COGNITIVE STYLES AS A FUNCTION OF LOCUS OF CONTROL

by

AMER HASSAN MOHANNA

A thesis

submitted in fulfilment

of the requirements for the degree

of

Doctor of Philosophy

Department of Psychology

University of Stirling

Stirling Scotland

November 1978

ACKNOWLEDGEMENTS

My supervisor, Dr. Alistair Ostell has provided highly effective guidance which has sharpened my abilities in conducting research. His advice and encouragement throughout the course of the research is deeply appreciated. I am also very grateful to Mr. Iain MacFarlane for his generosity in devoting time to reading the whole manuscript and offering valuable comments. I would also like to thank Dr. Ranald MacDonald for offering help in the statistical analyses of some of the data and for his advice on using the computer.

I am indebted to the technical staff of the Psychology department and in particular to Mr. Angus Annan for helping to construct the apparatus for the second study. My thanks also go to Mr. Robert Lavery and Robert Anstruther for their help in providing instruments.

Special thanks go to Mrs. M. Buchanan for typing the thesis with remarkable efficiency considering the pressure of time.

Dr. Carlos Roldan, with whom I shared an office, has always provided a working atmosphere due to his dedication to his research and his sense of responsibility. His company will thus be missed.

Finally, my friends, who have shared with me in the questioning of things around us, have immensely enriched and stimulated my mind. To all of them I offer my deepest gratitude.

DEDICATION

I would like to dedicate this thesis to the memory of my mother Fatima who, in her own way, had engendered in me the process of 'perceiving' my 'perception'.

ABSTRACT

This research began as an examination of the problem solving strategies of individuals who believe they can control reinforcements they receive (internals) and those who believe that outside forces control reinforcements (externals) under different conditions of skill and chance. This developed into a study of the cognitive functioning of internals and externals in concept formation tasks. Internal and external persons were identified using the internal-external locus of control scale developed by J.B. Rotter and his colleagues.

Three studies were conducted using different tasks and groups of subjects. The subjects of the first study were required to find a principle relating one of two response words to a list of five stimulus words. There were fifty trials using different sets of words. Three groups of subjects were used, each made up of internals and externals. The group under the skill condition was instructed that their performance depended primarily on their own skill; the group under the chance 1 condition (quasi chance) was instructed that their performance on the task would probably be no better than chance due to the extreme difficulty of the task; and the group under chance 2 (pure chance) were told that their performance on the task was totally controlled by chance as the arrangement of the

words was purely arbitrary. It was expected that internals would perform better than externals under the skill condition while externals would perform better than internals under chance 2. Subjects' perception of, and reactions to, the task were measured by a post-task questionnaire. The results did not uphold the predictions. Externals, relative to internals, utilised, produced and changed significantly more solution hypotheses while working on the task. The two groups did not differ in the number of correct answers and both of them were unsuccessful in deciphering the principle. In terms of subjects' reactions to the task, it was found that the internals reacted differently to the skill and chance 2 conditions, while externals were stable across these conditions. Moreover, subjects construed the chance 1 condition as resembling a skill condition.

The different ways in which internals and externals handled their solution hypotheses was further investigated in the second study. Two groups, one of internals and one of externals, were asked to scan a list of characteristics describing an object, and then to scan another list containing objects, one of which was best described by the characteristics. The two lists were presented separately to the subjects in order to discover whether subjects needed to switchback between the two lists while attempting to identify the correct object. The

subjects' reaction times in studying the characteristics (preparation time) and in naming the appropriate objects (solution time) were recorded. The subjects' perception of and reactions to the task were measured by a post-task questionnaire. The results strongly supported the predictions: the internals preparation and solution times were significantly faster than those of the externals who also used more switchbacks than internals. Moreover, both groups performed equally well on the task (in terms of naming the appropriate objects). Analysis of the subjects' perception of the task indicated that internals perceived the task to be more skill controlled than externals.

The third study was conducted to clarify some methodological problems associated with the first study and to further investigate the problem solving behaviour of internals and externals. Subjects were presented with a series of sets one per trial for twenty four trials, each of which consisted of two letters and two numbers. Certain sets were constructed using a common principle and subjects were required to identify the principle. Subjects perception of, and reactions to the experiment were measured by a post task questionnaire. The results showed that more externals were successful at finding the principle than internals. Externals used less trials per solution hypothesis and guessed on more trials

than internals. Both groups had similar numbers of correct answers. More internals than externals, however, employed complex solution hypotheses. It was also found that the internals confidence in finding the principle before commencing the task was higher than that of the externals.

Taken in conjunction the three studies indicate that finding the solution *per se* to the tasks did not differentiate internals from externals as readily as their different *approaches* to the tasks. The internals were more cautious and systematic in handling their solution hypotheses and processed information more efficiently and thoroughly. The externals, on the other hand, adopted a "butterfly" approach to testing their solution hypotheses, readily switching between them and returning to previously rejected hypotheses. They were less able than internals to process simultaneously two aspects of the task.

It was concluded that the different problem solving behaviours of internals and externals resemble distinctive *cognitive styles*. Whether these cognitive styles are effective in terms of identifying the solution to a problem seems to depend largely on three main factors: the skill element of the task, the type of task, and the level of task difficulty.

TABLE OF CONTENTS

APPENDICIES

REFERENCES

LIST OF TABLES

APPENDICES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION AND OVERVIEW

1.1 GENERAL INTRODUCTION

This thesis is an attempt to examine the effects of people's beliefs about their ability to control their life events on the way they solve problems. More specifically, the research is concerned with the relationship between perceived locus of control and actual behaviour in concept formation tasks. Locus of control is a personality variable concerning the generalised beliefs (or expectancies) people hold about their ability to determine the reinforcements they experience. This variable was formulated by Rotter and his colleagues (Rotter, 1966), and based on Rotter's own social learning theory of personality (Rotter, 1954).

Humans are always encountering new experiences in society which presents them with established values and rules of conduct. One remarkable aspect of human beings is their desire and willingness to be the initiators of their behaviour despite these cultural and social constraints. The extent to which a person's activities derive from external causes or autonomous functioning is a recurring question in psychology and philosophy because of its important implications in understanding human behaviour.

There is no doubt than when people are deprived of the ability to exercise control over what happens to them, grave consequences can occur. In such conditions a person can be rendered almost lifeless. The Seligman studies (Seligman, 1975; Seligman and Maier, 1967), for example, have shown the alarming effect of feelings of "helplessness" on animals and humans. In a helpless situation (where the organism cannot control aversive stimuli) the organism can become anxious, frustrated, and completely passive. Such a condition can be regarded as an extreme example of external control. People lose a sense of the effectiveness of their behaviour when the rewards and punishments which they experience are not directly related to their actions. Under these circumstances they can become automatons, passively accepting what is demanded of them.

External control of behaviour may lead to a blind acceptance of authority. Milgram (1963; 1974) has shown how people can be made to obey orders from sources of authority even to the extent of them ostensibly inflicing severe pain on other persons. While the human desire to be autonomous is strong, people frequently prove very susceptible to influence attempts by others. Before individuals can become effective in life situations they must first perceive themselves as being able to influence their individual circumstances.

Of course extreme beliefs about internal control in situations where such control is not possible, can have negative

consequences for an individual in the same way that strong beliefs about external control do, in situations where internal control is possible. However, a realistic belief in one's ability to control one's fate is certainly essential for coping with stress and meeting the demands of the environment. In fact the main aim of much psychotherapy is to bring about in clients a belief in their ability to control their lives. Thus the exercise of control and the ability to predict the occurrence of certain events can have a profound influence on people's sense of well being and personal worth. It is not surprising then that the issue of control is a recurring one in psychology.

Researchers have attempted to investigate this issue from a number of different, but overlapping orientations. The way people perceive others and their environment is contingent upon their beliefs and values. They construe the 'outside' world in such a way as to minimise perplexity by assimilating new experiences that are congruent with their past experience. The work of Fritz Heider (1958), for example, examined the effect of people's perception of others on their relationship with others. Heider views people as being the initiators of their behaviour. His ideas were extended by Jones and Davis (1965) and Kelley (1967; 1971) in the form of what has become known as attribution theory. Attribution theory, however, is not primarily concerned with internal-external control, but with a person's tendency to attribute causal ability to people.

Attribution theory postulates that there are two kinds of perceived causation: environmental and personal. Environmental causation arises from the attribution of responsibility for events, to forces and circumstances outside the control of the people participating in those events (i.e. an external attribution). On the other hand, personal causation involves attribution of responsibility for events to one or more of the persons involved (i.e. an internal attribution). Moreover, Heider's concept of people being the locus of causality of their own behaviour was extended by De Charms (1964) into the origin-pawn dimension. According to De Charms, an origin is a person who feels that he is the causal source of the outcomes of his actions, while a pawn is a person who considers outside forces as being beyond his control and as being responsible for what happens to him.

Witkin, Dyke, Faterson, Goodenough, and Karpe (1962) have identified a somewhat different but still relevant dimension concerning people's perceptions of their world, namely that of field dependence-field independence. Field independent people are characterised by their ability to decompose a figure into its separate segments, and are more selective in their cognitive functioning; while field dependent people treat both background and figure as one complex event and tend to be more global in handling cognitive experiences.

In sociology Riesman (1950) distinguishes between persons who are primarily influenced by the wishes and actions of others

(other -directed); and persons whose values are inculcated in them by parents etc, through socialisation (inner-directed), and who can act independently of the immediate pressures of the environment.

This thesis is based on Rotter's (1966) theory of internal versus external control of behaviour. Rotter employed both a cognitive and behaviourist orientation through the use of the concepts of expectancy and reinforcement. According to Rotter the internal is one who believes, generally speaking, that his behaviour causes the reinforcements he receives, while an external belives that these reinforcements are not contingent on his behaviour and are controlled by outside forces such as luck or fate. Hence Rotter's concept is referred to as the internal-external control of reinforcement. Rotter's theory is a social theory in that a person's expectancies about the nature of behaviour-reinforcement contingencies is seen as being socially acquired. The terms 'internal', 'external' and 'locus of control' are used in this thesis from now on in terms of Rotter's definitions. An internal-external scale (I-E scale) was devised by Rotter and his colleagues (Rotter, 1966) to measure generalised expectancies regarding the nature of behaviour-outcome contingencies. The measure establishes a personality continuum with 'internalty' versus 'externality' as the opposite ends. Rotter's scale will be referred to as the I-E scale hereafter.

Some of the above mentioned orientations concerning the agency of control are similar to the concept of locus of control. For example, De Charms's 'origins' are more likely to perceive themselves as controlling the rewards they receive from the environment (i.e. are internals), while the 'pawns' are more likely to resemble the externals. Moreover, internals have been shown to make personal causation attributions while externals are more inclined to attribute environmental causes to their own or other persons' outcomes (e.g. Sosis, 1974). Further, Seeman in two studies (Seeman, 1963; Seeman and Evans, 1962) have employed the I-E scale as a measurement of alienation or powerlessness (i.e. externals being more powerless than internals). It also seems logical to construe "helplessness" as an extreme sign of externality. Hiroto (1974) found that when internals and externals were placed in a helpless condition (using aversive tones), the externals were significantly more helpless than internals.

However, locus of control differs from the other orientations to internal-external control. The scores on the I-E scale and Witkin et al's field dependent-independent measures are not significantly correlated with each other (e.g. McIntire and Dreyer, 1973). There is also some evidence to suggest that Riesman's and Rotter's concepts are different, i.e. an inner-directed person may endorse external items on the I-E scale (Collins, Martin, Ashmore, and Ross, 1973).

1.2 GENERAL STATEMENT OF THE PROBLEM

Studies dealing with individual differences as a function of locus of control have shown that persons tend to behave in a fashion consistent with their external or internal beliefs (Lefcourt, 1966, 1976; Phares, 1976). The I-E scale has been used to study differences in achievement motivation; attitude change; conformity; problem solving; socio-political activity; and performance in schools and professional occupations. The I-E scale is also being utilised in therapeutic settings, and in research on controlling smoking and obesity. Many attempts have been carried out to find relationships between the I-E scale and various personality and intelligence measures.

Research on locus of control seems to have followed two main lines: molar and molecular. The molar approach is more concerned with the relationship between locus of control and other personality variables and complex social behaviour (e.g. conformity; socio-political activity). The molecular approach, on the other hand, probes into more specific cognitive activities such as the processing and organisation of information, and problem solving in laboratory situations. The molar approach has produced inconsistent and ambiguous findings (Joe, 1971), while the majority of the findings from the molecular approach have been more successful in delineating differences in the performance of internals and externals (Lefcourt, 1976).

Generally, internals, as compared to externals, are found to be more motivated, and solve problems better by seeking, assimilating, organising, and utilising task relevant information in a more efficient way. The research literature has consistently shown that internals are more cognitively active than externals (Lefcourt, 1976; Phares, 1976), yet correlations between the I-E scale and conventional intelligence tests are low and non-significant (Rotter, 1966; Phares, 1976). Thus it seems that some kind of "cognitive activity", other than that measured by normal intelligence tests differentiates internals from externals.

However, precisely 'how' and 'why' internals differ, cognitively, from externals and under what specific conditions is still not clearly defined. For example, the cognitive styles of processing information in a problem solving situation, as a function of locus of control, have been explained by post hoc conjectures (e.g. Lefcourt and Wine, 1969; Wolk and DuCette, 1974). More important, the literature does not reveal a mode of problem solving behaviour, by internals and externals, that is maintained across different situations and tasks. Previous work has concentrated on the solution of the tasks involved, and on that basis it has been inferred that different types of problem solving strategies were being used. It is useful to show that internals and externals differ in their handling of information, but it is also more important to determine whether these differences

generalise from one situation to the other. The present research studies two different levels of cognitive functioning by internals and externals: one situation specific, and one trans-situational. Warr (1970) defined situation specific cognitive processing as representing a "response style" while cognitive activities manifested across different tasks and situations was seen by him as representing a "cognitive style"[1]. Attempting to show that cognitive styles are a funtion of locus of control is important as it would provide an insight to the way internals and externals utilise and organise information. Modes of thinking and categorisation as a function of locus of control have not been properly investigated. As Weizman and Protter (1976) state: "Certainly the roles of general and specific internal-external factors in thinking are in need of much investigation" (p.863).

Although the problems employed in this thesis take the form of concept formation tasks, the research is not primarily concerned with the particular solution hypotheses used by subjects to solve the tasks. The emphasis, in this thesis, is more on different ways of developing, testing and utilising solution hypotheses as a function of personality locus of control.

---

1 This thesis adopted the same definition of 'response style' and 'cognitive style' as Warr's. The terms 'problem solving behaviour' and 'cognitive style' refer to the same phenomena.

Thus the present thesis is an examination of personality differences in the processing of information.

Three studies were conducted to examine problem solving behaviour as a function of locus of control, in an attempt to determine the nature of the cognitive activity that distinguishes internals from externals. The first study examined the problem solving behaviour of internals and externals under skill and chance defined conditions, as previous studies had provided inconsistent findings on the reactions of internals and externals to these conditions. The other two studies were designed on the basis of the results of the first study and were mainly concerned with the problem solving behaviour of internals and externals as a function of the task at hand (i.e. no skill versus chance conditions were involved).

1.3 AN OVERVIEW OF THE THESIS

a) Chapter 2: This chapter is concerned with the background of the I-E scale and is divided into two sections. The first section presents the theoretical framework of the internal-external control of reinforcement concept. The second section deals with the nature of the I-E scale.

b) Chapter 3: In this chapter a review of the literature is presented. The review is divided into three

sections. The first section deals with the relationship between personality locus of control and situation locus of control (i.e. skill and chance defined situations) in an attempt to shed light on the inconsistencies of the findings in this area. The second section is concerned with the cognitive components of locus of control and deals with information seeking and attention; utilisation and organisation of information; and learning. The third section presents the motivational correlates of locus of control.

c) Chapters 4, 5, and 6: These chapters are devoted to the first, second, and third studies respectively. Different groups of subjects were used in each study. Each chapter contains four sections: introduction, method, results, and discussion. It is important to note that the rationale behind the present research is broadly stated in the review of the literature (chapter 3). However, the introduction to each of the three studies offers a detailed analysis of the problem at hand. The second and third studies evolved out of the results of the first study.

d) Chapter 7: This chapter is divided into two sections. The first section presents a recapitulation of the results of the three studies in order to relate the cognitive styles of internals and externals to their interpersonal styles, and to other social-

cognitive research. The second section deals with the implications of the results of the present research for the concept of locus of control within a cognitive-social psychological context.

CHAPTER 2

THEORETICAL BACKGROUND

2.1 ROTTER'S SOCIAL LEARNING THEORY OF PERSONALITY

Rotter's social learning personality theory provides the theoretical framework for the internal-external dichotomy. The theory was developed by Rotter (1954; 1960; 1964) in an attempt to explain human behaviour in complex social situations. It is, therefore, a molar theory of personality which views human behaviour as changing perpetually when different experiences are encountered. The social learning theory may be considered as an attempt to integrate two diverse trends in American psychology, the behaviourist stimulus-response theories on the one hand and the cognitive theories on the other, by utilising expectancy and the empirical law of effect.

