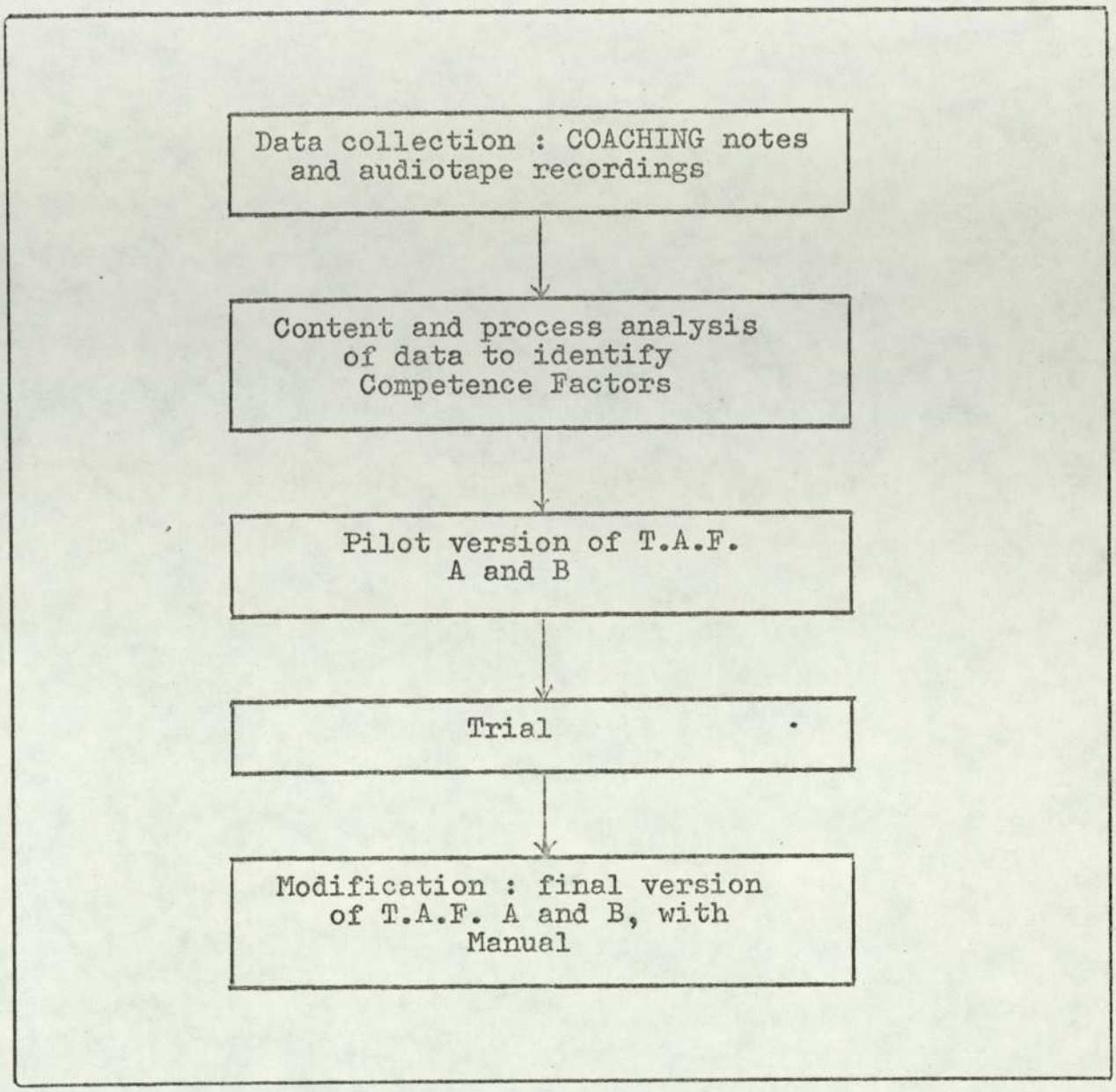
This is summarised in Exhibit 2.

The first task in developing T.A.F. A and B was to establish criterion measures of competence. The experience of the Abraxas staff members was used to develop these measures. They provided for content and process analysis their COACHING notes from the June, July and August 1974 Basic Courses, covering 52 Synectics sessions. In addition, 6 half-hour audiotape recordings were made of staff-course member discussions of 10 Synectics sessions in order to supplement the data collected from the COACHING notes. An example of the COACHING notes (SPLIT-SHEET I.R. notes) is shown in Appendix 4 of Volume III.

2.4 Content Analysis

This is a research technique, systematised by Berelson (1952), that permits objective and quantitative description of the content of a communication. The specific procedures of

EXHIBIT 2 : Development of T.A.F. A and B



content analysis are summarised in Exhibit 3.

Berelson (1954) expressed certain reservations about the application of content analysis :

"It is difficult to know under what conditions inferences can be validly drawn about the total population or only about the particular audiences....; to what extent they refer to the audience proper or to the producer's conception of the audience or to the producers themselves as atypical members of the audience. In short, the whole relationship between the content and the audience characteristics allegedly 'reflected' in it is far from a one-to-one relationship, and this fact in itself is a cautionary note against the over-interpretation of content data." (p. 54)

The COACHING notes and audiotapes were analysed in the following manner :

i) Universe : the COACHING notes and audiotape recordings;
ii) Unit of analysis : each paragraph of the COACHING notes and the individual contributions recorded on the audiotapes;
iii) Factor categories : the behavioural issues discussed by the staff and course members.

Detailed content analysis revealed that the staff and course members were judging the Synectics sessions in terms of 6 principal factor categories of competence :

EXHIBIT 3 : Content Analysis -
Berelson (1952)

i) Define the universe or the population of the communication to be examined.

ii) Select the unit of analysis to be used in counting content elements. This unit may be a word, sentence, paragraph, etc.

iii) Select the appropriate categories. Berelson suggested the use of subject matter categories, pro-con categories, value categories, etc.

iv) Carry out quantitative and qualitative analysis. The categories of behaviour being analysed are expressed often in percentages of the overall number of discrete communications.

It is assumed that the content of communications within a given universe expresses or reflects the modal attitudes, values, mores, etc. of that universe.

i) Pace;

ii) Activity;

iii) Process Flexibility;

iv) Speculation;

v) Communications;

vi) Participation.

Detailed descriptions of the competence factors are presented in the Manual for T.A.F. A and B - Appendix 5 of Volume III. The manual provides guidelines for the use of T.A.F. A and B.

Quantitative analysis of the data is shown in Exhibit 4. A high level of correlation ($r = 0.98$) was found between the number of COACHING paragraphs per competence factor and the number of audiotaped contributions per competence factor. The inference is that the staff-course member discussions followed closely the behavioural issues recorded in the COACHING notes.

2.5 Process Analysis

This is a research technique for analysing the interpersonal interactions between individuals. Process analysis was developed by Bales (1950; 1958). The categories of interaction identified by Bales as important for problem solving are shown in Exhibit 5.

Bales's categories have been used frequently to study problem-solving groups using audiotape recording equipment (Dyar and Giles, 1974). But his categories are too complicated

EXHIBIT 4 : Quantitaive Analysis of COACHING Notes and Audiotape Recordings

Competence Factor Category	COACHING Notes		Audiotape Recordings	
	No. of Paragraphs	%	No. of Individual Contributions	%
Pace	166	17.68	88	19.69
Activity Level	153	16.29	72	16.11
Process Flexibility	188	20.02	104	23.26
Speculation Level	122	12.99	39	8.72
Communications	149	15.87	60	13.42
Participation Level	161	17.15	84	18.80
TOTAL	939	100.0	447	100.0

EXHIBIT 5 : Categories of Interpersonal Interaction - Bales (1958)

Solidarity : Releasing Tension

1. Shows relief and feeling of accomplishment.
2. Laughs and smiles.
3. Assigns superior status to other(s).
4. Praises, commends, rewards.
5. Shows friendliness, courtesy and solidarity.
6. Makes a friendly joke.

Reaching Solution

7. Offers help, shares and exchanges ideas.
8. Permits, encourages and reinforces.
9. Complies with request, follows direction.
10. Confirms, announces an intention/decision.
11. Agrees, approves, endorses and concurs.

Proposing Action

12. Proposes action for self.
13. Proposes action for other(s).
14. Supports proposal, explains ideas.
15. Pacifies, conciliates and arbitrates.

Analysing and Diagnosing

16. Diagnoses self and makes interpretation.
17. Diagnoses other(s) and makes interpretation.
18. Diagnoses situation and makes interpretation.
19. Analyses self, other(s) or situation by reasoning.

Reporting Facts

20. Recalls experiences.
21. Reports about others.
22. Gives data about situation.
23. Shows attention and comprehension.

Opening Problems

24. Asks for help, support, permission.
25. Expresses a desire, wish, value, hope.
26. Requests for some activity.
27. Asks for expression of feeling and desire.
28. Asks for opinion(s).
29. Asks for information.
30. Shows deference, humility, respect.
31. Calls for attention of others.

Finding Difficulties

32. Daydreams, fiddles, doodles.
33. Shows confusion, asks for repetition.
34. Disagrees implying error.
35. Opposes, criticises, is skeptical.
36. Disapproves values, ideas and actions of other(s).

Personal Opposition

37. Shows excessive formality and reserve.
38. Asserts a superior status.
39. Attacks or deflates the status of other(s).
40. Gives command and direction.
41. Denies permission, blocks, restricts.

Negative Reactions : Antagonism

42. Shows anxiety, conflict, tension.
43. Shows frustration and dissatisfaction.
44. Seeks a higher status.
45. Defends self from a status attack.
46. Tries to control by flattery and pretence.
47. Shows resistance and is negative.
48. Shows envy.
49. Shows anger and antagonism.

for many training purposes. Furthermore, Klein (1963) indicated that it is often difficult to distinguish which categories certain remarks should be placed. For example, opinions may also be suggestions. Klein simplified Bales's categories in order to develop her own Interaction Schedule, shown in Exhibit 6. The 'task-related factual' and 'task-related combining facts and values' dimensions and categories were used in part to develop T.A.F. A and B.

Rickards (1974) developed a form for monitoring group problem-solving processes. The form is a general checklist and may be used to summarise briefly such aspects as total ideas produced, level of speculation, post-session comments of participants, etc. His form is similar in part to T.A.F. A and B. But Rickards offered no criterion measures. Therefore, his form does not permit systematic comparison of problem-solving sessions.

A more comprehensive procedure for studying group problem-solving processes has been developed by Colbert et al. (1971). Like Klein, they have simplified Bales's categories. Problem-solving sessions are recorded using C.C.T.V. equipment. These sessions are then evaluated by 2 or 3 trainers against a mutually agreed standard. Their evaluation is then discussed with the trainees with the objective of improving subsequent problem-solving sessions. As such, their approach is similar to that of Synectics training.

2.6 Sociograms

Sociometry was developed by Moreno (1934) and extended by

EXHIBIT 6 : Interaction Schedule - Klein (1963)

Dimension	Category
Task-related factual	Asks for information Gives information
Task-related combining facts and values	Asks for views Gives views Makes explicit proposal (optional category) Disagrees Agrees
Task-irrelevant, expressive, evaluative only	Expresses hostility Expresses withdrawl Expresses friendliness

Proctor and Loomis (1951). As used within this research, sociograms are illustrations of the interpersonal interactions of the LEADER, CLIENT and PARTICIPANT roles. The interpersonal interactions were measured by the frequency of verbal contact. The frequency was identified from the individual contributions recorded on T.A.F. A and B. The direction of the interactions was ascertained by careful observation of videotape recordings of the appropriate Synectics sessions.

2.7 Pilot Operation

Once the criterion measures were established, the pilot version of T.A.F. A and B was developed. This is presented in Appendix 6 of Volume III. The version was experimented with during the October 1974 Synectics Basic Course.

The pilot operation revealed that T.A.F. A and B :

i) Required further refinement in order to collect more detailed data regarding LEADER and CLIENT behaviour;
ii) provided insufficient observations of the PARTICIPANT role to identify any discernible styles.

Subsequently, a second (final) version of T.A.F. A and B and a separate instrument for investigating PARTICIPANT styles were developed.

LEADER and CLIENT styles were identified from a completed sample of T.A.F. A and B's through :

i) detailed examination of sociograms of the individual Synectics sessions;

ii) a detailed second-order process analysis, using Bales's categories of interpersonal interaction.

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

This is presented in Appendix 7 of Volume III.

3.1 Objective

The objective of the S.Q.S.Q. is :

* To identify PARTICIPANT styles through the application of factor analysis.