Social learning theory deals with how a specific behaviour is selected from a variety of potential behaviours available. The theory aims at predicting the behaviour that has the strongest potential for occurrence by considering three central variables: expectancy, reinforcement value, and the psychological situation. Expectancy is "... the probability held by the individual that a particular reinforcement will occur as a function of a specific behaviour on his part in a specific situation or situations" (Rotter, 1954, p.107). The value of reinforcement is defined as "... the degree of preference for any reinforcement to occur

if the possibilities of their occuring were all equal" (ibid, p.107). Finally, the psychological situation is one which "... is composed of cues serving to arouse in the individual certain expectancies for reinforcement of specific behaviours" (Rotter, Chance and Phares, 1972, p.37). It is important to note that all of the three variables are relative to the individual at hand.

Rotter's social learning theory views expectancy, reinforcement, and the psychological situation as interrelated and shaping goal-directed behaviour. In order to predict such behaviour the following formula was proposed:

$$BP_{x},S_{1},R_{a} = f\ (Ex,R_{a}S_{1}\alpha RV_{a},S_{1})$$

This formula reads: "The potential for a behaviour x to occur in situation 1 in relation to reinforcement a, is a function of the expectancy of the occurrence of reinforcement a, following behaviour x in situation 1, and the value of reinforcement a in situation 1" (Rotter et al, 1972, p.14). If the potential of behaviour is to be increased both expectancy and reinforcement value should be high. The locus of control arose mainly from one variable in the above formula, namely "expectancy".

According to the social learning theory, reinforcement strengthens an expectancy that an event or behaviour will be followed by that reinforcement in the future. The non-occurence of the reinforcement will weaken the already built expectancy.

Increase, or decrease of expectancy depends on whether or not a person views that reinforcement as contingent upon his own behaviour. Likewise, the non-occurence of reinforcement will reduce the expectancy more if he/she sees it as depending on his behaviour.

The increase and decrease of expectancy as a function of reinforcement contingencies was the result of early studies by Phares (1957) and James and Rotter (1958) which manipulated reinforcement contingency by skill and chance instructions. A skill determined task was found to produce greater expectancy changes (in terms of betting behaviour) than in a chance defined condition. The skill and chance conditions were regarded as "specific" situations so that differences in these conditions could be measured.

Rotter (1966) attempted to extend these learning differences in specific situations into a personality variable that would apply to more general situations. He maintained that history of reinforcement would influence the extent to which a person perceives or attributes the internality or externality of his locus of control. Thus expectancies "generalize" from specific to other situations that the individual regards as similar or related. The internal-external dimension deals with generalised expectancies regarding behaviour-outcome relationship. The I-E scale is, thus, a measurement of these generalised beliefs.

It should be stated that this research was more concerned with the I-E scale (i.e. locus of control) than with Rotter's social learning theory as a whole. Thus the concept of generalised expectancies for locus of control is the one under focus more than reinforcement value or the psychological situation. This approach is in line with most of the studies utilising Rotter's I-E scale. The upsurge of academic interest in locus of control has over-shadowed interest in Rotter's social learning theory of personality, and researchers are talking now about "locus of control in personality". Phares (1976) maintained that "... while the locus of control concept arose from social learning theory, social learning theory itself ultimately underwent some modification as a result of our increased understanding of locus of control" (p.10).

The internal-external control of reinforcement deals with

> ... the degree to which the individual perceives that the reward follows from, or is contingent upon, his own behaviour or attributes versus the degree to which he feels the reward is controlled by forces outside of himself and may occur independently of his own actions. The effect of a reinforcement following some behaviour on the part of a human subject, in other words, is not a simple stamping-in process but depends on whether or not the person perceives a causal relationship between his own behaviour and the reward. A perception of causal relationship need not be all or none but can vary in degree. When a reinforcement is perceived by the subject as following some action of his own but not being entirely contingent upon his action, then, in our culture, it is typically perceived as the result of luck, chance, fate, as under the control of powerful others, or as unpredictable because of the great complexity of

> the forces surrounding him. When the event is interpreted in this way by an individual, we have labelled this a belief in external control. If the person perceives that the event is contingent upon his own behaviour or his own relatively permanent characteristics, we have termed this a belief in internal control.
>
> (ROTTER, 1966, p.1)

It is important to note that the internal-external dichotomy is not a trait but rather a contemporary belief about the agency of control. This point is clarified in the next section.

2.2 THE I-E SCALE

A. Development of the I-E Scale

The I-E scale measures different beliefs about a person's ability to influence his/her behaviour and milieu. The first attempts to measure these beliefs came from Phares (1955) who devised a Likert type scale consisting of 13 skill items and 13 chance items. Phares predicted that those who endorse more skill (internal) items and those who endorse more chance (external) items will display a difference in the magnitude of expectancy increments and decrements similar to those differences exhibited under actual skill versus chance oriented conditions. The predictions were not upheld, although those related to the chance items approached significance.

James (1957) improved and revised Phares's scale and made the same predictions. His results supported the hypotheses. Rotter, Seeman and Liverant (1962) modified the scales which had evolved from the works of Phares and James. Rotter et al using results from a study by Liverant (1958) decided that the measurement of locus of control should include as many different aspects of life as possible (i.e. social, academic, personal, political, etc.). The first version of the I-E scale contained 100 forced-choice items with one item in each pair dealing with external and the other with internal beliefs. When this scale was item and factor analysed, it was reduced to 60 items. However, because of high correlations with social desirability measures and other psychometric problems the 60-item scale was discarded. Rotter and his colleagues then refined the 60 items and reduced them to 23 items where every effort was made to achieve internal consistency of items and low correlations with the Marlowe-Crowne social desirability scale. The final version of the scale included 6 filler items to disguise partially the real purpose of the scale. The 29-item version (see Appendix 1) became known as the Rotter Internal External Control Scale. Most locus of control research usesthis version.

The I-E scale is scored in the external direction (i.e. a high score implies an external locus of control and a low score implies an internal locus of control). The test-retest

reliability measures reported by Rotter (1966) for different samples, varying from one to two months, ranged between .49 and .83. Hersch and Scheibe (1967) reported test-retest reliability coefficients that ranged between .48 and .84 for a two month period. Recently, Zerega, Tseng and Greever (1976) found a test-retest reliability of .55 (N=306, $p<.001$) over an eight-month interval. Zerega et al also established the concurrent validity between the I-E scale and the MacDonald-Tseng internal-external locus of control.

Although the internal consistency estimates of the I-E scale (between .65 and .79 inclusive, Rotter, 1966) is not very high, it is nonetheless uniform, (all the correlations were in the .70s).

The discriminant validity for the I-E scale was established by low correlations with intelligence, social desirability, and political affiliation variables (Rotter, 1966). However, the I-E scale is not totally free from social desirability - internal items being more socially desired - (Altrocchi, Palmer, Hellman and Davis, 1968; Hjelle, 1971).

B. Multidimensionality of the I-E Scale

There is always a danger in personality research of equating the variable being measured with the instrument measuring it resulting in the classification of people into

rigidly defined categories. People are not 'internals' or 'externals' but are classified as internals or externals depending on whether they report that they construe events as being largely dependent on their own ability at the present time, or consider events as outside their control. The locus of control should be regarded as a working construct rather than a dispositional characteristic. Recently, Rotter (1975), in an attempt to clarify some misconceptions associated with the I-E scale, maintained that the internal versus external construct does not represent a typology or a bimodal distribution, for it is an approximate normal distribution describing particular populations. The I-E scale attempts to measure 'control' beliefs in a variety of areas and situations; it is a broad gauge tool. For this reason Rotter (1966) described the scale as being "additive". Thus this scale is not intended to be unidimensional and may involve many different types of control. Hersch and Scheibe (1967) argued that a person's endorsement of external items may either reflect physical or mental handicap or failure to cope with the fierce competitive nature of his environment. A number of studies have emerged that deal exclusively with the multidimensionality of the I-E scale.

Gurin, Gurin, Lao and Beattie (1969) and Lao (1970) found two separate factors embedded in the I-E scale. These factors being: beliefs in personal ability and competence as determining outcomes (labelled personal control) and beliefs in hard work,

skill, and opportunism (labelled control ideology). Mirels (1976) and Reid and Ware (1973) reported similar data; the former study labelled the factors as "felt mastery" versus "system control", and the latter study labelled the factors as "self control" and "social system control". Schneider and Pearson (1970) presented five factors: "luck or fate", "respect", "politics", "academics and leadership", and "success". Levenson (1973a) reported three factors: "internality", "control by powerful others", and "control by chance". Furthermore, Collins (1974) found four factors: "difficulty of world", "unjust world", "predictability-luck" and "political responsiveness".

Most of these researchers have extended the I-E scale to fit the needs of their particular research objectives. All these scales have not been as widely tested and standardised as Rotter's scale. However they may have considerable utility in areas such as socio-political activism where the I-E scale proved to be unreliable (see Abramowitz, 1973; 1974).

The present research did not involve a more molar approach (e.g. socio-political activism), but rather dealt with discrete behavioural responses or, in other words, with molecular behaviour. Since Rotter's I-E scale has proved to be a sensitive tool in delineating molecular responses, the standard I-E scale is employed in all the three studies reported in this thesis. It may seem ironical that the I-E scale, originally intended to be used as a 'broad gauge instrument', is more successful

in molecular situations than in molar ones.

Since its first introduction in 1966 the interest in locus of control has been considerable. Recently two books (Lefcourt, 1976; Phares, 1976) have appeared which are devoted entirely to locus of control. The consistency of individual differences found in the studies adopting molecular approach to locus of control provides a strong buttress to the reliability and validity of the I-E scale.

CHAPTER 3

REVIEW OF THE LITERATURE

The problem solving (and performance in general) of internals and externals has been investigated either as a function of skill versus chance instructions and/or as a function of the task at hand. Studies employing the latter approach have been mainly concerned with cognitive activity of internals and externals, while studies utilising the former approach have been interested in the effects of reinforcement value on performance, and in reactions to low versus high conditions of control.

The first study of the thesis dealt with the influence of skill versus chance instructions on the problem solving behaviour of internals and externals, while the second and third studies (which evolved from the results of the first study) dealt exclusively with the cognitive responses of internals and externals in solving problems. The aim of the review of the literature is two-fold: firstly to provide a view of the current status of research on the relationship between personality and situation locus of control, in an attempt to shed light on the inconsistencies of the findings in this area; and secondly, to outline the different parameters that affect the problem solving behaviour of externals and internals

(besides those of skill versus chance instructions) in order to show that the emphasis of past research has been mainly on broad cognitive functioning.

3.1 RELATIONSHIP BETWEEN PERSONALITY LOCUS OF CONTROL AND SITUATION LOCUS OF CONTROL

One of the main reasons for studying behaviour as a function of locus of control in a skill versus chance context is the value of reinforcement. This variable is one of the main ingredients of Rotter's social learning theory (see formula on page 14), and is expected to facilitate motivation. Moreover, as the social learning theory would predict, this facilitation of motivation acts differently on internals as compared to externals. In other words, since internals consider that reinforcement and other events in their life are related to their own behaviour (or under their control), they are expected to value, and thus be more motivated in, situations that allow for more self-control (i.e. skill conditions). Externals, on the other hand, who see their behaviour as being independent of reinforcement (or outside their control) feel more "at home" in chance defined conditions where reward is randomly received. Thus, because internals and externals value these situations differently, their behaviour should reflect this difference. As will be shown later, the literature does not offer a clear

picture of these differences.

The personality parameter of the relationship between personality and situation locus of control has already been explained. Before attempting to discuss this relationship, the other parameter (situation locus of control) is elaborated.

A) The Nature of Situation Locus of Control

Skill and chance are two different situations. The former allows the person to cope by inducing in him/her the expectancy that he/she can influence reinforcements. The latter situation impedes coping as reinforcement is random and the causal relationship between it and behaviour is obscure or non existent. Thus behaviour will be different in skill conditions than in chance. Phares (1962) presented subjects with a list of 12 nonsense syllables to establish their perceptual thresholds. The subjects were seated before a reaction time panel, and electrodes (through which painful electric shock could be delivered) were strapped to their fingers. The 12 nonsense syllables were projected on a screen (one at a time), 6 of which were accompanied by a 2-second shock and 6 which were not. Subjects were divided into skill and chance groups. The skill group were told that they could control the shock by pressing a button, while the chance group were told that the association between the button and the shock was arbitrary. The results showed

that, as predicted, perceptual threshold decrements were significantly greater under the skill conditions than in the chance condition (for both shock and nonshock syllables). Persons who cannot exercise control over what happens to them fail to cope with a potentially threatening environment more than those who can. Situation locus of control involves skill versus chance conditions where the contingency between behaviour and reinforcement is different.

Research on locus of control started as an investigation of situation specific expectancies. Rotter and Phares (1956) extended social learning theory by studying the effect of situational variables on value of reinforcement. They asked students to rank the importance of a list of activities chosen to represent three classifications of skills: academic, athletic, and manual. Subjects answered the questionnaires in different situations: some groups were in a gym class, some during an English class, and others during a shop period. There were highly significant differences in mean ratings as a function of the salience induced by the test situation (i.e. the situations subjects were under influenced their ratings).

Phares (1957) predicted that the generation of expectancies, based on one's past experience, would be greater in a skill defined condition as opposed to a chance defined condition where the tendency to generalise from one's early attempts is less probable. Subjects performed two series of tasks, one where

successful performance was presented as determined by skill, and the other where it was dependent on chance. The two series of tasks were presented under both conditions and were balanced in order of presentation. The tasks were line and colour matching with subtle differences between the lines and colours. Reinforcements were held constant and subjects were asked to bet on their performance before each trial. Phares found that, as predicted, expectancy shifts were greater in magnitude as well as in frequency under skill conditions. The type of expectancy shifts that occurred in chance were mainly "unusual" in the sense that they decreased following success and increased after failure. This kind of behaviour is analogous to the "gambler's fallacy" and is labelled as such by Phares. As will be demonstrated later on, gambler's fallacy is a typical response of externals under chance conditions. James (1957) and Walls and Cox (1971) obtained results similar to those of Phares (1957). Thus expectancies appear to differ as a function of situation locus of control (skill or chance). The ability to generalise from the past to the future is greater in skill condition because reinforcement is more under control. The implications of the past for the future are loose in the chance conditions thus allowing the build up of the "gambler's fallacy" conceptualisation.

James and Rotter (1958) investigated the relationship between partial reinforcement and resistance to extinction. They

hypothesised that partial reinforcement would be most effective in chance situations, but less so under skill. Subjects performed on an extra sensory perception (ESP) type task, with one group instructed that success in guessing was controlled by ESP skill and another group was told that such guessing was totally a matter of luck. Four groups were run under two conditions each of which had two schedules of reinforcement. Preceding each trial, subjects made estimates of their performance. The dependent variable was the number of trials to extinction; extinction being defined as three consecutive trials estimated at 1 or 0 on the 10 point scale of performance expectancies. Following 50% schedule of reinforcement, the group under chance conditions was significantly slower to extinguish. This was consistent with traditional findings. On the other hand, the skill group extinguished less rapidly following 100% reinforcement, (this trend approached significance, $p<.10$). James and Rotter interpreted their results in terms of stronger relationship between success and behaviour, as opposed to a weaker relationship between reward and behaviour. These findings were supported by Stabler and Johnson (1970) using children.

Other schedules of reinforcement were investigated by Rotter, Liverant and Crown (1961) to determine their effects under skill and chance conditions. Four groups performed two tasks with 25%, 50%, 75% and 100% reinforcement respectively.

The skill task was a hand steadiness task derived from Sky (1950) and the previously noted ESP task (without skill instructions) was employed for the chance condition. Rotter et al found that verbalised expectancy was of greater magnitude under skill as compared with the chance condition. These findings were supported by Holden and Rotter (1962), and are consistent with that of Phares (1957). Blackman (1962) used a task involving a series of randomly appearing lights in which the subject had to predict the occurrence of a red or a green light. It was found that the sequence length and the number of sequences affected the number of red responses in the extinction condition and the expectancy associated with it. Moreover, uncontrollable aversive events have been shown to result in great stress and passivity in animals (Seligman, Maier and Solomon, 1971).

Situation locus of control, therefore, influences expectancies in different directions. The tendency to generalise from past experiences is more manifested in skill as compared to chance conditions. It seems that when the relationship between behaviour and reinforcement is obscured, behaviour becomes random and learning is also impaired.

The relationship between personality locus of control and situational locus of control is central to the concept of locus of control. The performance of randomly selected groups of subjects under skill conditions is analogous to the

internal control dimension, while performance under chance conditions parallels the external control dimension. Thus when an internal is put under skill and an external under chance, these persons are said to be in congruent situations. Conversely, if an external is exposed to a skill condition and an internal to chance, then incongruency is created. Congruency, therefore occurs when personality and situation locus of control are the same.