3.2 Hypothesis

The S.Q.S.Q. is used to test the hypothesis :

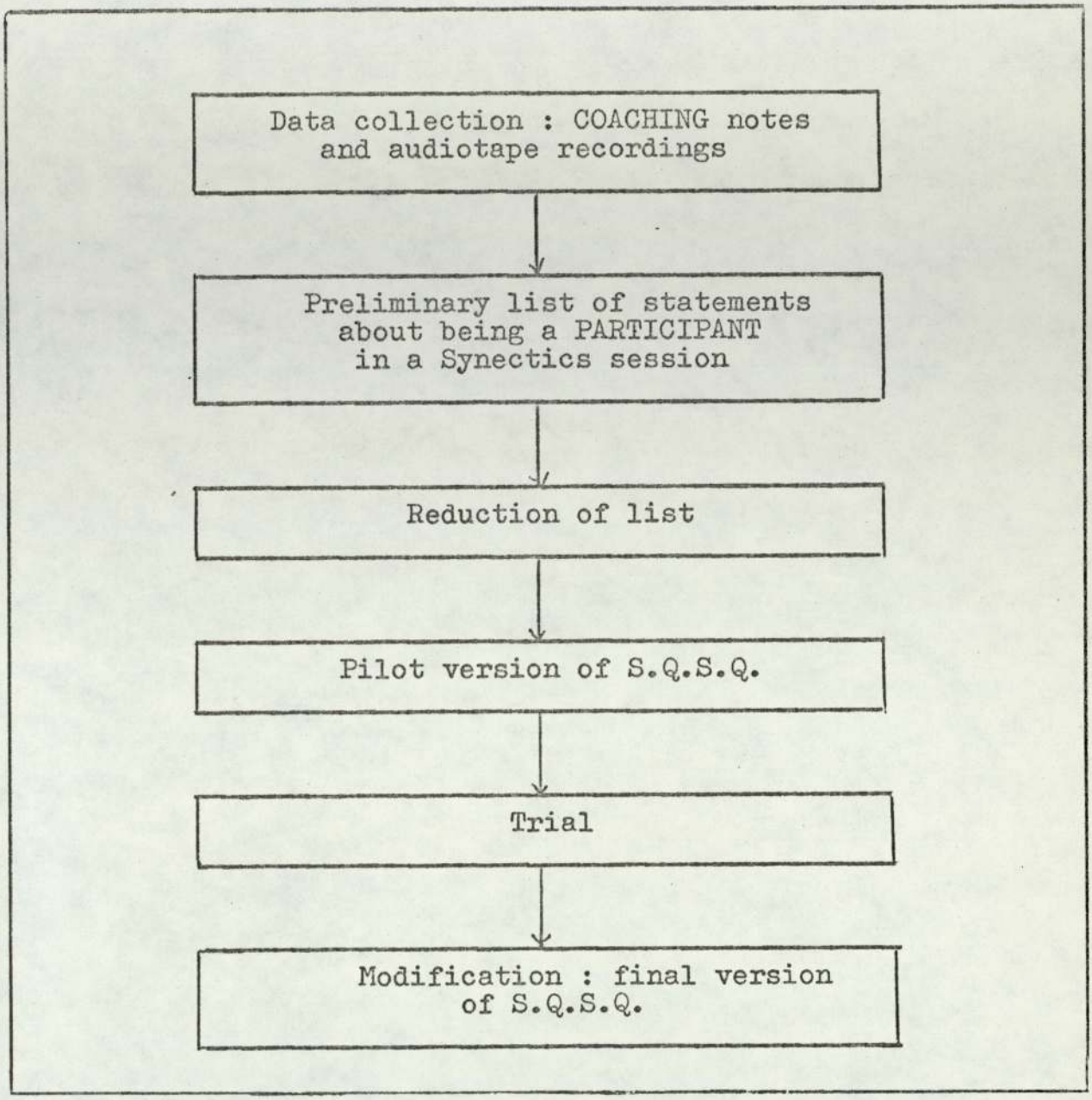
* That different PARTICIPANT styles are used within Synectics sessions.

3.3 Development of S.Q.S.Q.

This is summarised in Exhibit 7.

The S.Q.S.Q. was developed from the COACHING notes and audiotape recordings collected during the Synectics Basic Courses of June - August 1974. All references to being a PARTICIPANT in a Synectics session were tabulated to produce a list of 64 statements. This preliminary list was

EXHIBIT 7 : Development of S.Q.S.Q.



reduced to 50 statements in order to eliminate duplication.

The pilot version was experimented with during the October 1974 Synectics Basic Course and a 3-day Synectics Basic Course held at Bradford University in October 1974. Only minor grammatical modifications to the statements were required.

3.4 Q-Methodology

The Q-technique of correlation and factor analysis was introduced by Burt (1941) and extended by Stephenson (1953). The technique involves individuals being asked to make ratings of a set of traits by placing the traits into categories (of a predetermined size). Stephenson recommended that the sizes of the categories conform to a normal distribution. This restriction has been relaxed often in practice.

Cattell (1955) reviewed several factor-analytic studies. He pointed to the danger of reading too much into correlation coefficients. Causal relationships cannot be inferred from correlations alone. Correlation scores indicate little about the nature of processes and, within this research, the nature of styles. Cattell concluded that the Q-technique offers a useful approach for descriptive analysis of human behaviour; but any inferences and conclusions must be treated with caution.

3.5 Previous Q-Sort Studies

The development and application of the S.Q.S.Q. followed the research procedures used by Gough and Woodworth (1960) and Helson and Crutchfield (1970).

Gough and Woodworth designed their Q-Sort, presented in Exhibit 8, to measure the styles of 45 professional research scientists. Helson and Crutchfield's Q-Sort is presented in Exhibit 9. Their research instrument was used to measure the styles of 34 mathematicians. It includes several items which are similar to those of Gough and Woodworth's Q-Sort.

Both Q-Sorts were printed on separate cards. The subjects were asked to sort the cards into 5 categories. A questionnaire format was used within this research instead of a deck of cards for administrative convenience. The number of categories was extended to 7 to permit a wider range of responses.

Gough and Woodworth found 8 styles, which are summarised in Exhibit 10. Helson and Crutchfield found 5 styles, which are summarised in Exhibit 11.

There is an overlap in the findings of each study. Helson and Crutchfield's Type 1, 3 and 5 styles resemble respectively Gough and Woodworth's Zealot/Scholar, Artificer and Aesthetician. This is to be expected because of similarities among the items of both Q-Sorts.

EXHIBIT 8 : Research Scientist Q-Sort Deck -
Gough and Woodworth (1960)

1. Reacts quickly to research problems; immediately generates a great number of ideas.
2. Is somewhat deficient in his command of basic sources and technical literature in the field.
3. Pursues details and ramifications of research problems with great thoroughness.
4. His research interests lie within a narrow range.
5. Has exceptional facility in mathematical analysis.
6. Easily discouraged; needs help and encouragement to do his best work.
7. Is keenly interested in methodological aspects of research.
8. Prefers to work on problems which lend themselves to elegant and exact solutions.
9. Tends to slight the contributions of others; takes undue credit for himself.
10. Likes to play his hunches in research; is guided by his subjective impressions.
11. Is neat and orderly in his habits and manner of work.
12. Dislikes and avoids administrative details connected with research projects.
13. Is good at developing short-cuts and approximation techniques.
14. Frequently makes errors; his worked needs to be checked for accuracy.
15. Prefers to work alone; is not a 'team' research man.
16. Is erratic in his research output; varies from work of excellent quality to work of marginal or even inferior worth.
17. Indifferent to the practical implications of his own research.
18. Seldom comes up with a really new idea or suggestion.
19. Has exceptionally high standards of research performance for himself as well as for others.
20. Has a special talent for solving instrumentation problems.
21. Is thorough and patient in his approach to research issues; does not get upset if progress is slow.
22. Is a driving, indefatigable research man; cannot stop working on a problem until it is solved.
23. Is relatively uninformed on most subjects other than his research specialty.
24. Good at evaluating research; able to diagnose strong and weak points in a programme quickly and accurately.
25. Is fiercely competitive; wants to be the best man in every research task that he undertakes.
26. Seeks out the help and advice of other people when he hits a trouble spot in his own research.
27. Makes a serious effort to read current publications and to 'keep up' on the literature in his field.
28. Is creative in anything he tries, whether in science or not.
29. Has an orderly, well-organised approach to research; plans his projects and activities with great care and precision.
30. Gives freely of his own time and ideas to other research endeavors without asking for special credit or recognition.

EXHIBIT 8 Continued : Research Scientist Q-Sort Deck - Gough and Woodworth (1960)

31. Likes to talk out his research ideas and get other people's opinions.
32. Many of his ideas turn out to be impractical.
33. Is aware of his own professional limitations; does not attempt what he cannot do.
34. Has a quick tempo of thought and speech.
35. Prefers to think in analytical and mathematical ways, rather in terms of physical and structural models.
36. Is never to busy to 'talk shop' with other researchers.
37. Has an exceptionally good memory.
38. Has a knack for improvising quick solutions in research trouble spots.
39. Is a research perfectionist; devotes endless attention to matters of design, apparatus, procedure, etc.
40. Plays his cards 'close to his vest'; prefers not to tell anyone about his research plans until his work is finished.
41. Is a creative an inventive researcher.
42. Is intolerant of metaphysical issues.
43. Is a talented 're-write' man; can take other people's ideas and hunches and fashion them into practical research designs and programmes.
44. Has strong biases; is vehement in his disapproval of certain methods and procedures.
45. Primarily an 'ideas man'; prefers to turn his hunches and hypotheses over to someone else for systematic experimentation and analysis.
46. Somewhat given to bluffing; claims to know more than he does.
47. Stimulating to other people; seems to catalyse others into a more original and productive endeavour than they would otherwise achieve.
48. Tends to be sarcastic and disparaging in describing the work of other researchers.
49. Is intellectually gifted.
50. Has a lively sense of intellectual curiosity and inquiringness, a desire to know and to understand.
51. Is flexible and adaptable in his thinking; able to shift and to restructure easily.
52. Takes an aesthetic view; is sensitive to matters of form and elegance in research problems.
53. Has a 'sense of destiny' with respect to his own research career, an inner conviction of the worth and validity of his own efforts.
54. Enjoys philosophical speculation.
55. Lacks confidence, is afraid to strike out in new directions.
56. Subordinates everything to his research and scientific goals; puts scientific values above all others.

EXHIBIT 9 : Mathematician Q-Sort Deck -
Helson and Crutchfield (1970)

1. Work is characterised by intuitive power.
2. Has a 'sense of destiny' with respect to his research career, an inner conviction of the worth and validity of his own efforts.
3. Does not work on problems known to be very difficult.
4. Work is characterised by inventiveness and ingenuity.
5. Is thorough and patient with regard to research issues; does not get upset if progress is slow.
6. Research problem is more likely to originate in attempt to extend known proof or result than to clarify a nebulous area.
7. Prefers to get miscellaneous chores out of the way before settling down to research.
8. Grasps other people's ideas quickly.
9. Has a balanced critical view of his own field.
10. Is somewhat deficient in his command of basic resources and technical literature in the field.
11. Has an earnest desire to make a mark in mathematics.
12. Work tends toward systematisation and unification in mathematics.
13. Enjoys playing with puzzles.
14. Mathematical insights often come in dreams, upon waking, just before going to sleep or at some time other than during a period of concentration.
15. Lacks confidence, is reluctant to strike out in new directions.
16. Feels emotionally tense when a result seems imminent.
17. Has an active, efficient, well-organised mind.
18. Can imagine enjoying lines of work other than mathematics.
19. Is flexible in his thinking; able to shift and restructure easily.
20. Reacts quickly to research problems, immediately generates ideas.
21. Work is handicapped by poor manipulative ability.
22. Finds it difficult to read the work of others and prefers to spend his energies on own work.
23. Has an earnest desire to make a mark in mathematics.
24. Is sometimes aware of 'animate' characteristics of mathematical symbols and concepts; or, feels personal tenderness or intimacy with numbers or other mathematical entities.
25. Likes to work on problems with practical implications.
26. Dislikes and avoids administrative work.
27. Has a leisurely tempo of thought and speech.
28. Is excited by the possibility of doing work with computing machines.
29. Is more interested in discrete problems than continous ones.
30. Enjoys the manipulation of formulae.

EXHIBIT 9 Continued : Mathematician Q-Sort Deck -
Helson and Crutchfield (1970)

31. Takes an aesthetic view; is sensitive to matters of form and elegance in research problems.
32. Is interested in philosophical problems which arise in mathematics.
33. Must exert effort to express a mathematical train of thought in words.
34. Has a need to teach; enjoys instructing and working with students.
35. Easily distracted; tries to secure optimum conditions for concentration.
36. Does not enjoy collaboration.
37. Desire for salary increase is an important motivating factor.
38. Has interests or talents for writing a book or articles for intelligent laymen.
39. Is neat and orderly in habits and manner of work.
40. Subordinates other things to research goals; puts these values above others.
41. Can work away from library and mathematical colleagues.
42. Productivity runs in cycles.
43. Is a research perfectionist.

EXHIBIT 10 : Research-Scientist Styles -
Gough and Woodworth (1960)

The Zealot : This individual is dedicated to research activity. He sees himself as a driving, indefatigable researcher, with exceptional mathematical skills and a lively sense of curiosity. He is seen by others as tolerant, serious-minded, and conscientious, but not getting along with others and as not being able to 'fit in' readily with other people.

The Initiator : This individual reacts quickly to research problems, and begins at once to generate ideas. He is stimulating to others and gives freel of his own time. He sees himself as being relatively free of doctrinaire bias and as being a good 'team man'. Observers describe him as ambitious, well-organised, industrious, a good leader and efficient. They also characterise him as being relatively free of manifest anxiety, worry and nervousness.

The Diagnostician : This individual sees himself as a good evaluator, able to diagnose strong and weak points in a programme quickly and accurately, and as having a knack for improvising quick solutions in research trouble spots. He does not have strong methodological preferences and biases, and tends not to be harsh or disparaging towards others' mistakes and errors. Observers see him as forceful and self-assured in manner and as unselfish and free from self-seeking and narcissistic striving.

The Scholar : This individual has an exceptional memory, and is very precise in his work. However, he is not a research perfectionist nor an 'endless seeker for ultimates'. He does not hesitate to ask for help when blocked in his work, and feels that he can adapt his own thinking to that of others. He is well informed in his field, and is not given to bluffing. Observers describe him as conscientious and thorough, and as very dependable, but as lacking confidence and decisiveness of judgement.