B) Personality and Situation Locus of Control Congruency[1]

Rotter and Mulry (1965), in their classic study, tested the hypothesis that internals and externals perceive the value placed on the same reward differently in accordance with the nature of the situation (skill versus chance). Performance on the task (a very difficult-angle matching one) was presented to half the subjects as depending on their skill, while the other half received chance instructions. Rotter and Mulry found that internals took longer decision time in the skill condition as compared to internals in chance condition. Externals, on the other hand, showed the opposite trend (i.e. they took longer to decide on the correct stimulus under chance relative to externals

---

1 Unless preceded by the word "situation" the term locus of control would always imply personality locus of control.

under skill). This trend, however, did not reach significance. Moreover, under skill condition internals' reaction time was significantly longer than that of the externals. Most of the variability was caused by the greater length of the time taken by internals in the skill condition. Rotter and Mulry explained their results in terms of value of reinforcement. Internals value self-determined outcomes because these outcomes are more congruent with their generalised expectancies regarding control. Thus they are motivated to do well (by taking more time to decide) under such conditions. Externals, on the other hand, are more motivated in chance situations because such conditions abound in external control properties.

Julian and Katz (1968) extended the motivation model proposed by Rotter and Mulry by examining reward preferences of externals and internals. Julian and Katz carried out two experiments; the first one consisted of a competitive game presented under skill instructions. The task consisted ostensibly of judging which of 42 pairs of words were synonyms or antonyms. The difficulty of certain pairs was high to enable the experimenter to control feedback. The subject appeared correct on 60% of the items, while the opponent was seen as correct on 70% of the items. Subjects were given the option of relying on their opponent's knowledge to earn points. Julian and Katz predicted that, since internals value self determined rewards more than externals, they would rely on

themselves and avoid relying on others even if they lost points. The results supported such a prediction; internals displayed an obvious reliance on themselves more than did the externals, (these differences were significant at the .01 level). Moreover, Julian and Katz found that, although all subjects took longer decision time for difficult items, the difference was significantly more pronounced for internals. These results were interpreted by Julian and Katz as supporting Rotter and Mulry's motivation model. However, since a chance condition was not included in the Julian and Katz study, another experiment was run to test reversals in strategy preferences. The subjects had to choose the next number in an arbitrary series of numbers. The skill group was instructed that naming the correct numbers depended on their ability, whereas the chance group was told that the correct numbers were determined purely by chance (picking them from a large hat containing many possibilities). The opponent's competence was increased by making him correct on 90% of practice items. Julian and Katz predicted that internals, relative to externals, would rely more on others in a chance defined condition as compared with a skill condition. The results contradicted the hypothesis. Internals, as compared to externals, relied more on themselves in both the skill and chance conditions. Thus, although internals and externals were characterised by a preference for different strategies, the difference was not affected by situation

locus of control. Julian and Katz argued that a longer decision time in the Rotter and Mulry's study was not an indication of exerting greater effort but rather a reflection of a cautious approach in order to do well. Julian and Katz maintained that the need to control their outcomes made internals rely more on themselves in the chance condition. This is also a motivational model, but one that seems to be stable across conditions (i.e. patterns of strategy preference displayed by externals and internals seem to hold constant despite task demand characteristics). This begs the question whether the parameters of the chance condition in the Julian and Katz's study were genuinely chance controlled. This point will be discussed in greater detail in the introduction to the first study.

Julian, Litchman and Ryckman (1968) carried out two experiments based on the need to control concept. Julian et al hypothesised that internal or external controlled rewards would influence internals and externals differently due to the internals' preference for tasks that offer maximum control of outcomes. In the first experiment Julian et al gave internals and externals the choice of throwing darts at a target at closer or farther distances. If the subject chose a closer distance from the target he would be provided with less darts than if he chose farther distance. The prediction was that internals would choose a closer distance in order to exert greater control on

their performance. The results upheld Julian et al's prediction, and were explained in terms of motivational differences associated with the I-E dimension. Those authors carried out a second experiment to investigate the effects of lack of control on internals and externals, and predicted that internals' frustration would be more pronounced than that of the externals. Subjects were blindfolded while throwing darts at a target. Contrary to their predictions, the authors found out that it was the externals who manifested greater emotional reactions. Guided by Rotter and Mulry's conclusions, Julian et al asserted that by blindfolding their subjects, other-determined outcomes were created (i.e. a chance condition). They went on to argue that since externals value chance conditions, they would show greater concern in such situations; while internals would be indifferent to, or less concerned in, chance conditions due to their low level of motivations in such surroundings. It is interesting to note that while Julian and Katz (1968) used Rotter and Mulry's findings as a basis for their study, Julian et al (1968) employed them as post hoc explanations.

The rationale given by Julian et al (1968) for the results of their second experiment was confirmed by two studies (Rychman, Rodda, and Stone, 1971; Ryckman, Stone, and Elam, 1971). Internals exhibited more concern (or anxiety) when strongly criticised while they were throwing darts in a skill defined condition. Externals, on the other hand, showed more

concern when criticised under a chance condition. Although these results fit nicely in the congruent model, the Ryckman studies were complicated by some sex differences. In one study it was the females who confirmed to the predictions, while in the other study it was the males who did so.

Lefcourt, Lewis, and Silverman (1968) gave further support to Rotter and Mulry's findings and also demonstrated the importance of the subject's own perception of skill versus chance defined tasks. In addition to predicting longer decision times by internals and externals under congruent conditions, Lefcourt et al also predicted better recall of, and greater attention to, task relevant information. The task was a slightly modified version of the level of aspiration board (devised by Rotter, 1954) which involved the use of motor skills in obtaining points. The task was presented to one group of internals and externals as depending on skill and to the other group as depending on chance. Lefcourt et al's predictions were not confirmed until the subjects' perceptions of the skill and chance instructions were analysed. It was found that the majority of subjects accepted the skill instructions while many suspected the chance instructions. This tendency to accept skill instructions and to question chance instructions was more pronounced in the internals than the externals. Basing their data on the subjects' own perception of skill versus chance conditions, Lefcourt et al obtained

strong support for the personality situation locus of control congruency (i.e. internals took more decision time, were more attentive to, and reported more task relevant information under perceived skill than perceived chance; while the externals showed the reverse trend - this trend however approached borderline significance).

Direct support for Rotter and Mulry's results was recently reported by Dixit and Singh (1975). These authors replicated Rotter and Mulry's study with Indian subjects and found highly significant personality-situation locus of control interaction.

This interaction, however, is not always so clear cut. A study by Watson and Baumel (1967) made the notion of congruency more problematic by concentrating on the effect of anxiety on performance in an incongruent personality-situation locus of control setting. These authors hypothesised that internals and externals would display high rates of errors when placed in an incongruent situation due to high levels of anxiety. Subjects first learned a list of paired nonsense syllables, and were told to learn a second list which would contain both the learned pairs and new pairs. Subjects were then divided into skill and chance groups. Those in the skill condition were told that if they did not elicit the correct response when examining the second list, they would receive a mild electric shock. Thus the situation was under their control in the sense

that by providing the correct response subjects could avoid the shock. The chance group received the same instructions as the skill group. However, even if subjects produced the correct response they may still get the shock. Thus subjects were also asked if they required more practice on the first list before attempting to answer the second one. The results supported Watson and Baumal's predictions: internals made more errors, took more trials to learn the list (P was not quite significant, <.10) and requested more practice trials in the chance condition as compared with skill condition. Externals displayed the opposite trend. Internals' estimation of confidence in learning the second list was significantly higher than that of the externals. Watson and Baumal explained their results in terms of anxiety as a nonfacilitative level of motivation and concluded that the impairment of learning in incongruent situations was not caused, by low levels of motivation, but by high levels of anxiety. The results of Watson and Baumal, although paralleling those of Rotter and Mulry, did deviate from them indirectly. For example, Watson and Baumal found that internals, as well as the externals, were stable across different conditions of skill and chance. The variability of scores was caused by both the internals and externals. The results also implied that internals and externals were more concerned (by being more anxious) with incongruent surroundings, a finding which contradicts that of Julian et al (1968).

Petzel and Gynther (1970) extended the findings of Watson and Baumal in an interesting but intriguing study. They argued that performance as a function of locus of control in Watson and Baumal's study could have been affected by both motivation and anxiety or one of these variables. Petzel and Gynther employed a problem solving task to reduce the inhibiting effect of anxiety on performance. These authors formulated their predictions within Rotter's social learning theory framework (i.e. better performance by internals in skill conditions and by externals in chance conditions). The task employed consisted of 10 anagrams of average difficulty. These anagrams were presented to different groups of internals and externals under skill versus chance instructions. The results contradicted the social learning theory interpretation of the relationship between personality and situation locus of control. A strong and clear incongruent effect emerged: internals solved more problems (anagrams) when given chance instructions, and externals solved more anagrams under skill. Petzel and Gynther concluded that the performance of internals and externals under incongruent conditions in Watson and Baumal's study was not the result of anxiety alone, but also of motivation (i.e. externals were more motivated to perform well in skill situations, while internals were motivated under chance conditions). Petzel and Gynther's results pose an important question: is it possible to create a chance condition by using a task whose nature is more

skill oriented (i.e. anagrams)? Perhaps the elements making up anagram tasks leave little room for inducing a genuine chance condition. Moreover, the issue of personality-situation locus of control incongruency, though interesting, is still quite vague. Petzel and Gynther's study is the only one in the literature, so far, which produced such clear incongruent effects.

It is interesting to note that Petzel and Gynther also found the same "unusual" shifts in expectancies (gambler's fallacy) as those reported by Phares (1957) in the chance condition, but only for externals.

A study by McDonald, Tempone, and Simmons (1968) showed that high versus low control outcome did not have different effects on internals and externals. Subjects drove an automobile simulator and their control on the device was manipulated by increasing the speed and errors (low control) or by decreasing both of them (high control). Internals and externals did not differ in their performance (in terms of errors and evaluation of performance) although the manipulation of control was highly effective.

A study by DuCette and Wolk (1973) showed a superior performance by internals over externals in both the skill as well as the chance conditions. DuCette and Wolk (1973) argued that problem solving as a function of personalty-situation locus of control has not been adequately investigated. What DuCette

and Wolk did was to examine the extraction of information under skill versus chance conditions. Two types of tasks were employed. The first type involved the estimation of grades a subject would get after sitting the midterm and final exams. The second type of task was a problem solving one, of such a nature as could be presented with either skill or chance instructions. The task was composed of two cards on which was printed either an "A" or a "B". In the skill condition subjects were told that the experimenter would hold a card (one at a time) and would emit a nonverbal cue which indicated whether the card had an "A" or a "B". The cue was the way in which the experimenter held the card. The cards were held in front of the subjects with either three fingers in front of the card (indicating an "A") or two fingers (indicating a "B"). Subjects in the chance condition were told to "read" the experimenter's mind while he was looking at a card and say whether the card was an "A" or a "B", (a sort of an ESP exercise); the experimenter was not emitting any cues. Thus the task under chance required more guessings. Subjects were also asked at the end of each experiment to estimate the number of trials on which they were correct, and were required to rate their liking of the tasks. Results showed that internals and externals were not significantly different in their estimation of points for the midterm exam; however, internals made significantly closer estimates for the final exam than externals. There were no

significant differences between internals and externals on the test scores themselves. Moreover, internals, as compared to externals, performed better on the extrasensory perception task; took fewer trials to ascertain the correct principle in the skill task; and liked the skill condition more than the chance condition. Externals liked the chance task more than the skill task and were poorer in estimating the number of correct under skill than under chance. All these differences were significant. The DuCette and Wolk study, thus, showed that internals and externals did not react differently to the skill and chance instructions. Internals, relative to externals, extracted information more efficiently in both skill as well as chance situations.

In an attempt to resolve the ambiguity and inconsistencies surrounding personality situation locus of control interaction, Srull and Karabenick (1975) investigated the effects of situation locus of control on the cheating behaviour of externals and internals. Those authors argued that cheating was chosen as a dependent variable because it reflected a desire to appear to do well on a task and that such a desire would manifest itself in situations valued by the person. Thus Srull and Karabenick were employing the motivation model as their framework. The task consisted of a series of line puzzles, and was presented to groups of internals and externals as skill or chance oriented. Persistence on the task and effort ratings

were also included as dependent variables. The results strongly supported personality and situation locus of control congruency. This was manifested by highly significant locus of control by instructions interactions: internals cheated the most under skill and the least under chance; while externals displayed the exact opposite trend. The highest rate of cheating was by externals under chance. Srull and Karabenick also found that internals persisted (i.e. worked on more optional puzzles) much more than did the externals - in both skill and chance conditions. Internals also rated spending much less effort in skill (where they cheated most) than chance (where they cheated the least). Externals were stable across conditions with high ratings of effort. Srull and Karabenick explained their results in terms of broader motivational dispositions governing the behaviour of internals (i.e. internals value success under skill and would persevere despite failure). The behaviour of externals was more difficult to explain, and Srull and Karabenick speculated about the low cheating of externals under skill as indicative of fear of being detected.

It appears, therefore, that the skill and chance milieus provide internals and externals respectively, with an opportunity to function in a typical fashion. Feather (1968) investigated "typical" shifts in confidence after success and failure for internals and externals under a skill condition. Typical shifts were defined as an increase in confidence following success and

decrease in confidence following failure. Subjects were required to solve 5 easy anagrams (success condition) or 5 very difficult anagrams (failure condition) before attempting to answer 10 common anagrams of moderate difficulty level. Feather hypothesised that since the skill conditions allowed the internals to exercise control over reinforcements, then their previous experience would be related to their present behaviour (i.e. manifest typical changes in confidence). The findings supported Feather's predictions as internals made more typical shifts in confidence than externals over the 15 trials. Since Feather did not include a chance condition, Ryckman and Roda (1971) made the same predictions as those of Feather's, but also extended them to externals under chance (there was no skill situation in the Ryckman and Roda study). The rationale behind the predictions was that externals may behave in chance environment as if they could affect the outcome. Internal and external subjects were required to solve 15 line matching problems after experiencing success on 5 practice problems. Subjects were told that since the difference between the lines was very small, success or failure would depend on chance. Consistent with previous findings, subjects who experienced initial success expressed more confidence than those who experienced initial failure. However, Ryckman and Roda's hypothesis that externals would make more typical shifts was not entirely confirmed. Although externals made more such shifts after success, internals

shifted more frequently following failure. Thus results pertaining to skill conditions seem to be consistent with personality locus of control congruency, while those obtained under chance are equivocal.

Research on personality-situation locus of control is inconsistent. The nature of the task as well as the type of instructions given is of prime importance in identifying differences as a function of these two variables. This issue forms the nucleus of the first study and will be discussed in further detail in the introduction to that study.

3.2 COGNITIVE CORRELATES OF LOCUS OF CONTROL

Studies dealing with personality-situation locus of control congruency rely solely on the motivation model to explain the behaviour of internals and externals. The issue is left unclear in that although internals and externals differ in valuing self versus other determined outcomes, the mechanisms underlying such motivational propensities are neglected. It is here where research into the cognitive aspects of personality locus of control is most valuable.

Studying patterns of behaviour (as a function of locus of control) under skill and chance conditions can be said to be dealing with the motivational correlates of locus of control. At the same time these behavioural patterns include "cognitive

activity" (i.e. problem solving, utilisation of information, etc). Thus it may seem that these motivational and cognitive components are being treated simultaneously. However, the issue is rendered ambiguous by the tendency of certain investigators to consider locus of control as being primarily cognitive (Gavurin and Murgatroyde, 1973; Lefcourt, 1967; Lefcourt, Gronnerudi and McDonald, 1973; Lefcourt and Wine, 1969; McIntire and Dreyer, 1973) or primarily motivational (Baron, 1967; Julian and Katz, 1968; Julian et al, 1968; Petzel and Gynther, 1970; Rotter and Mulry, 1965; Watson and Baumal, 1967).

It should be stated that the present research does not consider motivational and cognitive variables as separate. However, the tendency of certain studies to concentrate on one variable rather than the other made it necessary to present these two components of locus of control separately.

One of the main proponents of locus of control as a cognitive variable is H M Lefcourt (1967, 1976). He maintains that the stability of the "framework of personal causation" strengthens the ability to confront conflicting information surrounding a person. In order to deal effectively with such information one must have enough knowledge of one's potentials and weaknesses. Information about oneself should be sought and assimilated to safeguard against the vagaries of life. Lefcourt argues that an internal locus of control is directly related to such competence.

The main issue here is that of "information" or "cues". As will be seen later, an internal locus of control is associated with an "active" process to assimilate information. Hence the rubric "cognitive activity" includes such factors as attention, organisation, utilisation, assimilation, and processing of information, deliberation and inquisitiveness.