The Artificer : This individual gives freely of his own time, and enjoys talking shop with other researchers. He is aware of his own limitations and does not attempt what he cannot do. He sees himself as having a special ability for taking poorly formed ideas of others and fashioning them into workable solutions. Observers see him as honest and direct, getting along well with others, and as unusually perceptive.

The Aesthetician : This individual favours an analytical approach to research. He prefers research problems which lend themselves to elegant and formal solutions. His interests are far-ranging and he tends to become impatient if progress is slow or if emphasis must be put on orderliness and systematic detail. His own view of experience is primarily an aesthetic one. Observers see him as clever and spontaneous, but as undependable and immature.

EXHIBIT 10 : Research-Scientist Styles -
Gough and Woodworth (1960)

The Methodolgist : This individual is intersted in methodolgical issues, and in mathematical analysis and conceptualisation. He is open about his own research plans and enjoys talking about them with others. He has little competitive spirit and tends to take a tolerant view of research differences between himself and others. Observers characterise him as a considerate person, free of undue ambition. At the same time they report a certain moodiness and an occasional tendency towards 'complicated and difficult' behaviour.

The Independent : This individual tends to avoid 'team efforts', and dislikes administrative details connected with research work. He is not a driving, energetic research man, although he does have a lively sense of intellectual curiosity. He prefers to think in reference to physical and structural models rather than in analytical and mathematical ways. Observers describe him as active and robust in manner, and forthright in judgement. He appears relatively free from worry and self-doubt, but inclined to behave abruptly and impolitely.

EXHIBIT 11 : Mathematician Styles -
Helson and Crutchfield (1970)

Type 1 : This individual holds himself aloof, though he typically seeks to lead and represent his special field within mathematics. For example, he is interested in having students and exerting influence. He has confidence in his depth of knowledge.

Type 2 : This individual enjoys the competition and camaraderie of his professional life. He often takes leadership or responsibility in departmental, professional or community undertakings (or conflicts). He tends to be friendly, hard working and active. He is conventional in his attitudes towards work.

Type 3 : This individual derives much pleasure from the pursuit of mathematical research and immerses himself in it. He is ambitious to do 'good' mathematics, knows his field well and has a balanced critical view. He is not particularly interested in sustained leadership or in practical considerations. He likes to talk mathematics, but tends to be shy.

Type 4 : This individual is clever, subtle and conscientious in his work, but also impulsive, argumentative and somewhat low in endurance. In mathematics or in administration, he seeks to attain his objectives by ingenuity and charm rather than direct force.

Type 5 : This individual resembles Type 1 in that he holds himself aloof from his colleagues and has confidence is his depth of knowledge. However, he is more self-absorbed and self-sufficient than Type 1. Occasionally he 'rules' his field, but it is not because he has sought to do so. Rather, he 'feels' his field within himself and brings it out of himself. He is concerned with the form, clarity and quality of his ideas.

Furthermore, the findings are similar to those of MacKinnon's (1962; 1965) researches on the characteristics of creative architects. These characteristics are presented in Exhibit 12. They resemble those of Gough and Woodworth's Aesthetician and Independent.

Gough and Woodworth indicated certain limitations of Q-Sort studies :

"However, it has to be admitted that there is a great and imponderable element of subjectivity in the endeavour and that the formulations represent inductions arrived at by reflective and psychological processes rather than by formal statistical analysis." (p. 95)

But they concluded that descriptive Q-Sorts are an adequate method of identifying styles.

3.6 Factor Analysis

The statistical procedures used with the S.Q.S.Q. are identical to those employed by Gough and Woodworth (1960). These procedures are summarised in Exhibit 13. A detailed and highly recommended description of these procedures is presented in 'Modern Factor Analysis' (Harman, 1967).

Specifically, the technique used with the S.Q.S.Q. was an inverse factor analysis. This required a principal axis factor analysis and a varimax rotation for factorial invariance. This entailed :

EXHIBIT 12 : Characteristics of Creative Architects - MacKinnon (1962)

1. Enjoys aesthetic impressions; is aesthetically reactive.
2. Has a high aspiration level for self.
3. Values own independence and autonomy.
4. Is productive; gets things done.
5. Appears to have a high degree of intellectual capacity.
6. Genuinely values intellectual and cognitive matters.
7. Is concerned with his own adequacy as a person.
8. Is a dependable and responsible person.
9. Has a wide range of interests.
10. Behaves in an ethically consistent manner; is consistent with own personal standards.
11. Has social poise and presence; appears socially at ease.
12. Enjoys sensuous experiences (including touch, taste, smell and physical contact).
13. Is critical, skeptical and not easily impressed.
14. Appears straightforward, forthright and candid in his dealings with others.
15. Is a talkative individual.

Listed in rank order are the 15 of 100 Q-Sort statements which MacKinnon considered most descriptive of creative architects.

EXHIBIT 13 : Factor Analysis Procedures Used With S.Q.S.Q.

1. Development of correlation matrix :

i) Define universe for analysis (items of S.Q.S.Q.);
ii) Establish sample (PARTICIPANTS involved in Synectics sessions);
iii) Collect data;
iv) Apply product-moment correlation procedure.

2. Extraction of initial factors :

i) Explore data-reduction possibilities by constructing a set of new variables on the basis of the interrelations shown in the data;
ii) Define the new variables as precise mathematical transformations of the original data. (No particular assumptions about the structure of the variables are required).

3. Rotation of factors to terminal solution :

Alter the configuration of the factor structure to achieve the simplest and most meaningful factor patterns.

i) Formulating a correlation matrix;

ii) Assembling from the mean correlations a set of reference Q-Sort items;

iii) Rotating the identified factors to achieve a terminal solution of interpretable factors.

The reference Q-Sorts and the intercorrelations among the identified factor scores are shown in Appendix 8 of Volume III.

Assistance to carry out the factor analysis was obtained from staff members of I.B.M. (U.K.) Ltd., Greenford, Middlesex.

The psychological meanings of the factor scores were derived by detailed examination of :

i) the order of placement of the reference Q-Sorts;

ii) the intercorrelations between the factor scores;

iii) T.A.F. A and B data concerned with being a PARTICIPANT in a Synectics session.

4.0 DATA COLLECTION

This was carried out during the 6 Synectics Basic Courses from November 1974 - March 1975. 98 Synectics sessions were analysed using T.A.F. A and B. 39 individuals attended these courses, and each completed a S.Q.S.Q. at the end of their course. The mean age of the course members was 32.47* years. 30 course members were male, and 9 were female.

* Data incomplete

5.0 DIFFICULTIES AND CONSTRAINTS

Several difficulties and constraints were encountered in developing and applying the research instruments :

5.1 Nature of Tasks

Feldhusen and Houtz (1975) developed the Purdue Elementary Problem-Solving Inventory. They argued that in order to investigate satisfactorily problem-solving behaviour :

i) Tasks should be realistic and meaningful;
ii) Problem solving should be viewed as a multi-faceted process involving a number of component skills and abilities;
iii) Tasks should be identical so as to evaluate reliably differential levels of performance.

Within this research the first two arguments were adhered to. But the third was ignored because each of the problems used in Synectics sessions are always different in content and ownership.

5.2 Synectics Developments

Several developments involving Synectics methods occurred during this research. For example, the ANALYSIS element of the Synectics Problem-Solving Scheme was expanded in December 1974 by the Abraxas Director of Training to include 'Power To Act' as this was felt to be an important

CLIENTSHIP issue. In turn this resulted in changes to T.A.F. A and B and the nature of the interpersonal interactions within Synectics sessions.

Moreover, there are differences between the U.K., U.S. and continental Synectics Problem-Solving Schemes. This is because of continuing research by each of the international licensees and because of cultural variations. For example, in the U.S.A. HOW TO STATEMENTS are called 'Goals and Wishes', and there is no formal MINI-ANALYSIS.

The effect of these ongoing developments is that T.A.F. A and B, the S.Q.S.Q. and the results of this research will become increasingly inappropriate for Synectics training.

5.3 Other Research Instruments

The Abraxas Directors permitted no other research instruments to be employed during this research. They felt that the use of creativity and personality tests would have a 'disruptive influence' on the course members. Also the application of such tests would have contravened the Abraxas training policy of no testing of course members' performances.

6.0 CONCLUSIONS

i) Problem-solving effectiveness may be examined from different perspectives. It should be distinguished from efficiency (competence).

ii) Whilst process, content and factor analysis have certain limitations, they offer a satisfactory approach for investigating style.

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CHAPTER NINE

RESULTS

Summary

3 LEADERSHIP, 2 CLIENTSHIP and 5 PARTICIPANT styles were identified. Psychological definitions of the styles are presented and discussed in terms of the principal study areas of this research. Analysis of the interpersonal interactions revealed that some style combinations were more effective than others.

Contents

1.0 LEADERSHIP STYLES

It was hypothesised that two LEADERSHIP styles are used within Synectics sessions - a rigid and a flexible pattern of behaviour. However, detailed process analysis revealed 3 LEADERSHIP styles :

i) Full-Control;
ii) Shared-Control;
iii) Absent-Control.

The characteristics of these styles are presented in Exhibit 1.

No optimum LEADERSHIP style was found. Rather, each LEADERSHIP style has advantages and disadvantages for the effectiveness of Synectics sessions and for group problem-solving competence. These advantages and disadvantages are shown in Exhibit 2.

1.1 Sociograms

Three distinct patterns of interpersonal interaction were identified. Each pattern is associated with a particular LEADERSHIP style. Examples of the patterns are presented in Exhibit 3.

i) Full-Control Pattern of Communication :

Communication is channelled primarily through the LEADER.

EXHIBIT 1 : Synectics LEADERSHIP Styles

1. Full-Control Style :

This LEADER tends to -

i) adhere strictly to the Synectics Problem-Solving Scheme;

ii) make explicit the transitions between the elements of the Synectics methods;

iii) repeat often the same prompts, for example, during the generation of HOW TO STATEMENTS;

iv) explain how he will use the Scheme;

v) never becomes involved in the content of the session;

vi) not omit any stages of the Scheme;

vii) have most of the communications channelled through him.

2. Shared-Control Style :

This LEADER tends to -

i) use flexibly the Synectics Problem-Solving Scheme;

ii) make quick transitions between the Synectics elements;

iii) vary often his prompts;

iv) allow possibly Brainstorming procedures within the session;

v) enter explicitly the content of the session; for example, he may PARAPHRASE an idea to facilitate the CLIENT's understanding;

vi) omit possibly stages of the Scheme;

vii) share control of the communication channels with the CLIENT.

3. Absent-Control Style :

This LEADER tends to -

i) allow the CLIENT and PARTICIPANTS to control as they wish;

ii) generally not use prompts;

iii) mainly occupy himself with administrative duties (writing upon the large pads HOW TO STATEMENTS, ideas, etc.);

EXHIBIT 1 Continued : Synectics LEADERSHIP Styles

Absent-Control Style (continued)

iv) assert his control of process if he perceives the session to be proceeding poorly; for example, if the activity level is low;

v) infrequently make explicit the elements of the Synectics Problem-Solving Scheme;

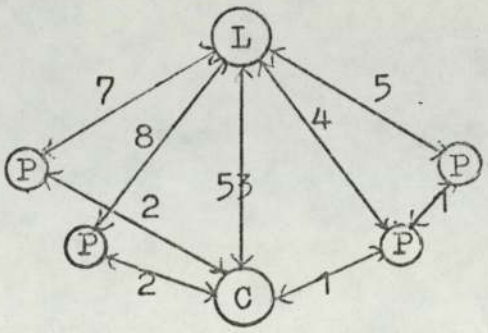
vi) have little of the communication channelled through him.

EXHIBIT 2 : LEADERSHIP Style Advantages And Disadvantages

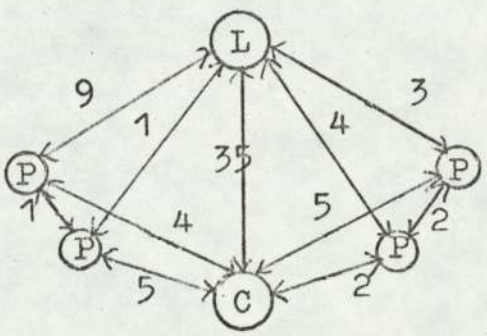
Style	Advantages	Disadvantages
Full-Control	Process control is predictable and psychologically 'safe'.	Process control may be over-rigid at times, with PARTICIPANTS becoming listless and feeling over-constrained.
Shared-Control	LEADER and CLIENT have a wider range of procedural options to select from.	Requires additional knowledge of and skill in problem-solving procedures.
Absent-Control	LEADER, CLIENT and PARTICIPANTS have an infinite number of procedural options to select from. LEADER is able to concentrate upon administrative procedures.	Lack of formal process control may be a potential source of confusion for CLIENT and PARTICIPANTS, who are required to have a detailed knowledge of Synectics methods.

EXHIBIT 3 : Sociograms

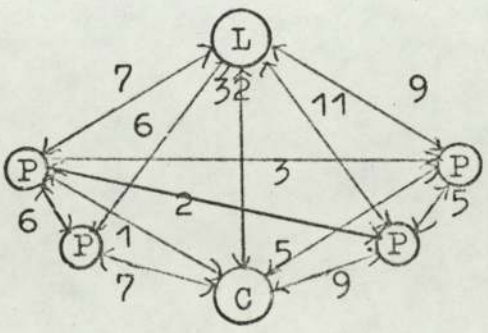
Full-Control Pattern of Communication : (Session No.2, November 1974 Synectics Basic Course)



Shared-Control Pattern of Communication : (Session No.6, November 1974 Synectics Basic Course)



Absent-Control Pattern of Communication : (Session No. 12, November 1974 Synectics Basic Course)



Key : (L) : LEADER (P) : PARTICIPANT
(C) : CLIENT ←25→ : Channels of verbalised communication, with discrete number of communications

ii) Shared-Control Pattern of Communication :

Control of the communication channels is shared by the LEADER and CLIENT.

iii) Absent-Control Pattern of Communication :

No one group member controls the communication channels.