Lefcourt (1967) argued that an external locus of control is determined by its consequences. If apathy and inactivity characterise externality, then in the presence of implicit cues that would allow for success, an external would fail to "pick up" these cues. Thus Lefcourt hypothesised that as the task's instructions become more explicit, externals would benefit more than would internals, because they require cues as to "how" and "why" one should succeed. The level of aspiration board was employed with three kinds of instructions: those which minimise the importance of the task (low-cue condition); those which hinted at the importance of success (moderate cue condition); and those which thoroughly explained what was expected of subjects (high-cue condition). Lefcourt's predictions were confirmed. Internals were stable across the three conditions, while externals changed dramatically. Internals outperformed externals under low-cue condition, while externals outperformed internals in the high-cue condition. Although internals performed better than externals under moderate-cue condition, the difference failed to reach significance. These results

indicate that externals are more responsive to external definitions of the task. Internals, on the other hand, seem to rely on their own perception and are less influenced by task explication. Lefcourt (1967) asserted that a low degree of motivation was not the cause of the external's passivity, but - and here lies the crux of the problem - because of "cognitive and perceptual type deficiencies". More explicitly, Lefcourt argued that "... the individual with external control expectancies does not adequately search for reinforcement opportunities. It is possible that he fails to maintain the kind of internal dialogue that would facilitate the cognitive sorting and categorizing of the situation so that the opportunities for reinforcement in different situations would be more self-evident" (p.377). As will become evident later on, the whole research dealing with the cognitive components of locus of control centres around this issue.

Generally, reserach in this area has concentrated on information seeking, utilisation and organisation of information, and problem solving (learning). Of course, all these variables overlap, and "cognitive activity" becomes an overriding concept which incorporates them.

A) Information Seeking and Attention

An internal is expected, in a problem solving condition,

to seek more task relevant information since he/she believes in his ability to influence outcomes. An external, on the other hand, is expected to show little interest in task relevant information in order to produce congruence between his/her expectancies (lacking the ability to influence rewards) and outcomes. Some studies support this line of reasoning.

Seeman and Evans (1962) investigated the behaviour of hospitalised male tuberculosis patients in seeking relevant information about their illness. Seeman and Evans hypothesised that since knowledge acquisition and the implied increase in personal influence is incongruent with the external's generalised beliefs, they would obtain limited knowledge relevant to their disease and recovery. The results of Seeman and Evans upheld such a prediction. More internals, as compared with externals, had more objective information about their illness, were rated by the hospital staff as having more knowledge of their condition, and were less satisfied with the information they received on the ward.

Tseng (1970), using vocational rehabilitation clients, found that internal clients possessed significantly more knowledge of their jobs than the external clients.

Seeman (1963) carried out a study similar to that of Seeman and Evans (1962). Subjects were reformatory inmates, and were divided into groups of internals and externals. The groups were tested for their interest in, and knowledge of, three

categories of information: a) the immediate reformatory situation; b) achieving successful parole; and c) long-range prospects for a non-criminal career. Seeman predicted that since the information of parole attainment implied the possibility of personal control, it should be of more interest to the internals than to the externals. Such an interest would be reflected by more accurate recall of parole information. This prediction was supported. Internals recalled significantly more parole relevant information than externals. Both groups did not differ significantly in their recall of other materials. Seeman concluded that a person gains control over his life when he possesses information about the determinants of outcomes, and that internals, relative to externals, in attempting to better their life situations, are more concerned with, and actively seek, information that provides personal control. In other words, the externals' attention to, and acquisition of, information is inferior to that of the internals' since externals are not concerned with personal control.

Davis and Phares (1967) investigated the acquisition of information in a social influence situation as a function of both personality and situation locus of control. Subjects (university students) were told that they would be asked to influence another subject regarding his attitude toward the Vietnam war. Subjects were also told that the experimenters possessed files of data of the person to be influenced. The major dependent variable

was the number of questions about the influencee. In addition subjects were given a) skill instructions where success was determined by ability; b) chance instructions where personality characteristics of influencer and influencee affected performance; or c) no instructions regarding causes of performance. The results strongly supported Seeman's (1963) contention. Internals asked more questions than externals under skill and no instructions conditions. There were no significant differences between internals and externals under chance, although the tendency of externals was to ask more questions. Recently, a study by Weiner and Daughtry (1975) supported these findings. Thus it seems that internals engage in more extensive data gathering procedures than externals especially in self-determined conditions. It would be reasonable then to assume that internals, as compared with externals, attend more to task relevant cues.

Lefcourt and Wine (1969) used the term "cue-searching" to explain the findings of Lefcourt (1967) and David and Phares (1967). They asserted that internals were characterised by a more active search for task relevant cues than externals. Lefcourt and Wine's main hypothesis was that internals relative to externals would exhibit more attentive behaviour (in terms of eye movements and actual observation) when trying to become familiar with another person. The results upheld the hypothesis: internals attended more to the person when his behaviour was uncertain, while externals looked more at the conventional

person. Moreover, the internals, relative to externals, made more observations about the puzzling as well as the conventional persons.

In a second experiment Lefcourt and Wine (1969) investigated the effects of high versus low structured environments on internals and externals. The hypothesis was that internals' performance would exceed that of the externals when the experimental structuring of the environment was minimal. Groups of internals and externals were first taken into an experimental room that was rich in detail. Subjects were then required to perform a neutral task, and after that they were asked to describe the experimental room as accurately as possible. This condition was labelled low-cue condition. The procedure of the high-cue condition was very similar to that of the low-cue condition. However, subjects were given, prior to their entry to the experimental room, some information regarding the need to pay attention to their environment. The results supported Lefcourt and Wine's prediction: significant interactions between locus of control and treatments were obtained. Internals made more observations under low-cue condition, while externals made more observations under the high-cue condition. Moreover, internals were stable across these two conditions, while externals were more affected by external manipulation of the environment. These results support those of Lefcourt (1967). Lefcourt and Wine concluded

that internals are characterised by more versatile scanning procedures than externals.

Thus, it seems that the externals' attentive mechanisms may be facilitated by structuring the environment in such a way as to render it more accessible. Externals may also benefit therapeutically from such environments. Kilmann and Howell (1974) attempted to investigate this line of thought by exposing institutionalised female drug addicts to structured versus unstructured therapeutic sessions. Where as internals were found to benefit more from both treatment formats, externals benefited from structured sessions only.

If internals are characterised by more active assimilation of information about their environment, could they form better predictions of their behaviour ? Two studies (Steger, Simmons, and Lavelle, 1973; Wolfe, 1972) have shown that internals, relative to externals, to be more accurate predictors of their academic performance. Recently, work by Gilmore and Reid (1978) supported such findings.

B) Utilisation and Organisation of Information

Studies reviewed in the previous section indicate that internals deploy better recall and attention especially when personal control is salient. Reverting back to Rotter's social learning theory, it seems that these studies emphasise the notion

that the cognitive correlates of locus of control are directly related to the attainment of reinforcement. The generalised expectancies of internals that reinforcement follows their own actions seems to equip them with certain strategies to maintain behaviour-reinforcement contingency. Externals, on the other hand, seem not to care much for behaviour-reinforcement contingency and thus adopt different strategies that are in accord with their generalised expectancies regarding personal control. Studies dealing with the utilisation and organisation of information are the only ones that come close to delineating specific modes of cognitive functioning of internals and externals.

Phares (1968) attempted to explain the more "active" cognitive system of internals in terms of better utilisation of information. Subjects (internals and externals) learned bits of information about four persons whom they were going to influence, and were tested for recall of this material. After one week the subjects were required to choose out of eight girls and ten occupations the best that would suite each of the four men. Subjects were required to write down the reasons for their matches and to recall the bits of information learned a week earlier. The subjects were offered financial or course credit rewards for correct matching (actually this was only to motivate the subjects). A control group was only required to recall the bits of information. Results showed that internals

gave significantly more reasons (50% more) for their matches than did the externals. When correct reasons were singled out, internals, compared to externals, gave much more (3 times as many) correct reasons. Furthermore, internals and externals in the control group did not differ significantly in their recall of material learned one week earlier. However, internals and externals in the experimental group were different, with internals recalling more items than externals (this difference just attained borderline significance, $P<.08$). Phares (1968) concluded that internals utilise information more effectively than externals, and that such utilisation is an essential prerequisite in furnishing an internal with better mechanisms for coping with reality. More interesting is that Phares discards motivation as a factor in differentiating internals from externals and adopts a strictly cognitive explanation.

If internals recall and utilise relevant information better than externals, then they should organise information differently. Bartel, DuCette, and Wolk (1972) investigated the recall of 25 nouns and the degree of category clustering as a function of locus of control. Their results showed that while significant differences between internals and externals in free recall of nouns were not obtained, internals displayed significantly more category clustering than externals. Moreover, the positive correlations between recall and category clustering

were highly significant for internals, and were not significant for externals. These differences as a function of locus of control led Bartel et al to conclude that strategies of learning are different for internals and externals with internals manifesting a greater degree of organisation of information. As Bartel et al put it "... organization seems to precede recall for internally controlled subjects" (p.255).

Bartel's et al study is the only one in the literature (so far) that deals with the structure of organising discrete information as a function of locus of control. It is important because it demonstrates qualitative differences in handling information. Yet, like its predecessors, it does not deal with the way information is utilised and organised.

C) Learning

If internals organise and utilise information better than externals, then it is only logical to assume that they are also better problem solvers and learners.

Lefcourt et al (1973) investigated the differences in hypothesis formation as a function of locus of control and field-dependence: field-independence. Subjects were given bogus instructions that described the task as dealing with verbal facility. The stimulus word list was designed so that the number of sexual double entendres was gradually increased.

The main dependent variables were latency of response (indicative of conflict or suspicion) and awareness of the sexual words (in terms of videotaped facial expressions and bodily movements). Lefcourt et al contended that internals would be quicker to extract or note the "odd" words. The results confirmed such a contention: internals exhibited response time delay before the externals, and laughed and smiled more than externals as the sexual words increased. Lefcourt et al asserted that it was the internals' more alert and active cognitive system that enabled them to notice immediately the sexually connoted words. As will be mentioned in the third study, these results are problematic.

Gavurin and Murgatroyd (1973) found a significant correlation between anagram solving and locus of control for females only. Internal females solved more anagrams than external females. The correlation was in the same direction for the males, but was not significant.

In an interesting study, Hickey (1976) compared the performance of internals and externals on word versus nonsense anagrams. A significant interaction was found between locus of control and the two types of anagrams. Internals solved more word anagrams than externals while externals solved more nonsense anagrams than internals. Hickey also found word anagrams to be of greater difficulty than nonsense anagrams.

Wolk and DuCette (1974) using a more sophisticated and

well-controlled experimental design supported the positive relationship between learning and internal locus of control. Wolk and DuCette attempted to provide a systematic investigation of the perceptual and cognitive properties of locus of control. They argued that such systematic evaluation was absent due to the diversity of tasks employed. In order to reduce task demand characteristics and provide a more sensitive measure of perceptual and cognitive processes, Wolk and DuCette utilised the incidental learning technique. Two studies were carried out. In the first study subjects were given the task of reading a story quickly to search for typographical errors. Later, subjects were asked to recall names, incidents, dates and other salient features of the story (incidental learning) as well as recalling typographical errors (intentional learning). Following this, subjects were given back the story and asked to memorise the dates. Again they were tested on intentional learning (dates) and incidental learning (names). In the second study the same procedure was followed. However, task difficulty and cue explication were varied. The sentences of the story were randomly sequenced in each paragraph and within each sentence words were randomly dispersed to create a high difficulty condition. A low difficulty condition was induced by presenting normal series of sentences in a paragraph. Subjects were either warned of the possibility of being tested on other aspects of the story (high-cue explication) or were

not warned of incidental learning (low-cue explication). Subjects received either the high or low cue explication conditions; while all subjects were put under high and low task difficulty conditions.

The results showed the typical trend of better performance by internals over externals. Internals found significantly more typographical errors and recalled more dates (intentional learning); they also recalled more names (incidental learning). Cue explication and task difficulty treatments influenced externals more than internals (a direct replication of Lefcourt's 1967; and Lefcourt and Wine's 1969, findings). Significant changes in externals' performance across conditions was manifested in intentional as well as incidental learning. Moreover, the positive correlations between intentional and incidental learning were high and significant for internals, while being low and non-significant for externals. Furthermore, under high-cue explication the same correlations were higher and reached significance for externals only.

Wolk and DuCette's main conclusions were that internals are characterised by a more "perceptually sensitive" cognitive system and by "... more active attentional processes, more intensive, efficient structuring of environmental stimuli, and more extensive use of all potential sources of information" (p.100). Such cognitive functioning, Wolk and DuCette went on

to say, furnished internals with the ability to comprehend reinforcement potentials and be more adaptive to their environment. This is implied in all the studies reviewed so far in this section.

These studies employed tasks where performance was determined by skill or at least by an ability that requires some kind of formal logical reasoning. It would be interesting to see if a task controlled by external control (i.e. luck, fate) would provide the externals with an opportunity to excel. Bronzaft (1972) reasoned that if externals believe in luck and fate as controllers of their behaviour, their performance on an ESP task should be better than internals. Bronzaft used a shorter version of the I-E scale (by selecting those items that stressed a belief or lack of belief in luck and fate). Each subject was faced with five photographs (his own being one of them) kept face down and under a white cover, and the subject was to point at a number on a white sheet, under which he thought his photo was. Results showed a significant ($P<.01$) positive correlation between the shortened version of the I-E scale and successes on the ESP task. Externals performed better than internals. This may contradict the findings of DuCette and Wolk (1973) which showed better performance by the internals on an ESP task. This inconsistency may be due to: a) the different nature of the tasks employed in the two studies; and/or b) the fact that Bronzaft used a shorter version

of the I-E scale, whereas DuCette and Wolk used the complete scale.

Internals appear to be superior to externals on tasks that demand more efficient utilisation and organisation of information. This begs the question whether internals are more intelligent than externals (in terms of high scores on intelligence tests). Surprisingly, correlations have been low or negligible between the I-E scale and a) several intelligence tests (Rotter, 1966; Hersch and Schebe, 1967; Kiehlbauch - reported in Phares, 1976); and b) academic performance (Eisenman and Platt, 1968; Hjelle, 1970; Warehime, 1972; Wolk and DuCette, 1974).

As can be seen, the findings of the research on the cognitive components of locus of control are impressively consistent in enunciating differences in the cognitive performances of internals and externals. The studies by Lefcourt (1967), Lefcourt and Wine (1969), Wolk and DuCette (1974) are important in that they demonstrate the differential effects of situational parameters (cue-explication) on the problem solving ability of externals and internals. The cognitive responses as a function of locus of control seem to interact with different features of the environment in such a way as to maximise congruence with generalised beliefs. However, one main shortcoming of the studies dealing with the cognitive correlates of locus of control is their neglect of the processes that precede problem solving

and learning. All that these studies have demonstrated (each in its own right) is that the performance and post task evaluation of internals and externals are different.

3.3 MOTIVATIONAL COMPONENTS OF LOCUS OF CONTROL

Research on the interaction between personality and situation locus of control regarded motivation as a situation specific characteristic. Internals become motivated under skill, while externals become motivated under chance. However, other studies have regarded internality as a motive in its own right. In other words, just as internals are equipped with a more active cognitive system, they are also characterised by higher levels of motivation.

Julian and Katz (1968) regarded the "need" to predict and control outcomes as a major motivational determinant of internals' behaviour irrespective of situation locus of control. Thus it seems that motivation and internality are positively related.

Hersch and Scheibe (1967) investigated responses of internals and externals to adjective check lists. The results led the authors to conclude that internality is more homogeneous than externality. Twenty three adjectives were checked significantly more often by internals than externals who checked more often only one adjective "self-pitying". Internals described

themselves as more "... clever, efficient, egotistical, enthusiastic, independent, self-confident, ambitious, assertive, boastful, conceited, conscientious, deliberate, persevering, clear-thinking, dependable, determined, hard headed, industrious, ingenious, insightful, organized, reasonable, and stubborn" (p.612). From these adjectives, the internals' behaviour seems to be more structured and calculated than externals.

Of particular interest here are the studies dealing with risk-taking as a function of locus of control. Liverant and Scodel (1960) proposed that since internals, relative to externals, are characterised by a greater need to control events, they would manifest more conservatism in a risk-taking situation. Wagering on various dice throws of known probabilities, internal subjects chose more intermediate probability bets and fewer low probability bets than the externals, thereby supporting the hypothesis.

It should be remembered that the internals in Julian et al's (1968) study made low risk choices while the externals made high risk choices in the dart throwing game. On the other hand, Baron (1968) and Strickland, Lewicki and Katz (1966) reported a positive relationship between external control and conservatism in taking risks.

Strong support for the positive relationship between externality and extreme risk taking was provided by DuCette and Wolk (1972). They investigated extreme levels of confidence,

persistence, atypical shifts in level of aspiration, and extreme risk taking as a function of locus of control. Subjects were given a questionnaire, and were also asked to respond to several questions involving an attempt to solve a puzzle. Results showed that externals, relative to internals, displayed more preference for extreme risks, low persistence, and atypical shifts in level of aspiration (quitting a task as soon as possible), and were more extreme in their estimation of success when responding to items related to cognitive, academic and occupational activities. DuCette and Wolk related such a preference for extreme outcomes to the readiness on the externals' part to receive unrealistic feedback about themsleves. More significantly, DuCette and Wolk concluded that "... externals place themselves in situations where they have little information about how much control they can exert over their fate. In other words, externality not only implies a belief in the fact that one's behaviour is under external control, it implies that one prefers it this way and will work to attain such an end" (p.258).