1.2 Style Variations

Detailed process analysis revealed that there was no ideal (pure) LEADERSHIP style. All 3 styles were used within any given Synectics session, although one particular style tended to predominate.

2.0 CLIENTSHIP STYLES

It was hypothesised that there are two styles of CLIENTSHIP. These were confirmed through detailed process analysis of the data. The CLIENT patterns of behaviour are :

i) Ambivalent;

ii) Explicit.

The characteristics of each style are presented in Exhibit 4.

No optimum CLIENTSHIP style was found. Rather, each style has advantages and disadvantages for the effectiveness of Synectics sessions and for group problem-solving competence. The relative advantages and disadvantages are shown in Exhibit 5.

2.1 Style Variations

No ideal CLIENTSHIP style was found. Each CLIENT used both styles in any given session, although again one style tended to predominate. No temporal patterns of change in CLIENTSHIP style were identified. Rather the style reflected a given CLIENT's interpretation of his particular problem. Because the content of each problem was unique, no two CLIENTS adopted precisely the same style.

3.0 PARTICIPANT STYLES

For the PARTICIPANT role 5 distinct styles were found :

i) Research-Orientated Style;
ii) Divergent;
iii) Systematic;
iv) Energetic;
v) Challenging.

The characteristics of each style are presented in Exhibit 6.

No optimum style was found. Rather each of the styles has advantages and disadvantages for the effectiveness of Synectics sessions and for group problem-solving competence. The advantages and disadvantages associated with each style are presented in Exhibit 7.

3.1 Style Variations

There was insufficient data to determine whether any given group member adopted more than one style in a particular session. As reflected in the HOW TO STATEMENTS, every style was used in each of the full-group Synectics sessions. Temporal style changes were indicated. In each of the 6 Synectics courses, the Energetic and Divergent styles were employed increasingly, especially after the introduction of the EXCURSION. Correspondingly, the Systematic style was employed less by Synectics group members.

It is not possible to relate any particular PARTICIPANT

style to the effectiveness of the Synectics sessions. This is because of the emphasis of idea development within Synectics methods : no one individual is responsible solely for the emergence of solutions.

EXHIBIT 6 : Synectics PARTICIPANT Styles

1. Research-Orientated Style :

This PARTICIPANT tends to -

i) request much information before participating actively in the session;

ii) offer ideas as information;

iii) ensure that he understands well the problem before offering HOW TO STATEMENTS and ideas;

iv) become involved actively in the session where he is knowledgeable about the problem area under consideration; and he may 'withdraw' from the session where he has little knowledge;

v) suspend judgement and avoid preconceptions until he has the 'full-facts'.

Generally, this PARTICIPANT investigates fully a problem before attempting to resolve it. He is seen by other group members as knowledgeable and conscientious.

2. Divergent Style :

This PARTICIPANT tends to -

i) offer a wide range of HOW TO STATEMENTS and ideas;

ii) enjoy exploring and developing different approaches to the problem situation;

iii) be able to rapidly change problem-solving direction;

iv) be more active in Problem Investigation stage of the Synectics Problem-Solving Scheme than in the other stages;

v) be free of any particular problem-solving prejudices.

Generally, this PARTICIPANT has an exploratory problem-solving style. He is seen by other group members as open-minded and 'easy-going'.

3. Systematic Style :

This PARTICIPANT tends to -

i) be methodical in his problem-solving approach;

ii) prefer to 'define correctly' the problem and its constraints before attempting to resolve it;

iii) offer HOW TO STATEMENTS and to develop ideas in a logical manner;

EXHIBIT 6 Continued : Synectics PARTICIPANT Styles

Systematic Style (continued)

iv) offer precise (as opposed to ill-formed) ideas;

v) to become more actively involved during the Idea Development stage of the the Synectics Problem-Solving Scheme than in other stages;

vi) examine thoroughly a problem situation.

Generally, this PARTICIPANT has an orderly problem-solving style. He is seen by other group members as analytical and at times over-concerned with detail.

4. Energetic Style :

This PARTICIPANT tends to -

i) react quickly during the session with HOW TO STATEMENTS and ideas;

ii) be an active member of his Synectics group;

iii) contribute often humorous HOW TO STATEMENTS, which help to raise the activity level of the session;

iv) prefer to participate in sessions with the EXCURSION procedure.

Generally, this PARTICIPANT is impulsive. He is seen by other group members as confident and occasionally immature.

5. Challenging Style :

This PARTICIPANT tends to -

i) disagree with or dislike the CLIENT's interpretation of the problem, the problem-solving direction selected by the CLIENT, or the content of the POSSIBLE SOLUTION(S);

ii) 'withdraw' from the session if he becomes emotionally out of sympathy with the group members or with the problem-solving content;

iii) be dogmatic about the 'best way' of solving the problem.

Generally, this PARTICIPANT has a confronting effect on the other group members. He is seen by them as independent and sometimes a nuisance.

EXHIBIT 7 : PARTICIPANT Style Advantages and Disadvantages

Style	Advantages	Disadvantages
Research-Orientated	Useful in obtaining salient aspects of the problem situation.	Too much information may confuse other group members.
Divergent	Useful at Problem Investigation stage of the Synectics Problem-Solving Scheme in opening up the problem; offers a wide range of HOW TO STATEMENTS for the CLIENT to select.	May prevent the achievement of a specific solution.
Systematic	Useful at Idea Development stage. Balances Divergent style with precision.	May inhibit speculation and novelty, especially in EXCURSION.
Energetic	Useful in EXCURSION; raises the activity level of session.	May become over-zealous and 'out-of-step' with other group members.
Challenging	Useful in offering a fresh perspective and in questioning (invalid) assumptions.	May usurp CLIENT role and disrupt the session.

4.0 STAGES IN SYNECTICS GROUP DEVELOPMENT

3 stages were identified in Synectics group development, displaying successive changes over time in group problem-solving style. These stages are summarised in Exhibit 8.

i) Orientation

Initially group members adhere rigidly to Synectics methods. The LEADER uses strictly the Synectics Problem-Solving Scheme. The CLIENT and PARTICIPANTS need to be asked by the LEADER for HOW TO STATEMENTS, ideas, etc.

ii) Exploration

With increasing practice, the Synectics methods are used flexibly. The LEADER offers options in the use of the Scheme. The CLIENT and PARTICIPANTS investigate alternative interpersonal processes for communication. They begin to volunteer HOW TO STATEMENTS, ideas, etc. without necessarily being asked by the LEADER.

iii) Autonomous

The group members are highly skilled in Synectics methods. The LEADER adopts an Absent-Control style, with the group members as a whole controlling implicitly process. The LEADER needs only to carry out administrative duties. He intervenes only in process control if he feels the Synectics methods are being abused or misapplied. Synectics sessions proceed smoothly. The Synectics group is highly competent.

EXHIBIT 8 : Stages in Synectics Group Development

Stage	Ideal Characteristics
Orientation	LEADERSHIP style : Full-Control. CLIENT and PARTICIPANTS are asked for HOW TO STATEMENTS, ideas, etc. Low level of competence. Total reliance on LEADER for process control.
Exploration	LEADERSHIP style : Shared-Control. CLIENT and PARTICIPANTS are asked for/ volunteer HOW TO STATEMENTS, ideas, etc. Medium level of competence. Partial reliance on LEADER for process control.
Autonomous	LEADERSHIP style : Absent-Control. CLIENT and PARTICIPANTS volunteer HOW TO STATEMENTS, ideas, etc. High level of competence. Process control is diffused thoughout the group. LEADER needs only to carry out administrative duties.

Increasing knowledge of, awareness of and practice in Synectics methods — time

5.0 EFFECTIVENESS

The principal tables of results are presented in Appendix 9 of Volume III.

In the 98 full-group Synectics sessions, the Problem Definition, Problem Investigation and Idea Development levels of effectiveness were reached. The range of HOW TO STATEMENTS was 9 - 31, with a mean 19.61 and a standard deviation of 4.87.

These sessions produced 137 POSSIBLE SOLUTIONS. 70 sessions produced one or more SOLUTIONS. The maximum number of SOLUTIONS for any given session was 4, with a modal value of 2. In 12 Synectics sessions the CLIENT's problem was resolved completely.

5.1 Control-Role Style Combinations

The LEADER and CLIENT roles have control functions. The interactions between the LEADERSHIP and CLIENTSHIP styles relative to solutions per session are presented in Exhibit 9. The relative effectiveness of each style combination is presented in Exhibit 10. Analysis of variance revealed significant interaction effects, particularly for the Shared-Control LEADERSHIP/Explicit CLIENTSHIP and Full-Control LEADERSHIP/Ambivalent CLIENTSHIP style combinations. These combinations represent style matches : they are a balance between flexibility of process control (LEADER role) and clarity of content control (CLIENT role).

EXHIBIT 9 : LEADERSHIP/CLIENTSHIP Style Combinations

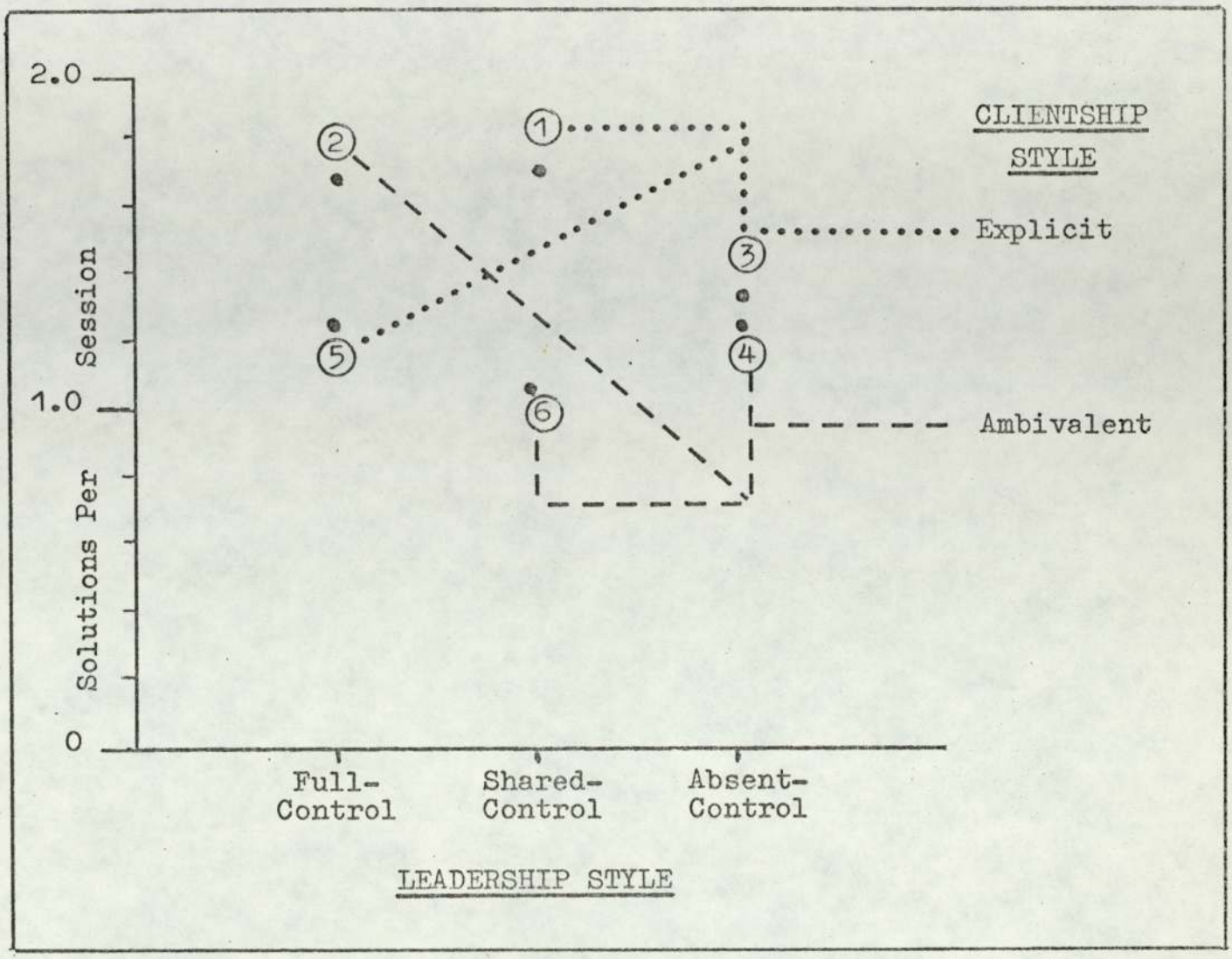


EXHIBIT 10: Relative Effectiveness of Control-Role Style Combinations

Exhibit 9 Key No.	LEADERSHIP Style	CLIENTSHIP Style	Solutions Per Session
①	Shared-Control	Explicit	1.700
②	Full-Control	Ambivalent	1.692
③	Absent-Control	Explicit	1.346
④	Absent-Control	Ambivalent	1.250
⑤	Full-Control	Explicit	1.211
⑥	Shared-Control	Ambivalent	1.091

5.2 EXCURSION Effects

The EXCURSION procedure had no significant effect upon the number of solutions per session. Although 9 CLIENTS reported that they felt that the IMAGING element of the EXCURSION contributed to the originality, novelty and quality of their POSSIBLE SOLUTIONS.

5.3 Male-Female Effects

No significant male-female (CLIENT) effects were found on the number of solutions per session. Also there were no significant male-female style differences.

5.4 Course Comparisons

No significant differences were found between courses and solutions per session. The mean value of solutions per session for the 6 courses ranged from 1.250 - 1.400, with an overall mean of 1.398.

5.5 Stages in Synectics Group Development

No significant differences were found between the individual stages and solutions per session. However, 11 of the 12 problems resolved completely occurred within the Autonomouus stage. Thus, using problems completely resolved as an index of effectiveness, the Autonomous stage was the most productive. Applying the criterion measure of problems resolved partially, the Orientation and Exploration

stages were approximately equally effective.

5.6 Individual Sessions

During the December 1974 and February 1975 courses, the Course Captain offered individuals the option of attempting to resolve alone one of their problems as an evening exercise. 6 individuals applied the ONE-IN-ONE MEETING format. Each resolved partially his problem. From the subsequent group discussions, it appeared that they adopted a Shared-Control LEADERSHIP style, as might be expected, since they were required to be CLIENT, LEADER and PARTICIPANT. There was insufficient data to indicate which CLIENT and PARTICIPANT styles were used. Various advantages and disadvantages emerged for this type of session over group applications of Synectics methods. These relative advantages and disadvantages are summarised in Exhibit 11.

5.7 Two-Person Sessions

The ONE-ON-ONE MEETING format was used in 5 courses. A time limit of 15 minutes per session was imposed by the Course Captain. 56 two-person sessions were held. These produced 37 POSSIBLE SOLUTIONS, i.e. 1.514 solutions per session. Using this latter criterion, the two-person sessions were marginally more effective than the full-group sessions. However, no problem was resolved completely.

Group discussions revealed certain advantages and disadvantages for the two-person sessions over the full-

EXHIBIT 11 : ONE-IN-ONE Session Advantages and Disadvantages

Advantages	Disadvantages
i) Procedures are more simple to apply; for example, there is no need to use the PARAPHRASE. ii) Problem Investigation and Idea Development are more rapid. iii) Generally only 5-25 minutes taken to achieve a POSSIBLE SOLUTION, compared with 15-45 minutes for group sessions. iv) More consideration may be given to individual HOW TO STATEMENTS and ideas : not constrained by group pressures (time, other individuals' styles, etc.) v) There is less inhibition in using the EXCURSION procedure.	i) Difficulties may be experienced in overcoming concerns with ideas. ii) There tends to be a lack of variety in the HOW TO STATEMENTS. iii) The ideas tend to be less original and novel.

group applications of Synectics methods. The relative advantages and disadvantages are summarised in Exhibit 12. A Shared-Control LEADERSHIP style appeared to be employed generally. There was insufficient data from the group discussions to determine which CLIENT and PARTICIPANT styles were used.

EXHIBIT 12 : ONE-ON-ONE Session Advantages and Disadvantages

Advantages	Disadvantages
i) Problem Investigation and Idea Development tend to be more rapid. ii) Procedures may be used more flexibly : individual stages of the Synectics Problem-Solving Scheme may be omitted. iii) More opportunities for discussion in the ANALYSIS. iv) More 'intimate' atmosphere created. v) POSSIBLE SOLUTIONS emerged rapidly in 8 sessions - after 1-2 minutes.(The earliest emergence of a SOLUTION in a full-group session was 9 minutes.)	i) Insufficient consideration given to some HOW TO STATEMENTS and ideas. ii) Occasionally, one individual may dominate the other and abuse process.

6.0 COMPETENCE FACTORS

Summary graphs representing each of the competence factors are shown in Exhibit 13. The competence-factor values are time-adjusted and are derived from from the 98 full-group Synectics sessions.

6.1 Pace

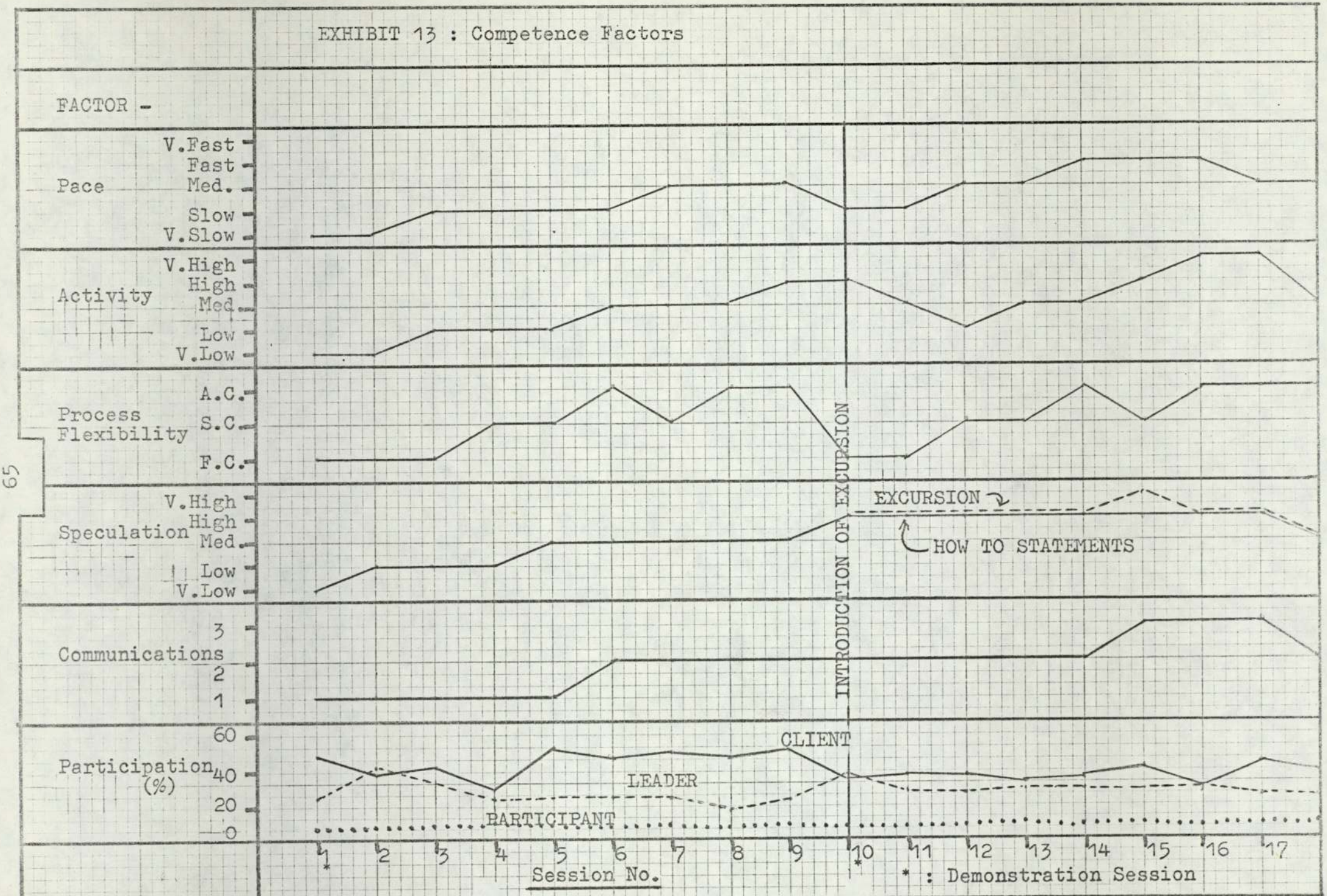
Pace refers to the speed with which the Synectics methods are used by group members. For each of the courses the pace curve tends to rise. Early Synectics sessions (No.s 1-3) tended to be very slow, reaching the medium pace level by session no.s 7-9. When the EXCURSION procedure was introduced, the pace fell but thereafter rose to either fast or very fast. The pace tended to fall in the final session of the courses.

The intermediate decline in pace was attributed by the course members to the introduction of the EXCURSION. 14 course members reported initial difficulty in learning this procedure. 3 course members considered it "irrelevant" and a "nuisance". The decline towards the end of the courses was due to the fatigue of the course members. 9 course members felt that there were "too many" Synectics sessions in the Synectics Basic Course; 5 members stated that they would have preferred less sessions.

6.2 Activity

This refers to the degree of alertness and physical

EXHIBIT 13 : Competence Factors



movement during a Synectics session. The general pattern of the activity level curves is similar to those of pace. The curves rise generally, with a slight decline after the introduction of the EXCURSION. 12 course members stated that the two declines in the level of activity resulted from mid- and end- of course fatigue.

6.3 Process Flexibilty

Process flexibility refers to the variations in the use of Synectics methods. It is reflected by the LEADER's control of the Synectics Problem-Solving Scheme. Increasing process flexibility was found in each half of the 6 courses examined. For sessions without EXCURSIONS, the LEADERS tended to change their styles from Full-, Shared- to Absent-Control, coded F.C., S.C. and A.C. respectively on Exhibit 13. A similar temporal pattern of change was found for the series of sessions with EXCURSIONS.

6.4 Speculation

Speculation refers to the use of analogy, metaphor and fantasy in a Synectics session. Two categories of speculation were examined : the number of speculative HOW TO STATEMENTS as a proportion of the total number of HOW TO STATEMENTS generated per session, and the level of speculation within EXCURSIONS.

For sessions without EXCURSIONS, the level of speculation within HOW TO STATEMENTS for each course increased from very low to very high. The high level was maintained once

EXCURSIONS were introduced into the sessions. The EXCURSIONS were also primarily at the high level. However, the speculation level of both categories tended to fall slightly towards the end of the course.

Most (30) course members reported that they enjoyed the speculative content of the sessions. 7 course members maintained that the use of speculation "made the sessions faster" and "much more lively", i.e. contributed to an increase in pace.

6.5 Communications

Communications refers to the correct use of the Synectics skills and procedures of HEADLINING, IN-OUT LISTENING and PARAPHRASING. In each course, communications were found to improve gradually. This involved PARTICIPANTS and CLIENT using HEADLINES and IN-OUT LISTENING more frequently, and the CLIENT using increasingly the PARAPHRASE during the Idea Development stage of Synectics sessions. With practice the LEADERS improved gradually on their administrative duties. However, communications deteriorated slightly towards the end of each course. Again course members attributed this decline to fatigue.

6.6 Participation

Participation refers to the degree of involvement of Synectics group members in their sessions. All group members participated in every session. The overall participation levels are summarised in Exhibit 14.

EXHIBIT 14 : Participation Levels

Sessions	Role	Range (%)	Mean (%)
Total	PARTICIPANT	2 - 17	7
	LEADER	19 - 35	27
	CLIENT	34 - 56	40
Without EXCURSIONS	PARTICIPANT	2 - 8	6
	LEADER	18 - 37	29
	CLIENT	29 - 61	44
With EXCURSIONS	PARTICIPANT	6 - 9	8
	LEADER	21 - 33	26
	CLIENT	22 - 48	37

In general, the level of involvement per PARTICIPANT was relatively stable at 7%. The LEADER level of participation tended to decrease in each half of the courses, and the CLIENTS' involvement increased proportionately. This reflected the the temporal pattern of LEADERSHIP style change. LEADERS participated proportionately more frequently when they adopted the Full-Control style, and less when they used the Shared-Control style. The lowest levels of LEADERSHIP participation were recorded for the Absent-Control style.

7.0 DISCUSSION

The results of this research are discussed in terms of the literature reviews of Chapters Two - Eight.

7.1 Synectics Methods

i) Quality of Solutions

This refers to the value of the courses of action developed during Synectics sessions. There is little indication of the quality of the SOLUTIONS achieved during the courses studied. The quality of solutions is essentially a CLIENT value judgement that was not investigated because of the difficulty of developing a satisfactory criterion measure. The quality of solutions should be evaluated once they have been implemented. The actual results should be examined systematically, based upon the contribution to knowledge, wealth, interpersonal relations, etc.

ii) Effectiveness

Applying the criterion measures described in Chapter Eight, Synectics methods are an effective problem-solving technique. Each Synectics session assisted to some degree the CLIENT to resolve his problem. However, these criterion measures should be treated with care. For example, whilst solutions per session is an adequate academic measure of effectiveness, the results of specialist applications of Synectics methods should be considered. It would be useful to study longitudinally the application of Synectics

methods to particular situations. A case-study approach would provide detailed data regarding the practical worth of the Synectics technique.

The number of or rate of generation of HOW TO STATEMENTS and ideas was found to be a poor criterion measure of effectiveness. This was because the Synectics sessions studied were concerned with developing only one or two HOW TO STATEMENTS and ideas into POSSIBLE SOLUTIONS.

iii) Competence

With repeated practice the 6 Synectics groups extended their problem-solving abilities. This improvement must be attributed in part to the specialist COACHING given by the Abraxas staff members. With an increasing level of competence, the effectiveness of Synectics methods was found to improve - applying the criterion measure of problems resolved completely.

iv) Expectations and Assumptions

Assumptions are suppositions derived from experience. Expectations are unsubstantiated preconceptions. Expectations and assumptions were shown to affect the outcomes of at least 9 Synectics sessions. In these sessions the CLIENT made the assumption that no SOLUTION could be achieved. This assumption was incorrect as SOLUTIONS were developed in each instance.