The motivational correlates of locus of control may manifest themselves in the particular tasks preferred by externals and internals (activity preference). Gold (1966) allowed internals and externals to choose either a skill condition (rolling a ball) or a chance condition (drawing), both being equally likely to yield a reward. No significant

differences between internals and externals were found. In another study, Gold (1967) asked the subjects (comprised of internals and externals) to write down whether or not they prefer to work in a situation that demanded skill or luck in order to earn rewards. The results were complicated by sex differences (internal males mainly prefering skill tasks). Schneider (1968; 1972) examined expressed preference for skill or chance activities as a function of locus of control and sex. Subjects were given a forced choice activity preference scale made up of pairs of skill and chance activities. The results were equivocal and sex differences affected the results (internal males showing greater choice of activities that demanded skill). It should be stated that such sex differences are common when choosing between skill versus luck oriented activities (Deaux, White, and Farris, 1975). However, Berzins, Ross, and Cohen (1970) failed to establish a significant relationship between locus of control and activity preference using male hospitalised drug addicts.

Another argument in support of locus of control as a motivational variable is that both achievement motivation and locus of control theories predict similar behavioural parameters - i.e. both of these theories overlap with each other - (Wolk and DuCette, 1973). These authors investigated the influence of locus of control on the predictability of achievement-motivation theory in relation to preference for intermediate risk,

estimation of future success and class room performance. Results of two separate studies indicated a high and positive relationship between internality and achievement-motivation. The main thesis of Wolk and DuCette (1973) is that similar psychological orientations underlie locus of control and achievement motivation and the relationship is influenced by the value of reinforcement. In other words, achievement motivation is directly related to internality since internals do not view reinforcement as random but systematically linked to their outcomes.

It is interesting to note that certain theories of motivation (e.g. Weiner, Frieze, Kukla, Reed, Rest, and Rosenbaum, 1971) incorporate the concept of locus of control as synonymous with certain levels of motivation. However, Weiner et al view internality versus externality differently. They contend that the causes of success and failure allocated by an individual fall under four elements: ability, effort, task difficulty, and luck. These four elements are also discussed by Heider (1958). According to Weiner et al the four elements that affect the perception of success and failure (see above) fall within two causal dimensions: locus of control (internal versus external) and stability (fixed versus variable). Internal causes may either be fixed (i.e. depending on the ability of the individual) or variable (i.e. depending on effort). External causes may also be fixed (i.e. difficulty of a given

task) or variable (i.e. luck). Weiner, Hekhausen, Meyer, and Cook (1972) investigated the above paradigm and indicated that the internal variable causes, such as effort, produce positive feelings and strengthen achievement motivation. In other words, if the causes of outcomes are viewed by a person to be contingent on his effort (which is not fixed), as opposed to his ability (which is fixed), then he would be more motivated to excel. Moreover, if failure was attributed by the individual to luck (an external variable factor) then he is more likely to persist despite failure, than if he attributed failure to task difficulty (an external fixed variable). However, as Wolk and DuCette (1973) suggest, Rotter's internals are characterised by higher levels of achievement motivation because they perceive themselves as the causes of their behaviour. Internals, relative to externals, then would be expected to value intrinsic motivation.

Research on motivation distinguishes between intrinsic versus extrinsic motivation (e.g. Atkinson, 1964; Calder and Staw, 1975a, 1975b; Deci, 1975; Hunt, 1965; Koch, 1965; Woodworth, 1918; Young, 1961). A person is said to be intrinsically motivated if he/she carries out an activity for its own sake, and extrinsically motivated if the activity is performed as a means of achieving an end such as a reward. Since internals rely less on external reinforcement and consider outcomes as self-determined, while externals construe

outside forces as controlling their events, then it is only logical that internals and externals should react differently to intrinsic versus extrinsic feedback. A number of studies have shown that internals outperformed externals under intrinsic feedback conditions (self-discovery of success), while externals were superior to internals when feedback was extrinsic (verbal praise) (Baron, Cowan, Ganz, and McDonald, 1974; Baron and Ganz, 1972; Kumchy and Rankin, 1975). Thus it seems that locus of motivation is different for internals and externals.

DuCette and Wolk (1973) argued that both the motivational as well as the cognitive components of locus of control should be considered when studying problem solving. After finding that the internals learned faster than externals under skill and chance defined conditions, DuCette and Wolk concluded "... that the mediating power of locus of control resides in both its cognitive and motivational qualities, neither of which are sufficient but both of which are necessary." Thus "... differing expectancies for control will give rise to different decision about the exertion of control (motivation) as well as differing efficiency with which this control is exerted (cognition)" (p.425).

Researchers concerned with the motivational properties of locus of control regarded the need to control as a drive to engage in activities which enhances such a need. Consequently,

this produces a tendency to perform better which then reinforces the need to control.

Studies dealing with the cognitive components of locus of control, on the other hand, construe the ability to view outcomes as being under one's control as synonymous with efficient, sensitive and active cognitive systems. According to Lefcourt (1976) "... the more intelligent and achieving a person is, the more likely he will perceive himself to be an active, effective person" (p.66).

3.4 Summary and Evaluation

Studies dealing with personality situation locus of control congruence did not always produce results typical of the congruency model especially when considering the behaviour of internals and externals under 'chance' defined conditions. The nature of these chance conditions may not be always representative of pure chance. In other words, there was an artefact in the instructions defining chance conditions.

Moreover, the literature reviewed so far suggests that internals, relative to externals, solve problems better because they: a) are more motivated, especially under challenging conditions, and b) process, organise, assimilate, and recall task relevant information more efficiently.

Studies dealing with cognitive functioning as a function of locus of control are concerned with broad differences between internals and externals. In fact these cognitive differences are so broad that they only imply differences in "cognitive activity". In other words, these studies were more concerned with a broadly "how" internals and externals differ in their cognitive functioning. What was needed was an investigation of specific cognitive responses as a function of locus of control to determine the extent to which these responses would generalise across different situations; i.e. to determine specific cognitive styles as a function of locus of control.

CHAPTER 4

FIRST STUDY

4.1 INTRODUCTION

Research dealing with the interaction between personality and situation locus of control has been characterised by inconsistencies. The aim of the first study was to provide an explanation for some of these inconsistencies.

The results of certain studies investigating personality and situation locus of control congruency clearly demonstrated that skill and chance conditions do influence internals and externals differently (Davis and Phares, 1967; Lefcourt et al, 1968; Rotter and Mulry, 1965; Srull and Karabenick, 1975). However, various studies indicate that internals and externals do not always display the kind of responses characteristic of the situational variable. The internals in the studies of Julian and Katz (1968) and DuCette and Wolk (1973) exhibited similar behavioural patterns in both the skill and chance conditions. In other studies internals and externals revealed more anxiety (Watson and Baumal, 1967), and solved more anagrams (Petzel and Gynther, 1970) in incongruent situations, and the two groups did not respond differently to low and high control situations (McDonald et al, 1968). Understanding of the results of these studies is made

even more difficult by the fact that the tasks and dependent measures employed by these researchers were very varied. It is suggested that some of the apparent inconsistencies in the results can be resolved by a more careful study of the "chance" conditions used.

DuCette and Wolk (1973) argued that the better performance of the internals, as compared to the externals, in both skill and chance conditions was due to their more efficient cognitive functioning and higher motivational levels. However, it is questionable whether the internals in that study were responding to a genuine chance condition. An element of skill may have been present in DuCette and Wolk's (1973) chance instructions where it was stated to the subjects that although the chance task was controlled by luck, "... some subjects could perhaps perform better than chance if they had extra sensory abilities (emphasis added)" p.422). The superiority of internals over externals in the 'chance' condition may have been due to such an element. This, according to Rotter's social learning theory,would induce certain levels of motivation for internals and render their search for cues more active. In fact, DuCette and Wolk maintained that the internals under chance might have used cues emitted unwittingly by the experimenter who knew what stimulus was on the card. In this context it is interesting to note that in the James and Rotter (1958) study the subjects under the skill condition were given

instructions that performance on an ESP task was controlled by ESP skill.

If the contention is correct that DuCette and Wolk's (1973) specific chance instructions created a challenge to the internals, then the contention that a quasi chance situation (i.e. a situation approximating chance) was created is also correct. Considering the Julian and Katz's (1968) results one may argue that the presence of others created a challenge for the internals and probably motivated them to rely on themselves in both the skill and chance conditions. Thus it should be noted that an induced chance situation is a function of both the nature of the task and the specific instructions used in the task.

Watson and Baumal (1967) used a learning task (paired-associate nonsense syllables) which was, obviously, a skill determined task. It can be argued that presenting such a task in 'control' versus 'no control' situations would not prevent a subject's performance from being self-determined. The difficulty with the Watson and Baumal's results lies in the degree of manifest anxiety. Since the salient features of the task implies self determination of outcomes, then being stripped of control over whether one experiences an electric shock or not would certainly frustrate a person who believes in self control.

Lefcourt et al (1968) employed a motor task in their study so it is not surprising that some of the subjects in that study construed the chance condition as being skill determined.

Similarly, the absence of any differences between internals and externals in the McDonald et al (1968) study could be due to the nature of the task utilised (i.e. a motor task). Therefore, although the manipulation of low versus high control was successful (in terms of subjects' estimation of control), the subjects' own perceptions of the task (in terms of situation locus of control) may have been different. In fact, McDonald et al argued that their subjects could have viewed the task under both conditions as being internally controlled. Thus the method by which an experimental variable is manipulated is of crucial importance in determining the way subjects perceive the situation and the way they respond to it.

A 'true' chance condition might not have been created in the aforementioned studies, for certain subjects (especially the internals) may have questioned the chance instructions and perceived the outcomes as being determined by their ability (i.e. skill). It is argued that chance was not intrinsic to the task (i.e. subjects were told that because of high task difficulty, the likelihood of their being correct on any trial was, based on past experience with subjects, only 50%).

The present study attempted to differentiate between two chance conditions. The first was a chance condition where the elements of chance were defined to the subjects (by instructions) as being represented in the task's difficulty. This condition is labelled chance 1 condition, (or quasi chance) and is the kind

of chance condition typically used by researchers. In the second chance condition the elements of chance were intrinsic in the task (similar to a gambling game). This condition is labelled chance 2 (or pure chance). In addition there was also a skill condition (i.e. subjects were told that the task depended entirely on their skill). Thus the present study should indicate whether: a) there are any differences in the behaviour of internals and externals under the two chance conditions;b)the behaviour of internals and externals under a skill condition differs from their behaviour under either of the chance conditions;c)subjects used in the previous research were responding to a quasi chance situation or not.

A problem solving (concept formation) task was employed as a means of investigating the cognitive functioning of internals and externals under these three conditions and motivation was manipulated by the task instructions. If internals are more motivated under skill and externals under pure chance, then their performance on the task should be affected by the task instructions. Performance under chance 1 for both groups could resemble their performance under the skill condition, or some subjects in each group could perceive their performance as being skill determined while others perceive it as being chance determined. The task used had to permit: a) the induction of skill, chance 1, and chance 2 conditions since the same task would be employed in three conditions; b) subjects to tackle the concept formation task

in quite different ways in order to investigate the subjects' cognitive activity; c)the possibility of subjects arriving at a correct answer in order to provide a baseline for subjects' performance and to render the task more interesting.

The task was based on trial-and-error learning in which the subjects were attempting to find a common principle (or concept[1]) relating one of two words to a set of five words over 50 trials. The idea was that through trial-and-error subjects would be developing, testing, and rejecting different solution hypotheses in an attempt to identify the correct principle. The focus of the research was on how subjects developed and used solution hypotheses, rather than on the solution hypotheses per se, and examining how the approaches of subjects varied under the three conditions.

Internals and externals were assigned to three groups: skill, chance 1, and chance 2. Any differences manifested in performance and subjects' reactions to these three conditions would then beexplained in terms of motivational and cognitive correlates of locus of control. The dependent variables were chosen so as to reflect both of these behavioural qualities.

---

1 In this thesis principle and concept are used interchangeably.

4.2 PREDICTIONS

In accordance with Rotter's social learning theory in general and the value of reinforcement in particular, it was expected that internals and externals would react differently to skill versus pure chance conditions. It was also expected that chance 1 would not be perceived as pure chance and hence would not elicit the type of behaviour typical of that in pure chance conditions. Moreover, under the skill condition the performance of internals was expected to be better than that of the externals (Lefcourt, 1976); whereas under pure chance it was expected that these differences would be minimised.

Several pilot studies were conducted to identify a suitable task for use in the main study. The task eventually selected proved difficult for subjects so no predictions were made regarding differences between internals and externals either in their ability to identify the principle or regarding the number of correct trials for each group.

The dependent variables used can be grouped under two main headings, the first called "task performance", and the second "perception of, and reactions to, the experiment". The former deals with the number and use of solution hypotheses, and the latter reflects motivational responses such as interest in and liking of the task, effort exertion etc. Subjects were also asked to indicate whether they perceived the task as being

skill or chance determined as a check on the experimental manipulation of the skill, chance 1, and chance 2 conditions.

Specific Predictions

Specific predictions regarding the performance of internals and externals were only made for certain dependent measures. These predictions are listed below.

Skill Condition

a. Task Performance

Since previous studies (e.g. Davis and Phares, 1967; Phares, 1968; Lefcourt and Wine, 1969; Lefcourt et al, 1973; Wolk and DuCette, 1974) have demonstrated the flexibility and thoroughness of the internals' cognitive functioning, it is hypothesised that they will employ a greater number of solution hypotheses than externals, in trying to identify the principle in the concept formation task. Internals, relative to externals, will also be more accurate in their estimation of the number of trials on which they gave a correct answer (DuCette and Wolk, 1973; Steger et al, 1973).

b. Reactions to the Experiment

Internals will find the task more interesting, and like it, more than externals (DuCette and Wolk, 1973). Although 'interest' and 'liking' may sound the same, they were included as separate indices to find out if they yielded different reactions. It should be remembered that DuCette and Wolk (1973) used a 'liking' index and not interest.

Internals will report spending more effort, when trying to decipher the principle, than externals (Srull and Karabenic, 1975).

Chance 1 Condition

a. Task Performance

Since it is expected that chance 1 may contain an element of skill in it, internals, as compared to externals are expected to utilise more solution hypotheses. However, both groups will manifest lower frequencies in the number of solution hypotheses relative to those under skill.

b. Reactions to the Experiment

It is difficult to make predictions regarding subjects reactions to chance 1 as it is neither a pure skill nor a pure chance condition. Still it is expected that internals interest

and liking will be less than that exhibited in the skill condition. Internals may exert more effort than externals due to the challenge imposed by the skill effect.

Chance 2 Condition

a. Task Performance

Chance 2 condition is a genuine chance condition, it is hypothesised that both the internals and externals will utilise fewer solution hypotheses as compared to internals and externals under skill. Externals may produce a higher number of correct trials and/or more accurate estimates of these trials than internals (Bronzaft, 1972).

b. Reactions to the Experiment

The externals will be more interested in, and like, the task than internals (DuCette and Wolk, 1973). Both groups will report exerting less effort. However, externals may expend more effort than internals (Srull and Karabenick, 1975).

In addition to the above dependent variables, other ones were introduced to investigate whether or not any significant differences might emerge in the attribution of responsibility for task performance (to internal versus external causes of

behaviour) as a function of both personality and situation locus of control.

Recently, the interest in establishing a relationship between locus of control and attribution theory (Jones and Davis, 1966; Jones, Kanouse, Kelley, Nisbett, Valins, and Weiner, 1972; Kelley, 1967, 1971) has been considerable (e.g. Gilmore and Minton, 1974; Hochreich, 1974, 1975; House, 1976; Joe, 1974; Krovetz, 1974; Lefcourt, Hogg, Struthers and Holmes, 1975; Phares and Lamiell, 1974, 1975; Phares, Wilson, and Klyver, 1971; Shaw, Floyed, and Gwin, 1971; Sobel, 1974; Sosis, 1974). Generally speaking these studies have demonstrated the fact that internals attribute responsibility to themselves (ability or effort) concerning their performance whereas externals blame external forces (noise or task difficulty).

It should be emphasised, however, that this issue was of secondary interest in this study. The attribution of responsibility variables used were task difficulty, competence, comfort, and distraction. No specific predictions are made for these variables.

4.3 METHOD

a. General Synopsis

The study was carried out in one phase. All the subjects worked individually on the task under one of the three conditions: skill, chance 1 or chance 2 conditions. After completing the task, the subjects answered the I-E scale and the post task questionnaire in order to assess their reactions to the experiment. A debriefing session concluded the experiment.

b. Assessment of Internality and Externality

The overall mean (N = 72) of the I-E scale was 11.42. The potential range of scores is from 0 to 23 as 6 items in the scale are filler items. Those who scores 11 and below were classified as 'internals', while those score 12 and above were classified as 'externals'. This allocation of I-E scores is in line with previous studies.

c. Experimental Design

It was intended to have an equal number of subjects in each cell but this was not possible due to lack of availability of subjects. There were 72 subjects distributed in each of the experimental conditions as follows: skill with 12 internals (6 males and 6 females), and 12 externals (6 males

and 6 females); chance 1 with 12 internals (7 males and 5 females), and 12 externals (5 males and 7 females); and chance 2 with 12 internals (5 males and 7 females), and 12 externals (7 males and 5 females). A 2x2x3 factorial design locus of control X sex X conditions with unequal number in cells (least squares analysis) was employed to analyse the data. Sex was included in the analyses not because of any specific predictions, but in case any differences might emerge. The experimental design is presented in Table 4.1

Table 4.1

Experimental Design of the First Study

SUBJECTS	CONDITIONS		
	SKILL	CHANCE 1	CHANCE 2
Internals	6M & 6F(13)*	7M & 5F (14)	5M & 7F
Externals	6M & 6F(13)	5M & 7F (15)	7F & 5M(13)

M = Males
F = Females

( )* = The number of subjects originally assigned to this cell. Some subjects were omitted where unsatisfactory data were obtained, or by random rejection.

d. Selection of Subjects

The subjects were Open University students who were enrolled in the Open University summer programme (1976 class) at Stirling University. The subjects volunteered to participate and were solicited via a noticeboard. Their age ranged between 20 and 46 years. Every effort was made to ensure that subjects were taking the experiment seriously and that their participation was genuine. Originally 83 subjects were tested. However 11 subjects were rejected for the following reasons: 1- One subject (a female under skill condition) refused to answer the questionnaire and I-E scale after completing the task. 2- Two subjects were old (a 70 year old male and a 65 year old female under skill condition) and were unable to concentrate while working on the task. Both subjects did not answer the post task questionnaire and I-E scale. 3- Six subjects did not take the experiment seriously (i.e. they were making jokes and not concentrating on the task). The subjects were an internal female and an external male (skill), three external females and an external male (chance 1). Four of these six subjects (two internals and two external females) did not answer all the items of the post task questionnaire. 4- Two subjects (an internal female under chance 1, and external female under chance 2) were randomly eliminated to provide for equal number of internals and externals in each of the three

experimental conditions.

e. Instruments

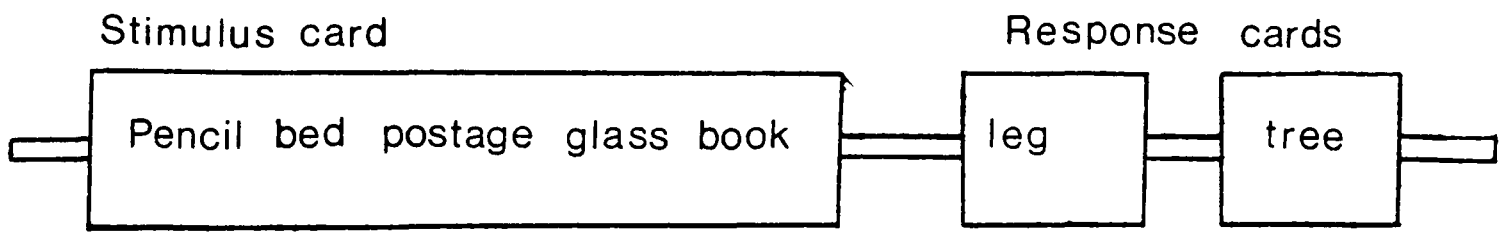
i Rotter's I-E Scale: as indicated in the introduction the present research utilized the I-E scale developed by Rotter and his colleagues (Rotter, 1966). Other measures of locus of control have been developed (cf. Bialer's Locus of Control Questionnaire (Bialer, 1961); the Crandall Intellectual Achievement Responsibility Questionnaire (Crandall, Katkovsky, and Crandall, 1965); the James Internal-External Locus of Control Scale (James, 1957); the Nowicki-Strickland Scale (Nowicki and Strickland, 1973). These scales have limited utility (all the aforementioned scales, except James's scale are devised for children), or do not have the same degree of reliability or standardization as Rotter's original I-E scale. The three studies reported in this thesis employed Rotter's original I-E scale.

ii The Task: Phares (1957) employed a colour matching task with subtle gradation to make the task difficult. Rotter and Mulry (1965) presented their subjects with an angle matching task where, again, the differences between the angles were minute and difficult to judge. This tendency to utilize difficult matching tasks was deemed necessary as the task had to

appear credible under skill as well as chance instructions. The same strategy was followed when constructing the present task, only this time words were used instead of colours or angles. Words were employed because they allow more room for the formation of solution hypotheses.

f. Pilot Studies

Numerous pilot studies were carried out to arrive at a task that was uncommon yet would motivate the subjects to decipher it. The task consisted of five words on a stimulus card (14 by 6 cms) and two response cards (6 by 6 cms) with one word on each (see diagram below). All the words were printed with black letraset size 207. The three cards were mounted on a wooden rod approximately 40 by 2 cms using blu-tack as adhesive. The distance between the stimulus card and the nearest response card was approximately $6\frac{1}{2}$ cms and the two response cards were very close to each other with a little gap in between:



Thus the subject would be presented with three cards simultaneously.

The main purpose of the pilot studies was to find a principle that would relate one word on a response card to a word on the stimulus card. Many different principles were tried to arrive at the following characteristics: a) difficulty in finding the principle; b) the generation of different solution hypotheses; and c) a principle which could be presented with either skill or chance instructions. There were 79 pilot subjects (undergraduates as well as librarians and postgraduates). The subjects were tested individually and their responses, comments, solution hypotheses and number of correct words were noted down. Pilot subjects were also given a 9 point rating scale at the end of the testing. The scale measured the subject's perception of the task and ranged from "purely a matter of chance" to "purely a matter of skill" (no measurement of locus of control was taken). After many tests a principle was obtained that: a - was very difficult to determine (only 3 subjects, females, were able to find the principle); b - was liked by the subjects (based on subjects' remarks and comments); and c - was not perceived as totally skill or chance determined (the mean of rating scale was 5.01).

g. Main Features of the Task used in the Experiment Proper

The format of presentation was exactly the same as that described in the above section (see diagram on page 85). The principle which related one of the words on a response card to a word on the stimulus card was that the particular response word contained the same number of letters as the second word on the stimulus card. The complete list of cards (in the order presented to the subjects) is presented in Appendix 1 and another example is given below:

Stimulus Card	Response Cards
picture spring wall model man	arm person

The correct response word is person since it contains the same number of letters (6) as the second word (spring) on the stimulus card.

There were 350 words in all (250 stimulus words and 100 response words). The length of all the words ranged from 3 to 8 letters inclusive. The 5 words on each stimulus card were always composed of different number of letters. In all the 350 words, a word never appeared twice. The distributions of the number of letters of the corrects words over the 50 trials were such that the gap (in terms of number of letters) between the correct and wrong response words was not always increased so as not to render the principle more salient. For

example, when the correct response word contained three words (e.g. map), the other response word (i.e. the wrong word) did not always contain number of letters much larger than 3 (e.g. mountain). Thus many of the other response words were four or five letter words. There were 9 trials when the correct word contained 3 letters, 9 trials when it contained 4 letters, 9 trials when it contained 5 letters, 9 trials when it contained 6 letters, 7 trials when it contained 7 letters and 7 trials when it contained 8 letters. The distribution of the number of letters of the wrong words is presented in Appendix 1.

The same task was used in skill, chance 1 and chance 2 conditions. The nature of the task was such that it could easily be presented under each of the three conditions. Thus the arrangements of the words on the cards were purely arbitrary. For example, under skill and chance 1 (where subjects were informed that there was a principle) the words on the stimulus card and a response word might seem to the subjects as open to associations such as similar meaning etc., or under chance 2 (where no mention of a principle was made) these words might look to the subjects as if they were not associated by any apparent rule.

h. Post Task Questionnaire

The post task questionnaire (see Appendix 1) was constructed specifically for the present study. It consisted of two main parts, the first part contained questions regarding number, type and order of solution hypotheses used by the subjects while working on the task, over the 50 trials (a detailed description of this part is given in the results section). The second part dealt with the perception of, and reactions to, the experiment which were measured by a number of 9-point rating scales[2] designed to assess the subjects' motivation and involvement in the task. Five related questions were asked "How much did you like the task?", "When trying to discover the underlying principle, how hard did you try?", "How interested were you in the task?", "How much do you think this was a task which depended on skill or chance?", and "How much do you think each of the factors listed influenced your performance?". The subjects also answered four additional questions

---

2 All the scales employed in the three studies were 9-point scales. Each represented a Bi-polar dimension with a neutral mid-point (5); the extremes were labelled with the appropriate terms (e.g. not interested at all - very much interested; purely a matter of skill - purely a matter of chance).

concerning whether they found the task to be too easy or too difficult; whether they were competent or incompetent to solve the problem; whether they felt comfortable or not comfortable during the testing session; and whether they were distracted or not distracted while working on the task. All these questions were answered using 9-point rating scales.

One of the questions (How much do you think this was a task which depended on skill or chance?) was used as a check for the experimental manipulation of skill, chance 1 and chance 2 conditions.

The post task questionnaire also contained a 50-point line (standing for the 50 trials) where subjects had to circle the points (trials) on which they guessed the answer. If a subject did not resort to guessing at all, he/she was required to tick a box. Subjects also indicated, by ticking a box, whether or not they thought they had found the principle. In addition, the subjects were asked to write down the number of trials on which they named the correct word. The scores were out of 50 (total number of trials). This was a measure of the subjects' estimation of their correct trials. At the end of the questionnaire, the subjects were given the option of writing down their own comments regarding their performance and/or any other aspects of the task.

i. Procedure

The subjects were tested individually. Upon the subject's arrival he/she was seated facing the experimenter with a table separating them. The subject was randomly assigned to skill, chance 1 or chance 2 conditions.

Skill and Chance 1 Conditions:

The subjects were given the following instructions:

INSTRUCTIONS

This is a learning task. You will be presented with three cards simultaneously. One card - the stimulus card - contains 5 words and the other two cards - the response cards - contain 1 word on each. There is an underlying principle which relates one of the two words on the response card to the stimulus card. Your task is to name the word on ONE of the response cards which you think goes with the stimulus card. There are 50 trials and you will have up to 30 seconds to work on each trial, (each trial consists of a different set of cards). The same principle applies to all cards. If you think you have found the correct principle, keep working on that principle until the 50 trials are over. You will receive immediate feedback after every trial; (if you name the correct word I will respond "correct", and if you name the wrong word I will respond "wrong").

The skill group received the following additional instructions:

Let me emphasise that this task depends on your skill at singling out the underlying principle. Although the principle is quite difficult to determine, we have found that some people are highly skilled in discovering it. The results depend entirely

upon your ability. Do as well as you can and we will see if you have any skill at this task.

I will further explain the nature of the task before commencing the experiment proper.

The chance 1 subjects were given these additional instructions:

Let me emphasise that the underlying principle you are required to discover is very difficult to determine, so much so that most people do no better than chance in finding the correct word for each trial. However some people do get high scores presumably because they are lucky and guess the correct word, unless they happen to discover the principle. Needless to say, chance plays a major role in discovering the correct word on each trial.

I will further explain the nature of the task before commencing the experiment proper.

Chance 2 Condition:

The instructions for the chance 2 group were as follows:

INSTRUCTIONS

You will be presented with three cards simultaneously. One card - the stimulus card - contains 5 words and the other two cards - the response cards - contain 1 word on each. Your task is to name the word on ONE of the response cards which you think goes with the stimulus card. There are 50 trials and you will have up to 30 seconds to work on each trial, (each trial consists of a different set of cards). Let me emphasise that these three cards are related purely by chance. The "correct" word on the response card is simply the first of the two response words which we picked out of a large hat containing many possibilities. In other words, there is no relationship among the three cards except that the "correct" word on the response card (which goes with the stimulus card) was determined purely on a chance basis. Therefore, this is a test of your luck in finding the correct word on each trial.

You may, quite naturally, wonder why we are showing you the stimulus card. This was deemed necessary for purposes of comparability. Another group of subjects in this study is told that there is a logical underlying principle which relates one of the response cards with the stimulus card; and that group is required to discover this principle. However, as we have indicated, the actual relationship between the cards was determined purely by chance. Thus, for purposes of comparability, we are interested to see how many of the 50 words you can find now that you realise the true nature of the task. Let us see if you are lucky at this task.

I will further explain the nature of the task before commencing the experiment proper.

After this, the subject was shown a sample of the cards' arrangement (i.e. 3 cards mounted on a wooden rod). The subject was then asked if he/she undertstood the instructions. The experiment proper did not commence until the subject indicated that he/she completely understood what was expected. In the chance 2 condition, the subjects were slightly perplexed after reading the instructions. However, their perplexity diminished following further explanations by the experimenter. It was hoped that while working on the task, the chance 2 instructions would make more sense to the subjects.

The subject was timed using an ordinary stop watch, in order to check that he/she would not exceed the 30 seconds limit. The subject was assured that the timing was for that purpose and not to determine his/her speed. No measurement of the subject's reaction time was taken.

The experimenter held the wooden rod in front of the

subject by placing his fingers between the stimulus card and the nearest response card, and started the stop watch with the other hand. If the subject gave a response before the 30 seconds elapsed, the stop watch was stopped; if he/she exceeded the time limit, the experimenter stopped the stop watch and urged the subject to give a response. After naming a response word the subject was allowed a few seconds (about 5) to scan the three cards before presenting the next trial[3]. The same procedure was followed throughout the 50 trials. The subjects' number of correct responses was recorded.

When the 50 trials were over the subject was escorted to another table and was given the post-task questionnaire to answer. After completing the post-task questionnaire, the subject was handed the I-E scale. While the subject was answering the scale the experimenter was checking the appropriateness of the subject's answers to the post-task questionnaire (i.e. not leaving out items, no vague wordings etc.)

After completing the I-E scale, and if the post-task questionnaire was answered adequately, the subject was thanked, debriefed, and his questions were answered (if any). The subject was asked not to discuss the experiment with his colleagues.

---

3 This five seconds interval would allow the subject to check the reason(s) for his solution hypothesis being correct or wrong.

4.4 RESULTS

The main purpose of the first study was to find out if the subjects would display different behavioural patterns under chance 2 conditions as compared to skill and chance 1 conditions, and whether any differences exist between internals and externals across these conditions.

It was essential to determine whether or not the experimental manipulations regarding skill, chance 1 and chance 2 conditions were successful before drawing any valid conclusions from the results. Treatment check results will therefore be presented first followed by distribution of I-E scores across the three conditions. Reports on task performance come next. Reactions to the experiment conclude the presentation.

For the predicted differences, a priori t tests based on orthogonal comparisons (Edwards, 1972) were employed to test mean differences whenever significant interactions were found, even if the direction ran contrary to the prediction. If a significant interaction occurred and was not predicted, then Tukey's HSD test (q) for a posteriori pairwise comparisons (Kirk, 1968) was used. Chi-square tests were employed where applicable. The experimental design is presented in Table 4.1 (p. 82).

a. Treatment Checks

One of the rating scales in the post task questionnaire was a measurement of the subjects' own perception of task control.

Table 4.2

Mean Ratings of Skill, Chance 1 and Chance 2 as a function of Locus of Control

	CONDITIONS			
	SKILL	CHANCE 1	CHANCE 2	COMBINED
Internals	7.67	5.27	2.07	5.00
Externals	8.00	4.53	2.11	4.88
Combined	7.84	4.90	2.09	4.94

Low score indicates chance control, high score skill control, 9-point rating scale used.

The subjects' ratings of the question "How much do you think this was a task which depended on skill or chance?" were analysed in a 2x2x3 factorial design. Unless otherwise stated, this design was used for all subsequent analyses. The breakdown of sums of squares of treatment check scores, presented in Table 4.2, indicates that the experimental manipulations were very effective. As Table 4.2 shows subjects perceived the task in accordance with the instructions given.

There were no significant differences due to locus of control or sex.

Table 4.3

Summary of analysis of variance of the subjects' rating of task control for skill, chance 1 and chance 2 as a function of locus of control and sex.