The influence of expectations was illustrated during the

group discussion of session no. 9 of the January 1975 course. A PARTICIPANT, who had used the Challenging style in the session, remarked :

"I did not think that the CLIENT made the best choice in his HOW TO (STATEMENT) selection. And I did not expect any solutions to come out of the session."

Nevertheless, two SOLUTIONS were developed during this session.

Gough (1957) has indicated previously the dangers of tacit assumptions. Zanna et al. (1975) studied the effects of expectations within a teaching programme. Individuals holding positive expectations performed better than those with negative expectations, as measured on the Comprehensive Basis Skills Test. Battle (1965) and Dweck (1975) have indicated the effects of assumptions and expectations. From a series of experiments, Battle found that college students with expectations of success were more persistent in the face of academic difficulties than students with expectations of failure. Dweck studied the effects of assumptions within problem solving. His results supported the suggestion that confirmed expectations (negative or positive) become assumptions, upon which subsequent problem-solving performance is partly dependent.

7.2 Leadership and Management Styles

i) Nature of Styles

Unlike most of the styles discussed in Chapter Three, the Synectics role styles are not necessarily either task- or social-relations orientated. They are neutral. The effect of the styles depends upon the manner in which they are employed. For example, the Challenging style may be adopted towards an individual (social-relations orientation) or towards the task activity by questioning assumptions or the selected problem-solving direction (task orientation).

ii) Michigan State University Studies

The patterns of behaviour and interaction of the Full-, Shared- and Absent-Control styles are similar respectively to those of Lippitt and White's (1958) Authoritarian, Democratic and Laissez-faire styles. But, unlike Lippitt and White, no one best style was found.

In particular, Lippitt and White maintained that the Laissez-faire style is ineffective because each group member tends to pursue his own goals at the expense of the task activity. This contention is supported in this research in the 4 sessions where the Absent-Control style was used within a group of low problem-solving competence. But the Absent-Control style was preferable in groups of relatively high problem-solving competence. This is because at the Autonomous stage (high competence), the CLIENT and

PARTICIPANTS may function efficiently and effectively, with the LEADER having to carry out administrative duties only. In contrast, at the Orientation and Exploration stages (low and medium competence), the CLIENT and PARTICIPANTS require the LEADER to control process.

Thus, the results support to some extent Gordon's (1951) argument :

"The most effective leader is one who can create the conditions by which he will actually lose leadership.....; the person who finds himself the leader of a group will by creating the proper conditions distribute the leadership function throughout the group. It seems that there may be a direct relationship between the degree to which leadership is given over to the group and the extent to which the group will utilise the maximum potential of its members." (p. 334)

iii) Transactional Analysis

Each of the Synectics role styles tended to have Parent - Adult - Child characteristics. For example, the EXCURSIONS elicited Child behaviour, although the sessions were characterised primarily by Adult behaviour. Parental behaviour was minimal and associated with the Challenging style.

iv) Style Flexibilty, Combinations and Matches

The results support Reddin's (1970) contention that style

flexibility is important for effective leadership. Effectiveness is raised where a satisfactory style combination is achieved. The LEADER must change his style to match the level of competence of his group members and, in particular, the CLIENT's style. No preferred CLIENTSHIP/PARTICIPANT or LEADERSHIP/PARTICIPANT style combinations were indicated from the data.

Jahoda (1958) and Greiner (1967) have pointed also to the need for style flexibilty and adaptability in successful problem solving. Jahoda argued for adaptability and integration of individuals with their environment. Individuals must improve their ability to solve problems and to react flexibly to changing environmental conditions. Greiner put forward a similar viewpoint. He stressed the importance of group problem solving as a method of sharing power, where there is an opportunity for subordinates to define problems.

Synectics methods go further. Through the concept of CLIENTSHIP, Synectics methods ensure that subordinates not only assist in defining problems, but also are involved actively in implementing the solutions to those same problems.

Bennis (1966) described organisations of the future as characterised by adaptive, rapidly changing temporary systems. There will be 'task forces' organised around problems to be solved by groups of relative strangers with a diverse set of professional skills. Senior management

will become the co-ordinator of such task forces. Under such circumstances, style flexibility and style matches will become increasingly important for improving problem-solving effectiveness. No one style will predominate for any length of time. Styles will need to be adapted within these specific task forces.

Supporting evidence for the Full-Control LEADERSHIP/ Ambivalent CLIENTSHIP style match comes from Peak (1945). She studied the effects of different leadership styles on political and religious ideologies. She found that individuals reacted favourably to a stable authoritarian leadership style under emotionally insecure and ambiguous conditions. Concurring evidence is supplied by Ziller (1955), who investigated the relation between stress and leadership style. Leaders became more authoritarian in order to cope effectively with situations of increasing uncertainty.

7.3 Problem Solving

i) Process Flexibility

Process flexibility may be increased by combining Synectics methods with other problem-solving techniques. This would allow a greater range of procedural options for LEADERS adopting the Shared-Control style.

ii) Set Difficulties

Each of the 6 course members who used the ONE-IN-ONE MEETING format reported set difficulties, in terms of :

i) transforming/completing deficiencies within ideas;
ii) generating and developing novel HOW TO STATEMENTS and ideas.

However, two individuals reported that they found the EXCURSION procedure a useful 'set breaking' device. No such difficulties were manifested in the group sessions : group members were always ready to offer HOW TO STATEMENTS and ideas.

iii) Group Problem-Solving Styles

Using Shaw's (1964) terminology, the Absent-Control style produces a decentralised pattern of behaviour. A centralised pattern is associated with the Full-Control

style.

No data were obtained regarding member satisfaction and LEADERSHIP style. Although 5 course members stated that they enjoyed the decentralised pattern because "there is more opportunity for discussion", "we can explore ideas better" and "process isn't so inhibiting."

iv) Ambivalence and Ambiguity

Ambiguity is defined in terms of the lack of clarity. Ambivalence refers to the co-existence of two or more opposing goals or attitudes. Ellesberg (1961) maintained that ambiguity and ambivalence are reciprocal variables. Becker and Brownson (1964) demonstrated that individuals tend to avoid ambiguity whenever possible. Varying degrees of ambiguity will occur within any Synectics session, especially as group members explore novel and ill-formed ideas. Changing situational requirements will almost inevitably result in CLIENTS possessing ambiguous goals and attitudes.

v) PARTICIPANT styles

Several similarities emerge when comparing the results of this research with those of Gough and Woodworth (1960), described in Chapter Eight. The Scholar style is similar to the Research-Orientated style, the Methodologist to the Divergent style and the Independent to the Challenging style.

Comparisons of the S.Q.S.Q. results with those of McKenney and Keen (1974) studies on cognitive style reveal almost identical styles. From 1970 - 1974 McKenney and Keen carried out several experiments using 107 M.B.A. students in order to identify cognitive problem-solving styles. They identified 4 styles :

i) Systematic;
ii) Intuitive;
iii) Receptive;
iv) Preceptive.

The characteristics of each style are summarised in Exhibit 15. McKenney and Keen's Systematic style is almost identical to the Systematic PARTICIPANT style, as are the Receptive and Preceptive styles to the Research-Orientated style. The Intuitive style is similar to the Energetic and Divergent styles. The only style not accounted for in McKenney and Keen's studies is the Challenging style. And yet the Challenger style is essential for effective problem solving because it has the advantages of questioning (invalid) assumptions and offering novel perspectives.

EXHIBIT 15 : Cognitive Problem-Solving Styles - McKenney and Keen (1974)

1. Systematic Style :

Individuals who use this style -

i) look for a method and make a plan for solving the problem;

ii) are conscious of their approach;

iii) defend the quality of their solutions largely in terms of method;

iv) define the specific constraints of the problem early in the process;

v) discard alternatives quickly;

vi) move through a process of increasing refinement of analysis;

vii) conduct an ordered search for additional information;

viii) complete any discrete steps in the analysis.

2. Intuitive Style :

Individuals who use this style -

i) keep the overall problem in perspective;

ii) redefine continuously the problem;

iii) rely on unverbalised cues;

iv) defend a solution in terms of 'fit';

v) consider a number of alternatives and options simultaneously;

vi) move backwards and forwards in the analysis;

vii) explore and abandon alternatives very quickly.

3. Receptive Style :

Individuals who use this style -

i) suspend judgement and avoid preconceptions;

ii) are attentive to detail and to the exact attributes of the data;

iii) insist on a complete examination of the data set before deriving conclusions.

EXHIBIT 15 Continued : Cognitive Problem-Solving Styles - McKenney and Keen (1974)

4. Preceptive Style :

Individuals who tend to use this style -

i) look for cues in the data set;

ii) focus upon relationships;

iii) develop a set of precepts from the salient aspects of the problem.

7.4 Human Group Processes

i) Group Development

The 3 stages of Synectics group development occur at Tuckman's (1965) Performing stage. Forming, Storming and Norming did not happen explicitly within the courses studied because the Synectics group structure and task activity were defined in advance of the problem-solving sessions.

Forming, Storming and Norming tended to be implicit. For example, at the end of session no. 4 of the February 1975 course, there was a minor conflict between the LEADER and two PARTICIPANTS. The latter resented the former experimenting with the Synectics Problem-Solving Scheme. They would have preferred the LEADER to have established a mutual understanding that the session was to be experimental.

ii) Assembly Effects

These occur when a group is able to achieve collectively something which could not be accomplished by an individual or a combination of individual efforts.

In each course there were minor assembly effects prior to the introduction of the EXCURSION. There were major assembly effects in the final two or three sessions of the courses. In both instances the characteristics of the assembly effects were rapid idea transformation (high pace and activity levels) and a spontaneous 'triggering'

of HOW TO STATEMENTS. As 4 course members remarked: "everything just flowed", "there were no difficulties this time", "we were really a group" and "we came together as one".

The minor assembly effects were dissipated by the introduction of the EXCURSION. The pace and activity levels fell because the group members were required to learn an additional procedure.

iii) Communication Patterns

Using Dubin's (1959) terminology, the general linkage systems for the 3 stages in Synectics group development and for the associated LEADERSHIP styles are summarised in Exhibit 16. As process control became increasingly decentralised, the linkage patterns changed from radial to circular, reflecting the gradual transitions in the nature of the interpersonal interactions.

EXHIBIT 16 : Synectics Communication Patterns

Synectics Group Development Stage	Linkage System	LEADERSHIP Style
Orientation	Radial and Serial	Full-Control
Exploration	Radial and Circular	Shared-Control
Autonomous	Circular	Absent-Control

7.5 Training

i) Learning

The competence curves may be viewed as learning indices, after the Carroll (1963) model of learning. Carroll argued that time is the central variable in learning, and that individuals differ in the amount of time to develop skills. His arguments are supported to some extent within this research.

ii) End Effects

The general decline in the overall level of competence in the final sessions of the courses is called 'end effects'. End effects are the fall in performance towards the finish of a learning programme (Deese and Hulse, 1967). They result commonly from fatigue, lack of motivation and anticipation of achieving a learning objective.

7.6 Creativity

The characteristics of the 5 PARTICIPANT styles taken as a whole correspond closely to the characteristics of highly creative individuals (Rogers, 1954; MacKinnon, 1962; Davis, 1975). This overall creative style may be summarised in terms of a high level of activity and high degrees of spontaneity and open-mindedness, although concerned with detail and at times withdrawn.

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CHAPTER TEN

CONCLUSIONS, STRATEGIES, RECOMMENDATIONS AND LIMITATIONS

Summary

The strategies for improving problem solving, human group processes and related training are presented. The strategies are derived primarily from the identified Synectics role styles. A case study is presented in order to illustrate an application of the strategies. The principal conclusions, recommendations and limitations are given also.

Contents

1.0 CONCLUSIONS

The principal conclusions of this research are :

i) Problem-solving effectiveness is influenced by style. Within their assigned roles, Synectics group members are able to adopt/display various patterns of behaviour which influence the (nature of the) outcomes of their problem-solving sessions.

ii) No one style is effective for all situations. Style combinations need to be considered. Effectiveness can be improved by achieving style matches. Style flexibility is essential for attaining style matches.

iii) Under conditions of continued practice with feedback (COACHING), Synectics groups improve their level of problem-solving ability and their problem-solving effectiveness (measured in terms of problems completely resolved).

iv) Effective involvement in Synectics sessions requires a knowledge and an awareness of alternative problem-solving procedures and skills, style options, and preferably a high level of problem-solving competence. The effective group member changes his style to take into account differing problem-solving requirements, i.e. adopts a contingency approach to problem solving.

v) Content, process and factor analysis (Q-Sorts) offer a satisfactory approach for investigating style effectiveness

and competence. The value of these research techniques is enhanced with the aid of C.C.T.V. equipment.

Conclusions relating to the research areas of the literature review are presented at the end of Chapters Two - Seven.

2.0 STRATEGIES

Role strategies may be derived from the Synectics role styles in order to improve problem solving and human group processes. The role strategies may be supplemented by training strategies. The role strategies are presented in Exhibit 1. The training strategies are presented in Exhibit 2.

The strategies should be regarded as ideal types. In practice they may be modified, depending upon problem-solving and training situation requirements.

A case study illustrating an application of the strategies is presented in Exhibit 3. The case study comprises :

i) the transcript of the audiotape recording of a Synectics session in which the strategies were employed;

ii) an analysis of the session in terms of the identified role styles;

iii) an analysis of the session in terms of Bales's (1958) categories of interpersonal interaction;

iv) the session notes recorded by the LEADER;

v) the SPLIT-SHEET I.R.s (feedback notes) from the Synectics group members;

vi) a discussion of the session.