VARIATION	SS	DF	MS	F	P
A (locus of control)	.125	1	.125	.085	
B (sex)	.681	1	.681	.460	
C (conditions)	391.083	2	195.542	132.194	<.001
AB	.208	1	.208	.141	
AC	3.592	2	1.796	1.214	
BC	2.041	2	1.020	.690	
ABC	2.393	2	1.197	.809	
Within cells	88.752	60	1.479		

b. I-E Scores

Table 4.4 shows the means and standard deviations of I-E scores across skill, chance 1 and chance 2 conditions. The overall mean is 11.42. The distribution of internals and externals is presented in the methods section. The internals' scores ranged from 3 to 11 inclusive; those of externals from

Table 4.4

Means and standard deviations (S.D.) of the I-E scores across the three conditions

	CONDITIONS							
	SKILL		CHANCE 1		CHANCE 2		COMBINED	
	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
IM	7.67	2.73	9.29	1.38	7.20	2.83	8.05	2.32
IF	8.67	1.51	7.40	2.61	7.71	1.89	7.92	2.00
EM	14.17	1.94	15.20	1.64	15.14	2.27	14.80	1.95
EF	14.83	2.86	14.14	1.86	15.60	2.19	14.86	2.30
I	8.17	2.12	8.35	2.00	7.46	2.36	7.99	2.16
E	14.50	2.40	14.67	1.75	15.37	2.23	14.85	2.13
Com-bined	11.34	3.92	11.51	3.65	11.42	4.52	11.42	4.00

IM = Internal Males
IF = " Females
EM = External Males
EF = " Females
I = Internals
E = Externals

12 to 20 inclusive.

A. Task Performance

1. Decipherment of the Principle

Only seven subjects (an internal female and two externals, one male and one female, under skill); two internals (one male and one female) and two external females under chance 1

were able to find the correct principle. These results correspond with those of the pilot studies. The principle was not an obvious one to the subjects which may have rendered it insensitive to differences as a function of locus of control. Thus as far as solution per se, both internals and externals were unable to find the correct principle.

2. Number of Correct Words

The number of correct words was recorded for each subject (the scores are out of 50 words, or trials). Analysis ov variance of number of correct words did not result in any significant differences. The means (Table 4.5) are close to each other and are almost on a 50% basis (a similar finding was obtained in the pilot study). The highest number of correct words was by internals under chance 1, and the lowest was by externals in chance 2.

Table 4.5

Mean scores for the number of correct words identified as a function of locus of control and conditions

	CONDITIONS			
	SKILL	CHANCE 1	CHANCE 2	COMBINED
Internals	24.92	25.73	24.07	24.91
Externals	25.08	24.84	22.11	24.01
Combined	25.00	25.29	23.09	24.46

The scores are out of fifty.

3. Number of Estimated Correct Words

Subjects were required to give an estimate of the number of correct words which they thought they had named during the 50 trials. The scores are again out of 50. An analysis of variance of the number of estimated correct words produced no significant differences. Thus, contrary to the expectation put forward in the introduction to the first study, internals and externals did not differ significantly in their estimation of correct words they had identified. The means are reported in Table 4.6. Compared with the means of the number of correct, those of the estimated number of correct words are generally lower (cf. Table 4.5). The externals under skill exhibited the highest estimate; the lowest estimate was by externals under chance 2.

Table 4.6

Mean scores for the estimated number of correct words as a function of locus of control and conditions

	CONDITIONS			
	SKILL	CHANCE 1	CHANCE 2	COMBINED
Internals	22.17	23.86	23.67	23.24
Externals	26.42	23.47	20.87	23.59
Combined	24.30	23.67	22.28	23.42

The scores are out of fifty.

4. Solution Hypotheses used to decipher the Principle

In order to clarify any ambiguity that might arise, the term "solution hypothesis" will be operationally defined. Since the principle is one which relates a response word to a word on the stimulus card, a solution hypothesis to find such a principle is defined as any cognitive attempt at relating one of the response words to the word(s) on the stimulus card. Thus any attempt to relate the two words on the response card to each other or to choose a response word due to the subject's own preference will not be considered a solution hypothesis proper, and will be labelled as spurious solution hypothesis hereafter.

As indicated in the method section there were two

parts of the post-task questionnaire that dealt with solution hypotheses. The first part simply asked the subjects to write down the total number of solution hypotheses which they employed over the 50 trials. The second part was concerned with the manner by which subjects tested and rejected their solution hypotheses. Five solution hypotheses (based on results of pilot studies) were listed with a space in the left hand column of each solution hypotheses. The first solution hypothesis was concerned with a relationship between the word on the response card and the stimulus card in terms of similar meaning; the second in terms of opposite meaning; the third in terms of number of letters; the fourth in terms of a common category (i.e. category clustering); and the fifth in terms of letter sequence (i.e. the word on the response card contained the same letter(s) as the one(s) prominent in the words on the stimulus card). Subjects were instructed to examine the five solution hypotheses and add any solution hypotheses they used which were not included in the list. The subjects were also instructed to write down numbers in the spaces near each solution hypothesis denoting the order of utilisation. For example, number 3 against a solution hypothesis indicated that that particular solution hypothesis was employed third. If a subject returned to a solution hypothesis after having used it, he was told to write down another number against it. Thus the numbers 1 - 4 - 6 indicated that a solution hypothesis was utilised first, fourth

and sixth respectively. There was also a space against the statement "simply guessed the correctword", and subjects were instructed to write down numbers against it (similar to the manner described above) in cases where they guessed.

Following our definition of a solution hypothesis, it was deemed necessary to establish those solution hypotheses that coincided with the definition of a solution hypothesis and those that did not. Two independent judges were consulted for this purpose. They were given the operational definition of a solution hypothesis, and then were presented with a list of all the 'solution hypotheses' that were added by the subjects. The judges were asked to assign all the additional solution hypotheses to the categories "solution hypotheses" versus "spurious solution hypotheses" depending on whether or not they agreed with the definition of a solution hypothesis. It should be noted that some of the solution hypotheses that were added by the subjects were actually very similar to the five listed solution hypotheses, only the wording was different. These were included as part of the five listed solution hypotheses. Thus, the added solution hypotheses were different from the listed five. Nine new solution hypotheses and four spurious ones emerged. The new solution hypotheses were as follows: relating a response word to the stimulus card words in terms of: 1 - adjectives; 2 - vowels; 3 - consonants; 4 - rhythm;

5 - rejection of the response word that agreed with the stimulus card words; 6 - spelling the words backwards; 7 - adding a letter to the words; 8 - forming a sentence; and 9 - forming new words from letters of stimulus and response words and testing to see if they were related. The spurious solution hypotheses dealt with: 1 - liking of the response word; 2 - left-right (L.R.) sequence of correct response words (i.e. if the correct response word was three times on the left hand side, then it is about time that it should be on the right; this spurious solution hypotheses was considered a 'gambler's fallacy'); 3 - naming the response word if it reminded the subject of any experience; and 4 - concentrating on the experimenter's reactions before choosing a response word.

The agreement among the three subjects (i.e. the two independent judges plus the experimenter) was unanimous.

i Number of 'quasi' Solution Hypotheses

As stated earlier, the first part of the post-task questionnaire dealing with task performance asked the subjects to write down the number of all solution hypotheses they used over the 50 trials. This measure was rendered ambugious for two main reasons: firstly, the number of all solution hypotheses did not coincide with the number of solution hypotheses actually

employed by the subjects (second part of the post-task questionnaire concerned with performance). Secondly, it was difficult to tell whether or not solution hypotheses or spurious solution hypotheses were included in this measure since what a subject regarded as a solution hypothesis might not have conformed to the operational definition of a solution hypothesis. Hence these were labelled 'quasi' solution hypotheses to distinguish them from solution hypotheses based on the second part of post-task questionnaire dealing with performance. Thus, the result pertaining to quasi solution hypotheses (summary of, analysis of variance and mean scores) are presented in Appendix 1 for reference only.

ii Number of Solution Hypotheses

The number of different solution hypotheses included both the five listed solution hypotheses and those added by the subjects which conformed to the definition of a solution hypothesis.

Table 4.7

Mean scores for the number of different solution hypotheses as a function of locus of control and conditions.

	SKILL	CHANCE 1	CHANCE 2	COMBINED
Internals	2.75	3.49	.90	2.38
Externals	6.00	4.53	1.56	4.06
Combined	4.42	4.01	1.23	3.22

The breakdown of sum of squares for the number of different solution hypotheses, presented in table 4.8, shows that internals and externals behaved differently and that the difference was also affected by the three conditions. The highly significant locus of control main effect indicates that, contrary to theprediction, externals employed more different solution hypotheses than did internals (see Table 4.7). The highly significant conditions main effect indicates that subjects under skill and chance 1 used more different solution hypotheses than subjects under chance 2 (Table 4.7). Thus subjects clearly reacted to the chance 2 instructions as a genuine chance condition but their responses to the skill and chance 1 instructions were not so distinct.

Table 4.8

Summary of analysis of variance of the number of solution hypotheses as a function of locus of control, sex, and conditions.

VARIATION	SS	DF	MS	F	P
A (locus of control)	50.000	1	50.000	38.055	<.001
B (Sex	.889	1	.889	.667	
C (conditions)	141.361	2	70.681	53.795	<.001
AB	.331	1	.331	.252	
AC	22.921	2	11.461	8.723	<.001
BC	.678	2	.339	.258	
ABC	1.431	2	.716	.545	
Within cells (error)	78.833	60	1.314		

The significant interaction was inspected using t tests. The t values indicatedthat externals, as compared to internals, utilised more solution hypotheses under skill ($t = 6.373$, $df = 60$, $p<.0005$) and under chance 1 ($t = 2.311$, $df = 60$, $p<.03$). Although externals employed more solution hypotheses than internals under chance 2, such a difference was not significant. These results are plotted in Figure 4.1.

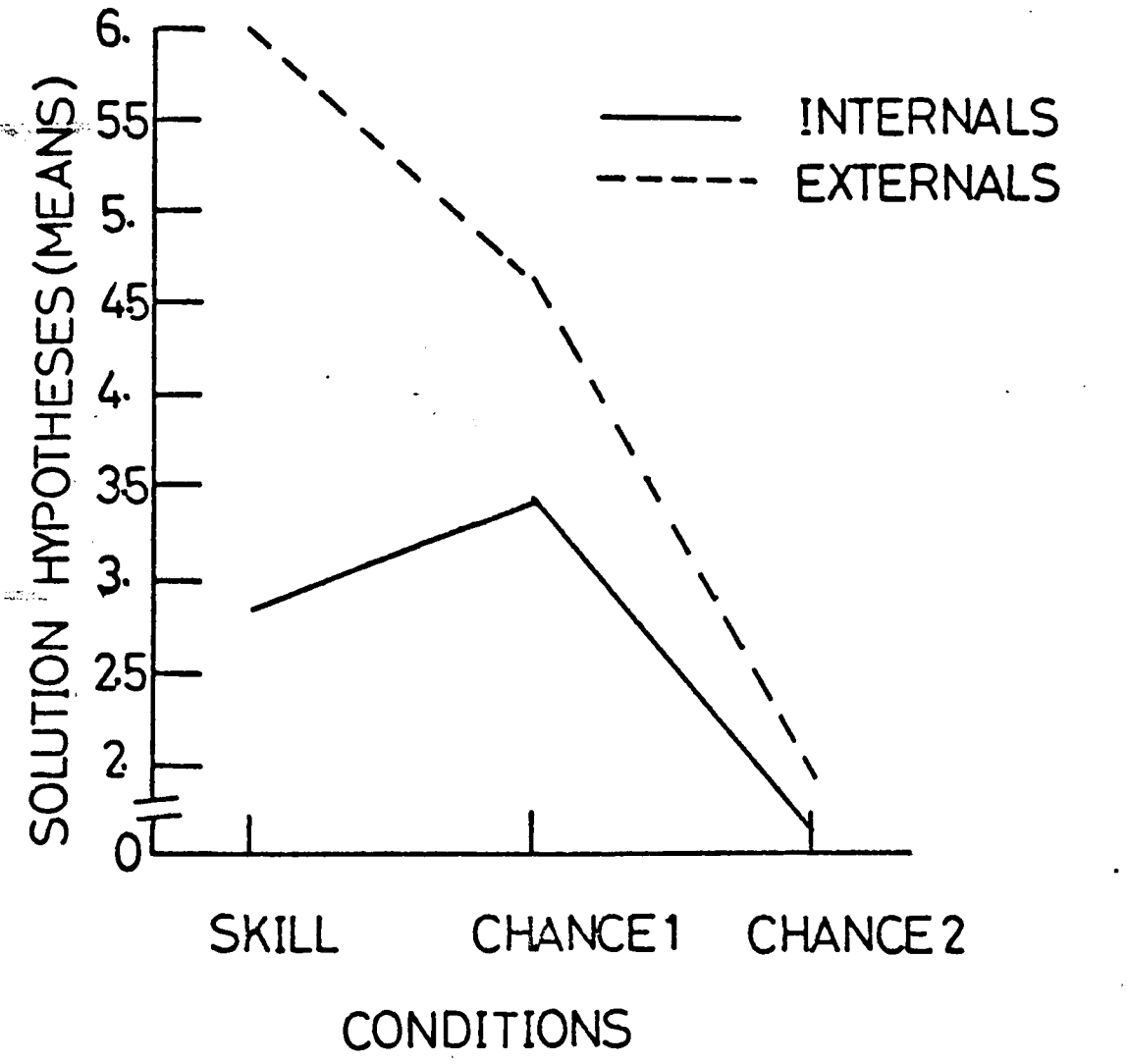


Figure 4.1

Interaction between locus of control and number of different solution hypotheses for the three experimental conditions

These unexpected, and highly significant findings demanded further investigations into the type and pattern of solution hypotheses utilised by internals and externals.

iii Number of the First 10, 20, and 30 Correct Trials

Before taking any step further, it may be argued that these differences in the number of solution hypotheses used were simply due to differences in reinforcement (correct trials). In other words, during the early stages of the trials, the number of correct words may have been greater for externals than internals and it could be argued that this difference was responsible for them employing more solution hypotheses.

Table 4.9

Mean number of correct responses for the first 10, 20, and 30 Correct trials as a function of locus of control and conditions

		SKILL		CHANCE 1		CHANCE 2	
		I	E	I	E	I	E
10	T	3.50	3.92	4.33	4.00	4.42	4.00
20	T	8.50	10.00	9.92	9.33	9.67	8.83
30	T	13.83	13.08	14.17	14.67	14.58	13.75

I= Internals
E= Externals
T= Trials

In order to account for this variable A 3x2x3 (conditions X locus of control X trials - first 10, 20, and 30 correct trials)

split plot factorial design with repeated mesaures on the last factor was carried out. Table 4.10 presents summary of analysis of variance for first 10, 20, and 30 correct trials.

Table 4.10

Summary of analysis of variance of the first 10, 20 and 30 correct trials as a function of locus of control and conditions

VARIATION	SS	DF	MS	F	P
Between people	1402.500	71			
A (conditions)	13.361	2	6.681	0.3201	
C (locus of control)	1.185	1	1.185	0.0568	
AC	10.565	2	5.282	0.2531	
Sub.w.gps. within people	1377.389	66	20.870		
B (trials)	3596.028	2	1798.014	473.6232	<.001
AB	4.444	4	1.111	0.2927	
BC	1.398	2	0.699	0.1841	
ABC	18.352	4	4.588	1.2085	
Bxsubj.w.gps.	501.111	132	3.796		

The only significant difference found was the trials main effect indicating that as trials increase so did the number of correct trials (see Table 4.9). Therefore, internals and externals were not significantly different from each other in terms of initial correct trials. Hence both groups were not differentially reinforced.

iv Number of Internals and Externals Employing the Five Listed Solution Hypotheses

Table 4.11 shows the number of internals and externals who used the five listed solution hypotheses over the three conditions. As the table shows externals equalled or exceeded

Table 4.11

Number of Internals and Externals who used the five listed solution hypotheses across the three conditions.

	SKILL		CHANCE 1		CHANCE 2	
	I	E	I	E	I	E
S.M.	11	11	12	12	7	11
O.M.	4	7	5	6	0	4
N.L.	5	11	6	11	0	1
C.C.	5	11	8	9	4	6
L.S.	6	11	9	10	0	2

S.M. = Similar meaning
O.P. = Opposite meaning
N.L. = Number of letters
C.C. = Common category
L.S. = Letter sequence
I = Internals
E = Externals

internals on all the five solution hypotheses and across the three conditions. Investigating the differences between internals and externals using the Fisher Exact Probability Test (Siegel, 1956), 2 tailed, indicated that: under skill more externals, related to internals, used "number of letters" and "common category" solution hypotheses ($P<.05$); more externals used the "letter

sequence" solution hypothesis, but this difference only approached significance (P<.10);under chance 1 more externals used the "number of letters" solution hypothesis than internals, however, the difference reached borderline significance (P<.10). All the other differences were not significant. It is interesting to note that almost all the subjects have utilised the 'similar meaning' solution hypotheses. Thus it seems that people most commonly associate words with their meanings in this task.

v Number of Internals and Externals who added Solution Hypotheses and Spurious Solution Hypotheses to the Listed 5 Solution Hypotheses

As indicated earlier, 9 solution hypotheses and 4 spurious solution hypotheses were added by the subjects to the listed 5 solution hypotheses. One spurious solution hypothesis stood out more than the other spurious solution hypotheses, and that being L.R. (left-right sequences of response words). Since such a spurious solution hypothesis was more frequent than the others and was indicative of a gambler's fallacy type of behaviour, L.R. sequences are presented as a special kind of spurious solution hypothesis. The number of internals and externals who added solution hypotheses and/or spurious solution hypotheses across the three conditions is presented in Table 4.12.