EXHIBIT 1 : Synectics Role Strategies

1. LEADERSHIP Strategies :

1.1 Planning

In addition to the usual planning considerations, the LEADER needs to take into account :

i) the CLIENT's interpretation of the problem situation;
ii) the competence level of the Synectics group.

Client style considerations are more important for the LEADER than the CLIENT's level of problem-solving ability.

1.2 Basic Strategies

The LEADER has primarily 3 strategies :

i) The LEADER should adopt the Full-Control style when interacting with an Ambivalent CLIENT and low competent PARTICIPANTS.

ii) The LEADER should adopt the Shared-Control style when interacting with an Explicit CLIENT and medium competent PARTICIPANTS.

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

1.3 Style Flexibility

The LEADER should change his style as the CLIENT's style alters in order to achieve style matches (Full-Control LEADERSHIP/Ambivalent CLIENTSHIP and Shared-Control/ Explicit CLIENTSHIP style combinations).

2. CLIENTSHIP Strategies :

2.1 Planning

In addition to the usual planning considerations, the CLIENT should to take into account :

i) the nature of his problem situation;
ii) his problem-solving objectives.

These should be discussed in detail with the LEADER.

2.2 Basic Strategies

The CLIENT has primarily 2 strategies :

i) The Explicit style is preferable where the problem is clearly defined and objectives are specific.

EXHIBIT 1 Continued : Synectics Role Strategies

CLIENTSHIP Strategies Continued :

ii) The Ambivalent style is preferable where the problem constraints are ill-defined and objectives are general.

2.3 Style Flexibility

As a broad generalisation, the Ambivalent style tends to be more productive at the Problem Investigation stage of the Synectics Problem-Solving Scheme. The Explicit style tends to be more productive at the Idea Development stage.

However, much will depend upon the CLIENT'S own perceptions of the problem content : he should at least be aware of his (adopted) style and his selected problem-solving direction.

3. PARTICIPANT Strategies

There are primarily 5 strategies, based upon each of the PARTICIPANT styles.

3.1 Style Flexibilty

i) PARTICIPANTS may adopt the style(s) they feel is most suitable for themselves.

ii) Care should be exercised in the use of each style. Over-rigid adherence to a particular style will almost inevitably have dysfunctional effects for problem solving. For example, continued use of the Challenging style would disrupt the session.

iii) The highly creative PARTICIPANT will adopt each style during the session.

iv) PARTICIPANTS may adopt a given style depending upon the CLIENT's wishes. For example, the Divergent style is useful for developing alternative problem-solving approaches at the Problem Investigation stage

EXHIBIT 2 : Training Strategies

Several strategies are available for Synectics trainers :

i) To present formal lectures on the Synectics role styles and strategies. These might be given on Day 2 or 3 of the Synectics Basic Course.

ii) To discuss, using videotape recordings, the possible styles, style variations and group interpersonal interactions. The discussions might centre upon -

* both the mechanics and dynamics of the role styles;
* how subsequent sessions might be improved using the course members' newly-acquired knowledge about the role styles and strategies.

iii) To include in the course manual material concerning the styles and strategies. This material should be adapted from the appropriate sections of Volume IV.

iv) To demonstrate (model) specifically in a Synectics session the role styles and strategies. This demonstration session should be followed by a detailed discussion of the style effects and the related underlying issues.

Course members should be encouraged to practice each of the styles in order to develop their problem-solving skills and knowledge.

EXHIBIT 3 : Synectics Case Study

1.0 SYNECTICS GROUP MEMBERS

Name	Age Years	Occupation	Role
Marie Miles	29	Housewife	CLIENT
John Miles	35	Accountant	LEADER
Stephen Trent	32	Accountant	PARTICIPANT (PT.) No. 1
Peter Price-Jones	34	Accountant	PARTICIPANT No. 2
Leslie Saward	25	Student	COACH

1.1 Experience

Each of the group members has between 14-32 months experience of applying Synectics methods; please see the 'Synectics Practice Within the Family' case study of Volume IV.

2.0 SESSION MATERIALS

i) 5 A4 notepads with pencils;
ii) 3 large wall-mounted note pads (2' x 3') with crayons;
iii) Timer;
iv) Audiotape recording equipment (two tape recorders; audiotapes; microphone; leads);
v) Synectics manuals. Each manual contained the following sections of Volume IV : Aston Study (1974-1976); Feedback Sheet; HOW TO STATEMENTS; Synectics Problem-Solving Scheme (Basic Flowsheet).

3.0 PREPARATION

The Synectics meeting room was arranged by the COACH on the morning of the 5th September 1976; please see the Meeting Room Requirements section of Volume IV.

The group assembled at 2.00 p.m. The COACH assigned roles to each of the group members and distributed the manuals. There ensued a 25 minute discussion led by the COACH on the strategies. The COACH described the strategies with their background development and answered questions on the role styles.

Next a 6 minute Planning session was held between the CLIENT and LEADER. This was followed by an 18 minute Synectics session, and by a group discussion of the session (2 x 45 minutes with a 5 minute interval). The discussion centred on the style and process aspects of the individual contributions within the Synectics session.

EXHIBIT 3 Continued : 4.0 SYNECTICS SESSION

Role	Transcript	Style Analysis	Process Analysis
LEADER	Let's begin. Marie, tell us you PROBLEM AS GIVEN.	Full-Control	Calls for attention of others; instructs CLIENT to state her problem definition.
CLIENT	To enjoy my free time.	Explicit	States problem definition; written up by LEADER on large pads.
LEADER	Now....give us your ANALYSIS.	Full-Control	Instructs CLIENT to describe her problem situation; PARTICIPANTS write notes.
CLIENT	I have a lot of free time now that Steven and Jane are back at school. Something about 4 hours a day. And I want to use this free time to do something useful and enjoyable.	Explicit	Gives information in a precise manner; diagnoses situation and makes interpretation.
LEADER	Would you like to say something about the ideas you have thought of? And what have you tried to date?	Shared-Control	Asks for further information.
CLIENT	Not much really. I've organised some coffee mornings, which weren't very successful....	Explicit	Gives further information.
PT. No. 1	Why weren't they successful?	PT. : Research-Orientated. LEADER : Absent-Control	Asks question to elicit further information. LEADER permits question.
CLIENT	I'm not sure really. People did not stay very long. I've thought about lingerie parties for friends.	Ambivalent Explicit	Client is vague in recalling experiences and reporting about others; gives precisely further information.

EXHIBIT 3 Continued : SYNECTICS SESSION

Role	Transcript	Style Analysis	Process Analysis
LEADER	Would you tell us how it is a problem for you?	Shared-Control	Asks for further information.
CLIENT	Because I want to do something helful and enjoy myself at the same time, especially now that the children are older. My Power To Act is that I have the house to myself once John goes to the office, and can use the Cortina (car) during the day. My Ideal Solution is to do something that would be both fun and useful.	Explicit	Gives precisely further information about situation.
LEADER	Right, does everybody understand the problem? If you have any questions, try and expresss them as HOW TO'S for me to write up on the pads. Would someone like to start off.....?	Shared-Control	Checks that problem is understood by PARTICIPANTS, who nod their heads to affirm.
CLIENT	How to make the coffee mornings successful. It would be nice to put some life into the coffee mornings, as I enjoy them.	Explicit Systematic	Offers restatement of part of problem explanation, giving background to her thoughts. -All HOW TO STATEMENTS written up by LEADER-
PT. No.1	How to become a woman of leisure. My wife has the opposite problem..... she complains that she hasn't enough time to do nothing.	Challenging	Offers suggestion/opinion, opposing CLIENT's wishes; gives background thoughts.
PT. No. 2	Yes.....How to become a woman of pleasure. What I was thinking....	Energetic	Offers suggestion/opinion, making a friendly joke. Laughter and smiling.

EXHIBIT 3 Continued : SYNECTICS SESSION

Role	Transcript	Style Analysis	Process Analysis
CLIENT	I can guess what you're thinking....	Explicit	Disapproves values, albeit in an amused manner; shows slight reserve.
PT. No. 2	.....you said that you wanted to have fun.....	Energetic	Supports own suggestion/ opinion.
CLIENT	I'd like some more speculative HOW TO'S .....I want to get away from the normal type of ideas. So could Peter and Stephen use the Divergent and Energetic strategies?	Explicit	Gives precise direction, requesting PARTICIPANTS to adopt specific styles.
LEADER	All right. Let's have lot's of different and lively HOW TO'S.	Shared-Control	Complies with and PARAPHRASES CLIENT's request.
CLIENT	How to be happy Samaritan. I did some work for the Samaritans some years ago, but left after 6 months as they were over self-righteous although they did some good work.	Explicit Divergent	Offers suggestion/opinion; gives background thoughts.
PT. No. 2	How to be Mary Poppins. I was.....	Energetic	Offers suggestion/opinion.
PT. No. 1	How to be.....	-----	Interrupts.
LEADER	Just a minute, Stephen, let's hear Peter's background.	Full-Control	Permits PARTICIPANT No. 2 to continue.
PT. No. 2	I was thinking that Marie could become Marie Poppins - you know flying about with an umbrella doing good deeds. I was trying to develop the Samaritan idea.	Energetic	Gives background thoughts.

EXHIBIT 3 Continued : SYNECTICS SESSION

Role	Transcript	Style Analysis	Process Analysis
LEADER	Now, Stephen, what's your HOW TO?	Full-Control	Permits PARTICIPANT No. 1 to continue.
PT. No. 1	How to be the Devil's Advocate. Challenging the Samaritans idea, I thought that Marie could do something destructive. How about demolishing houses?	Energetic/Divergent/ Challenging	Offers suggestion/opinion; gives background thoughts.
LEADER	Can I have that as a HOW TO?	Full-Control	Prompts and encourages PARTICIPANT to develop another HOW TO STATEMENT.
PT. No.1	All right. How to become a demolition expert.	Energetic	Offers suggestion/opinion
PT. No. 2	How to help John do his work. We are short of staff sometimes, and if you could type up some reports for us.....	Systematic/Divergent	Offers suggestion/opinion; gives background thoughts.
CLIENT	Yes, that would be good....earning some money at home.....How to make money at home.....	Explicit Systematic	Concurs : offers suggestion/ opinion in a precise manner.
PT. No. 1	How to be an Angel. I was thinking about the T.V. series.....you could do some part-time nursing.....there always seems to be a shortage of nurses in hospitals.	Systematic/Divergent	Offers suggestion/opinion; gives background thoughts.
LEADER	Well, we have about 10 HOW TO'S. Marie, would you indicate what is appealing in any of these HOW TO'S.	Shared-Control	Gives information about the problem-solving situation; requests direction from CLIENT.

EXHIBIT 3 Continued : SYNECTICS SESSION

Role	Transcript	Style Analysis	Process Analysis
CLIENT	I like the Mary Poppins type of idea. Can we develop this some more?	Explicit	Gives direction; requests further suggestions/ opinions to be directed towards a specific concept.
LEADER	Right. Let's have some more HOW TO'S like the Mary Poppins one.	Shared-Control	Supports CLIENT's request.
PT. No. 2	How to be a chameleon Marie Poppins. You could change your personality to suit what you're doing....I'm not too sure what I mean.....	Energetic	Complies with CLIENT's wishes; offers suggestion/ opinion, giving background thoughts.
CLIENT	Yes, I like that type of idea..... possibly.....How to become the 'Bionic Woman'.....doing the housework super-fast.....How to be super-efficient.	Explicit Energetic	Offers suggestion/opinion in a precise manner; gives background thoughts.
PT. No.1	How to run keep fit classes.....that would make you almost bionic.	Systematic	Offers suggestion/opinion; gives background thoughts.
PT. No. 2	How to develop your mind. I don't like strong women....some of the women in the Olympics were hideous.	Divergent	Offers suggestion/opinion; gives background thoughts.
LEADER	Some more HOW TO'S, Marie, or shall we move on to the idea development stage?	Shared-Control	Offers options to the CLIENT.
CLIENT	.....I'd like to select the Mary Poppins HOW TO.	Explicit	Gives specific direction to pursue.
LEADER	Good. Would you say how it appeals to you?	Shared-Control	Encourages; requests information.

EXHIBIT 3 Continued : SYNECTICS SESSION

Role	Transcript	Style Analysis	Process Analysis
CLIENT	I like the flying and magic part of being Mary Poppins....going around doing useful things....but I don't want to be prim and proper like Julie Andrews.....	Explicit	States reasons for choice in a precise manner. Laughter and smiling.
LEADER	And how would you like this HOW TO developed?	Shared-Control	Requests further information.
CLIENT	I would like the flying part developed .....not literally.....doing something that I would enjoy.	Explicit	Gives further direction in a precise manner.
LEADER	Take a minute to think of an idea on Marie's chosen HOW TO while I clear the sheets. An idea, gentlemen, please...	Full-Control	Gives instructions : CLIENT and PARTICIPANTS write down ideas on their smalll pads.
PT. No. 1	My idea is for Marie to join the W.V.S. (Woman's Voluntary Service), using her car to visit hospitals and such, doing deeds of daring-do....or whatever the W.V.S. do....	Systematic	Offers idea.
CLIENT	.....I'm not too keen on.....	Ambivalent	Resists idea.
LEADER	A PARAPHRASE first.	Full-Control	Instructs CLIENT to feedback her understanding of the idea.
CLIENT	Oh yes.....you're saying that I could become a W.V.S. type of Mary Poppins, visiting the sick and cheering them up.	Explicit	Complies with LEADER's instruction : offers own interpretation of the idea.

EXHIBIT 3 Continued : SYNECTICS SESSION

Role	Transcript	Style Analysis	Process Analysis
PT. No. 2	Building on it.....you might run special events for the patients..... like wheel chair races around the 'Scilly Isles' (a notorious accident 'blackspot' on a dual carriageway in Claygate, Surrey)....	PT. : Systematic/ Energetic. LEADER : Absent-Control.	LEADER permits PT. No. 2 to extend PT. No. 1's idea. Laughter and smiling.
CLIENT	I like that! You mean doing something out of the ordinary. The plusses are : the car would encompass the flying part of being Mary Poppins. Being in the W.V.S. would be useful..... The wheel-chair part would be fun..... but lethal.....I don't think the hospitals would approve.....I'm stuck with how to develop more realistic suggestions.....I can join the W.V.S. or similar organisation without any trouble.....but I would like something more down-to-earth to do.....I'm not sure really.....the W.V.S. is rather....	Explicit Ambivalent	Encourages : offers PARAPHRASE and ITEMISED RESPONSE, showing attention and comprehension. CLIENT rambles.
LEADER	Tell us in HOW TO form what you would like to do.	Full-Control	LEADER interrupts CLIENT and instructs her to be more specific in her problem-solving direction.
CLIENT	.....How to.....make the W.V.S. enjoyable.	Explicit	Complies with LEADER's instruction.
PT. No. 2	You could organise a fund-raising fair for several hospitals in the area..... where the hospital patients and staff could get together with the general	Systematic	Offers idea; explains background thoughts.

EXHIBIT 3 Continued : SYNECTICS SESSION

Role	Transcript	Style Analysis	Process Analysis
PT. No. 2 cont.	public. You could organise the wheel-chair races safely.....and I know a couple of councillors who would be willing to help provided that you did most of the organisation.....	Research-Orientated	Offers information.
CLIENT	That would be very good.....yes..... I've got a POSSIBLE SOLUTION. I've some ideas for it already. I'm certain that Joan (a friend) would help.....	Explicit	Supports and praises idea in an excited manner.
LEADER	All right. Let me write up the SOLUTION before you get carried away and start 'phoning people.....	Full-Control	Restrains CLIENT's enthusiasm.
	Tell me what you want me to write up.		Instructs CLIENT to state a course of action for implementation.
CLIENT	To join the W.V.S. or similar sort of thing.....so as to run my fun-fair. To contact Peter's friends and to persuade Joan to help.....she's very capable at this sort of thing.... last year she organised the Parent-Staff.....	Explicit Ambivalent	Proposes course of action for herself in a precise manner. CLIENT shows excitement.
LEADER	Hold on! Give me your NEXT STEPS.	Full-Control	LEADER interrupts and instructs CLIENT to state her action steps.
CLIENT	To ring the various people concerned and to visit the W.V.S. tomorrow.	Explicit	Proposes action for self in a precise manner. POSSIBLE SOLUTION and NEXT STEPS written up by LEADER.

EXHIBIT 3 Continued : SYNECTICS SESSION

Role	Transcript	Style Analysis	Process Analysis
LEADER	This is new, feasible and appealing....	Full-Control	Checks solution criteria.
CLIENT	Yes.	Explicit	CLIENT is affirmative.
LEADER	Do you need any more ideas?	Shared-Control	Checks whether CLIENT wishes further assistance from PARTICIPANTS.
CLIENT	I'd like Peter and Stephen's notes.... Peter was scribbling down some 'phone numbers, I think....	Explicit	Requests further ideas.
LEADER	Right. That's it then....Thankyou,	Full-Control	Concludes session; expresses gratitude.
CLIENT	Yes.....Thankyou.....	Explicit	Expresses gratitude.

5.0 SESSION NOTES Recorded by the LEADER

P.A.G. : To enjoy my free time.

HOW TO STATEMENTS :

1. How to make the coffee mornings successful.
2. How to become a woman of leisure.
3. How to become a woman of pleasure.
4. How to be a happy Samaritan.
5. How to be Mary-Marie Poppins.
6. How to be the Devil's Advocate.
7. How to become a demolition expert.
8. How to help John to do his work.
9. How to make money at home.
10. How to be an 'Angel'.
11. How to be a chameleon Mary Poppins.
12. How to become the 'Bionic Woman'.
13. How to be super efficient.
14. How to run keep fit classes.
15. How to develop your mind.

POSSIBLE SOLUTION :

To join the W.V.S or similar organisation. To run the Miles fun fair. To contact Peter's friends, and obtain help from Joan. NEXT STEPS : To 'phone these people; visit to W.V.S.

5.0 SESSION NOTES Recorded by the LEADER

P.A.G. : To enjoy my free time.

HOW TO STATEMENTS :

1. How to make the coffee mornings successful.
2. How to become a woman of leisure.
3. How to become a woman of pleasure.
4. How to be a happy Samaritan.
5. How to be Mary-Marie Poppins.
6. How to be the Devil's Advocate.
7. How to become a demolition expert.
8. How to help John to do his work.
9. How to make money at home.
10. How to be an 'Angel'.
11. How to be a chameleon Mary Poppins.
12. How to become the 'Bionic Woman'.
13. How to be super efficient.
14. How to run keep fit classes.
15. How to develop your mind.

POSSIBLE SOLUTION :

To join the W.V.S or similar organisation. To run the Miles fun fair. To contact Peter's friends, and obtain help from Joan. NEXT STEPS : To 'phone these people; visit to W.V.S.

EXHIBIT 3 Continued : 6.0 FEEDBACK

The CLIENT, LEADER and PARTICIPANTS were asked by the COACH to comment particularly of their application of the role strategies.

'What I found useful, helpful and enjoyed'.	'My concerns, HOW TO'S, ideas for improvement, wishes'.
CLIENT The session went well. The ideas were very good. The CLIENT strategies helped make me aware of my behaviour. I liked John using the S/C (Shared-Control) style strategy - I wasn't pushed around by the process as has happened before. Peter and Stephen were very helpful in their Energetic styles - gave some original ideas.	Wish - more Divergence in H2s (HOW TO STATEMENTS).
LEADER The Shared-Control strategy was useful - it took some of the burden of me to make process decisions. It fitted with Marie's Explicit style so that the session was natural. No hang-ups about Synectics jargon = it wasn't obtrusive this time.	No complaints!
PARTICIPANT No. 1 I liked the P. (PARTICIPANT) strategies - they helped me to focus and direct my efforts and keep in tune with what Marie wanted.	The tape - my voice sounds appalling.

EXHIBIT 3 Continued : FEEDBACK

PARTICIPANT No. 1 (Cont.) John and Marie made an excellent team - their interchange was balanced.	(John has dominated some of the Synecticsising that we have held at the office.)
PARTICIPANT No. 2 The PARTICIPANT strategies made me organise my ideas and H2s. The strategies helped to make the whole session more directed. John's control of process - the CLIENT was skilfully handled.	More practice with the strategies. Have they more uses?
COACH (Summary of notes) Competence factors : PACE : Medium ACTIVITY : High PROCESS FLEXIBILITY : Well-balanced between the CLIENT and LEADER SPECULATION : Medium COMMUNICATIONS : Good PARTICIPATION : Balanced and active	How to increase the pace.

EXHIBIT 3 Continued : 7.0 DISCUSSION

The following points emerged from the post-session discussion, which was led and audiotaped by the COACH.

7.1 LEADER Strategies

The LEADER reported that he found the Full-Control strategy useful to direct the CLIENT and PARTICIPANTS' excitement towards achieving the POSSIBLE SOLUTION. The Full-Control strategy was also productive in restraining the CLIENT from rambling and from resisting ideas.

The LEADER stated that he had decided in the Planning session to use primarily the Shared-Control strategy since he considered that the CLIENT had relatively precise problem-solving objectives and that the PARTICIPANTS were of medium competence. While the PARTICIPANTS had been involved in numerous ONE-ON-ONE (two-person) sessions, they had only participated in 4 full-group sessions prior to September 5th.

The Absent-Control strategy was said by the LEADER to be useful when "the session was proceeding smoothly."

7.2 CLIENT Strategies

The CLIENT stated that the Explicit strategy "fitted the way I saw my problem.....although I realised I was incoherent (Ambivalent) at times, but John's change of strategy (from Shared- to Full-Control) seemed to cure that. .....The strategies made me aware of how I was behaving."

7.3 PARTICIPANT Strategies

The PARTICIPANTS reported that they were able to readily "mix" and "switch" the strategies. They agreed with the LEADER that the Full-Control strategy was useful in directing their excitement. There appeared to be a "fit" between the Full-Control and Energetic styles when "we were over-enthusiastic."

However, there were some 'intent v. effect' differences of opinion. For example, "How to help John do his work" was intended to be Divergent. But it was perceived by the CLIENT to be Systematic.

3.0 RECOMMENDATIONS

The principal recommendations of this research are :

3.1 Synectics Methods

The recommendations for Synectics practice are :

i) To apply role strategies when using the Synectics Problem-Solving Scheme. The strategies are intended to complement current Synectics methods.

ii) To apply one or more of the training strategies associated with the Synectics role strategies.

iii) To publish a comprehensive text of Synectics methods.

iv) To simplify and apply T.A.F. A and B with their criterion measures for COACHING Synectics groups.

In addition, further systematic (and comparative) research should be carried out into the effectiveness of Synectics methods. Of particular use would be detailed case study evidence.

3.2 Leadership and Management Styles

To rationalise the numerous current theories in order to develop a coherent approach for systematic research. Standardisation of terms would assist the development of reliable measures of style.

3.3 Problem Solving

i) To develop a detailed taxonomy of problems and problem solving.

ii) To investigate systematically the effects of combining Synectics methods with other problem-solving and related techniques.

iii) To identify the styles associated with other problem-solving techniques, such as Brainstorming methods. It is hypothesised that there are style similarities between Synectics and Brainstorming methods because of the techniques' resemblance.

iv) To develop a wider range of objective measures of problem-solving effectiveness.

3.4 Human Group Processes

To apply the principal outcomes of this research within a project management study. This would involve assisting a collection of individuals to become rapidly an effective problem-solving group, which is intended to act as an organisational 'task force'.

3.5 Training

i) For Synectics Inc. and their international affiliates to place more emphasis on the transfer of Synectics training into work, social and other situations. This

transfer should be carried out by extending the Synectics Development Programmes. The Synectics role styles and strategies should be modified and adapted to individual, group and organisational needs and requirements. The onus for this transfer will be on individual course graduates. But Synectics trainers should investigate alternative methods of assisting instrumentally the transfer of training.

ii) To investigate the effectiveness of the Synectics Development Programmes as a method of training transfer.

iii) To evaluate systematically the effectiveness of th Synectics training, especially at the Intermediate level of evaluation (3 - 4 months after training).

iv) To evaluate systematically the effectiveness of C.C.T.V. as a Synectics training aid. Specifically, 3 applications should be studied :

* modelling;
* feedback;
* modelling with feedback.

v) To study and improve Synectics learning principles.

vi) To develop a theory of Synectics training and problem solving. This would assist academic researchers to study systematically the effects of applying Synectics methods.

vi) To establish a comprehensive taxonomy of problem-

solving training in order to understand better skilled performance.

3.6 Creativity

i) To establish -

* a detailed and satisfactory definition of creativity;
* objective measures of creative performance;
* a fully developed theory of creativity.

ii) To explain how Synectics methods contribute to creative problem solving.

iii) To investigate further the relationship of PARTICIPANT style with creative problem-solving activity. This research should be extended to include personality and other measures.

4.0 LIMITATIONS

Several limitations surround this research :

4.1 Rationality

In developing the strategies it has been assumed that all Synectics group members behave rationally. However, rationality may be affected by personal animosity, organisational power struggles, differences in attitudes and opinions, etc. These factors may undermine the conditions for effective task activity, such as the willingness to problem solve. Inevitably these factors will contaminate the problem-solving styles, and may even make problem solving impossible.

4.2 Meanings

The styles are derived from the meanings attributed by the June 1974 - March 1975 course members to their problem-solving behaviours. Different course members may employ different styles because they interpret their behaviours in an alternative manner.

Meanings are complex (Karpik, 1968) and are often difficult to verbalise because they tend to be unconsciously adhered to. Weber (1964) maintained :

"In the great majority of cases, actual action goes on in a state of actual unconsciousness of its subjective meanings." (p. 111)

Cicourel (1974) has indicated the dangers of empirically studying meanings. Two or more individuals may interpret differently the same pattern of behaviour. The most dangerous situation is where an individual attempts to impose his meanings on others. If the meanings are not shared, the effects are potentially disastrous.

4.3 C.C.T.V.

Difficulties were encountered in attempting to examine the non-verbal communication of Synectics groups. For example, the technical limitations of C.C.T.V. coupled with the physical constraints of the training rooms made it impossible to investigate systematically eye contact and tone of voice. This would have been possible with superior equipment (several cameras with zoom lenses and monitors) and more open training conditions.

4.4 Statistical Difficulties

i) There were insufficient data from the S.Q.S.Q.s to ascertain the influences of education, work function and age on the problem-solving effectiveness of the Synectics groups.

ii) It was not possible to apply correlation techniques in a statistically meaningful manner to the competence factors because of the limited ranges of the criterion scales. However, positive correlations between factors may be inferred to some extent by inspection.

iii) The analysis of variance tables should be interpreted with care because of the relatively small number of solutions (0 - 4) developed within any given Synectics session.

5.0 CONCLUDING REMARKS

The full meaning of this research will be borne out only by the individuals who use and experiment with the styles and strategies. Success in using the strategies will come with practice and experience of the styles. As How (1946) maintained :

"Knowledge is a treasure, but practice is the key to it."