Table 4.12

Number of internals and externals who added solution hypotheses and spurious solution hypotheses to the five listed solution hypotheses across the three conditions.

	Solution Hypotheses			Spurious Solution Hypotheses: L.R. Only			Spurious Solution Hypotheses: Remaining Spurious Hypotheses		
	S	C1	C2	S	C1	C2	S	C1	C2
I	2	2	0	0	2	1	0	0	0
E	6	6	0	1	8	11	2	3	7

I = Internals
E = Externals
S = Skill
C1 = Chance 1
C2 = Chance 2
L.R. = Left-Right

The number of externals who added solution hypotheses or spurious solution hypotheses exceeded that of the internals. No subject added a solution hypothesis in chance 2. Investigating the differences between internals and externals using the Fisher Exact Probability Test (2 tailed) indicates that: under skill the differences approached significance ($P<.20$) for added solution hypotheses; the differences for L.R. sequences and other spurious solution hypotheses were not significant . Under chance 1 the differences were not quite significant ($P<.20$) for added solution hypotheses, and were not significant for the other spurious hypotheses; however, the differences were significant

when considering L.R. sequences, $P<.05$, (i.e. more externals as compared to internals, employed L.R. sequences). Under chance 2 the differences between internals and externals were not significant for added solution hypotheses, but were significant for added spurious solution hypotheses (excluding L.R.), $P<.01$, and for L.R. only ($P<.005$) favouring externals. Thus more externals, relative to internals, added spurious solution hypotheses and employed L.R. sequences.

Collapsing skill and chance 1 conditions, the results were arranged into contingency tables and analysed using a X^2 corrected for continuity (Siegel, 1956). More externals ($N = 12$) added solution hypotheses than internals ($N = 4$) ($X^2 = 6$, $df = 1$, $P<.02$, two-tailed). Thus the externals seem to be more variable in their employment of solution hypotheses (in terms of the sheer number of solution hypotheses).

vi Utilisation of Old Solution Hypotheses

As shown on page 102 the number of repeats (i.e. going back to an already utilised solution hypotheses and then using it again) can easily be determined. The number of subjects using old solution hypotheses was investigated to account for any differences between internals and externals across the 3 conditions.

Table 4.13

Number of internals and externals returning to an already utilised solution hypotheses across the three conditions.

	CONDITIONS		
	SKILL	CHANCE 1	CHANCE 2
Internals	3	4	1
Externals	10	11	5

As table 4.13 indicates, less internals, relative to externals, were returning to already used solution hypotheses. Investigating these differences using the Fisher Exact Probability Test (2 tailed) indicatedthat more externals went back to old solution hypotheses than internals in skill, chance 1 and chance 2 ($P<.02$; $P<.01$; $P<.05$ respectively).

Table 4.14 shows the mean scores for the number of repeats made by internals and externals across the three conditions.

Table 4.14

Mean scores for the number of repeats as a function of locus of control and the three conditions

LOCUS	SKILL	CHANCE 1	CHANCE 2	COMBINED
Internals	.42	.50	.10	.34
Externals	4.00	3.00	.41	2.47
Combined	2.28	1.75	.26	1.43

Analysis of variance of repeat scores resulted in three highly significant differences: locus of control main effect ($F = 34.492$; df 1/60, $P<.001$); conditions main effect ($F = 10.982$; df 1/60, $P<.001$); and locus of control X conditions interaction ($F = 7.148$; df 1/6, $P<.002$). All the other differences were not significant. Examination of the means (Table 4.14) indicated that externals used more repeats than internals, and that subjects under skill and chance 1 used more repeats than subjects under chance 2. However, most of the variability was caused by the externals. Inspection of the locus of control X conditions interaction using Tukey's q test for *a posteriori* pairwise comparisons (Kirk, 1968) indicated that under skill and chance 1 externals employed more repeats than internals ($q = 8.136$; df 2,60, $P<.001$; $q = 5.682$; df 2,60, $P<.001$ respectively).

Thus it seems that externals changed solution hypotheses more rapidly and were returning frequently to used solution

hypotheses, while internals lingered with their solution hypotheses and were less mobile in changing them.

It must be admitted that these results are not totally conclusive for the subjects had to remember after completing the task in what order they used solution hypotheses. Thus the subjects' memory could have been at fault. Nonetheless, we consider such results important, as most of the differences between internals and externals were highly significant. The results, therefore, merited further consideration.

vii Number of Trials on which Subjects Guessed

After finishing the task the subjects were required to circle the trial(s) on which they guessed on a 50 point line (corresponding to the total number of trials). The number of trials on which subjects guessed proved a problem for two main reasons: a) it was very difficult to discern on which trials pure guessing was used, since many subjects employed spurious solution hypotheses which were similar to guessing; and b) 61 subjects (33 externals and 29 internals) indicated in the comments they wrote at the end of the questionnaire that the "guessing" scale was confusing due to difficulty in remembering specific trials on which they guessed.

Therefore, the 'guessing' index is rendered ambiguous, and summary of analysis of variance and mean scores for number of trials on which subjects guessed as a function of locus of control, sex and conditions is presented in Appendix 1 for reference purposes only.

However, a measure of the subjects' guesses could be obtained. As indicated earlier, the subjects had the option of ticking "simply guessed the correct word" if they did not employ any solution hypothesis. Counting the number of internal and externals who ticked the aforementioned item indicated that under the skill and chance 1 conditions no subject endorsed the item; but under chance 2 condition 7 internals (3 males and 4 females) endorsed the item as compared to only 2 externals (males). Testing this difference between internals and externals using the Fisher Exact Probability Test (Siegel, 1956), two tailed, revealed that such difference approached significance ($P<.10$). Thus, it seems, to a rather limited extent, that more internals than externals simply guessed the correct word under chance 2 condition.

Summary of the Results of Task Performance

The analyses of the results so far demonstrated that the experimental manipulations of skill, chance 1 and chance 2

were highly effective, and that skill and chance 1 produced similar responses from subjects as compared to responses produced by chance 2. Moreover, our predictions regarding the performance of internals and externals were not upheld. Whereas both groups did not differ in the solution of the problem per se, they differed considerably in the manner they generated and utilised solution hypotheses. The externals, as compared to the internals, used and added more solution hypotheses; they employed more spurious solution hypotheses and adopted gambler's fallacy behaviour; they changed solution hypotheses and returned to old solution hypotheses more frequently. These results although unexpected, provide a valuable insight into the way internals and externals handle their solution hypotheses. They also enhance the effectiveness of the I-E scale in delineating molecular behaviour differences.

B. Reactions to the Experiment

The following indices were included to determine the subjects' involvement in the task, and their attribution of internal versus external causes. As indicated earlier all these indices were measured using a 9 point rating scale.

i Liking of the Task

To assess the degree of liking the subjects displayed to the task, subjects responded to the following question: "How much did you like the task?"

Table 4.15

Mean ratings of the subjects' liking of the task as a function of their locus of control and the three conditions.

	CONDITIONS			
	SKILL	CHANCE 1	CHANCE 2	COMBINED
Internals	5.08	6.96	4.70	5.58
Externals	4.83	5.80	5.26	5.30
Combined	4.96	6.38	4.98	5.44

Low score denotes dislike, high score the reverse.

The analysis of variance for liking scores resulted in a significant conditions main effect ($F = 6.026$; df 1/60, $P<.004$) which was the only significant difference obtained. The locus of control X sex interaction approached significance. The mean scores (Table 4.15) show that subjects under chance 1 condition liked the task more than subjects under either skill or chance 2 conditions. Thus contrary to our hypotheses, internals and externals did not differ significantly in their liking of the task.

Within personality comparisons using q tests revealed that internals under chance 1 liked the task more than internals under either skill or chance 2 (q = 4.087 - chance 1 versus skill, and q = 4.913 - chance 1 versus chance 2, df 2,60; P<.01 for both comparisons). The externals did not differ significantly in their liking of the task over the three conditions. Internals, therefore, accounted for most of the variability by liking the task under chance 1 the most.

ii Interest

Subjects rated the degree of their interest in the task by responding to the following question: "How interested were you in the task?"

Table 4.16

Mean ratings of the subjects' interest in the task as a function of their locus of control and the three conditions.

	CONDITIONS			
	SKILL	CHANCE 1	CHANCE 2	COMBINED
Internals	8.17	7.77	5.27	7.07
Externals	6.83	7.79	6.71	7.11
Combined	7.50	7.78	5.99	7.09

Low score indicates disinterest, high score the reverse.

The analysis of variance for interest scores produced a highly significant conditions main effect ($F = 6.354$; df 1/60; $P<.003$) and, more interestingly a significant locus of control X conditions interaction ($F = 3.566$; df 1/60, $P<.03$). Sex main effect reached borderline significance ($P<.09$). Inspection of the mean scores (Table 4.16) indicated that the skill and chance 1 groups were more interested in the task than the chance 2 group. Investigation of the locus of control X conditions interaction using t tests showed that, as predicted, internals, relative to externals, were more interested in the task under skill ($t = 1.861$, df = 60, $P<.05$) while externals displayed more interest in the task under chance 2 than internals ($t = 2.000$, df = 60, $P<.025$). Under the chance 1 condition the two groups were almost identical. Thus a strong personality situation locus of control congruence was achieved. These trends are plotted in Figure 4.2.

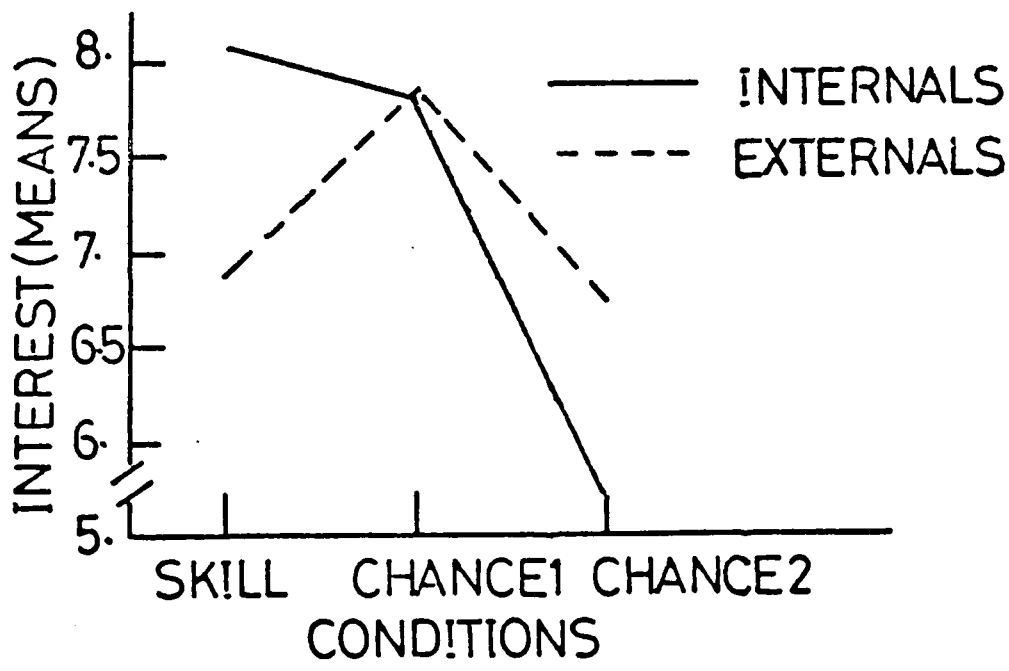


Figure 4.2

Interaction between locus of control and ratings of the subjects' interest in the task for the three experimental conditions.

Within personality comparisons using q tests indicated that the internals under skill and chance 1 were more interested in the task than internals in chance 2 ($q = 5.686$ - skill versus chance 2; $q = 4.902$ - chance 1 versus chance 2; df 2,60; $P<.01$, for both comparisons). Chance 1 and skill internals did not differ significantly. The externals, on the other hand, displayed no significant differences in their interest in the task across skill, chance 1 and chance 2. Thus, again, the internals accounted for most of the variability, while externals were static across conditions. It is interesting to note that internals reacted similarly to skill and chance 1 but their reaction to chance 2 was significantly different.

It also seems that the interest index was more sensitive to personality differences than the liking index.

iii Effort Scores

Subjects responded to the following question: "When trying to discover the underlying principle, how hard did you try?"

Table 4.17

Mean self-ratings of the subjects' effort while working on the task as a function of their locus of control and the three conditions.

	CONDITIONS			
	SKILL	CHANCE 1	CHANCE 2	COMBINED
Internals	8.17	8.21	5.10	7.16
Externals	7.75	7.44	7.70	7.63
Combined	7.96	7.83	6.40	7.40

Low scores indicates low effort, high score the opposite.

Again, the analysis of variance resulted in a significant conditions main effect ($F = 6.431$; df 1/60, $P<.003$) and a locus of control X conditions interaction ($F = 7.820$; df 1/60, $P<.001$) only this time both differences were highly significant. All the other differences were not significant. Mean scores (Table 4.17) indicated that the skill and chance 1 groups spent more effort while working on the task than chance 2 group. Investigation of locus of control X conditions interaction using t tests indicated that, as predicted, under chance 2 externals reported expending more effort than internals ($t = 3.824$; df = 60, $P<.001$). However contrary to the prediction, internals and externals did not differ significantly in their effort exertion under skill, although the internals' scores were higher. Within personality comparisons using q tests showed that internals

under skill and chance 1 expended more effort than the equivalent group under chance 2 (q = 6.396 - skill versus chance 2; q = 6.479 - chance 1 versus chance 2; df 2,60; P<.01 for both comparisons). Externals, on the other hand, were stable across the three conditions. Therefore, internals accounted for most of the variability by reacting differently to chance 2 as compared to their reaction to either chance 1 or skill. Again, it is interesting to note that internals considered skill and chance 1 as though they were the same condition.

iv Task Difficulty

Task difficulty ratings ranged from "the task was too easy for me" to "the task was too difficult for me".

Table 4.18

Mean ratings of the subjects' perception of task difficulty as a function of their locus of control and the three conditions.

	CONDITIONS			
	SKILL	CHANCE 1	CHANCE 2	COMBINED
Internals	6.83	5.61	5.10	5.85
Externals	6.42	6.06	5.54	6.01
Combined	6.63	5.84	5.32	5.93

Low score denotes less difficulty, high score the opposite.

Analysis of variance for task difficulty scores resulted in significant conditions main effect ($F = 3.920$; df 1/60, $P<.03$) which was the only significant difference obtained. Table 4.18 shows that subjects perceived the skill conditions to be more difficult than either chance 1 or chance 2 conditions. In general subjects were uncertain as about how to evaluate the task's difficulty. This uncertainty was more evident under chance 2.

Within personality comparisons using q tests indicated that skill internals rated the task as being more difficult than chance 2 internals ($q = 3.604$; df 2,66; $P<.05$). All the other mean differences were not significant. Once more the variability was mainly caused by the differential reactions of the internals to chance 2 as compared with their reactions to either skill or chance 1.

v Competence Scores

Competence ratings ranged from "I am not competent at such a task" to "I am highly competent at such a task".

Table 4.19

Mean ratings of the subjects' perception of their competence to solve the task as a function of their locus of control and the three conditions.

	SKILL	CHANCE 1	CHANCE 2	COMBINED
Internals	4.17	4.91	4.73	4.60
Externals	4.42	4.87	4.43	4.57
Combined	4.30	4.89	4.58	4.59

Low score indicated incompetence, high score the reverse.

The analysis of variance for competence scores did not produce any significant differences. The mean scores (Table 4.19) are generally low and approaching uncertainty. This may be either because the subjects thought that the task was beyond their competence, or that such an index was vague.

vi Comfort scores

Comfort ratings were ranging from "I wasn't feeling comfortable at all during the experiment" to "I was feeling very comfortable during the experiment".

Table 4.20

Mean ratings of the subjects' comfort during the experiment as a function of their locus of control and the three conditions.

	SKILL	CHANCE 1	CHANCE 2	COMBINED
Internals	6.33	7.30	4.80	6.14
Externals	5.67	6.94	6.74	6.45
Combined	6.00	7.12	5.77	6.30

Low score indicates discomfort, high score the reverse.

Analysis of variance for comfort scores produced two significant differences: a conditions main effect ($F = 3.061$; df 1/60, $P<.05$), and a locus of control X conditions interation ($F = 3.178$; df 1/60, $P<.05$). All the other differences were not significant. The mean scores (Table 4.20) reveal that chance 1 group felt more comfortable than chance 2 group. Using q tests to determine whether or not the chance 1 group felt more comfortable than the skill group did not result in a significant difference. Investigation of the locus of control X conditions interaction using q tests indicated one significant difference only: under chance 2, externals rated themselves as being more comfortable than internals ($q = 3.404$; df 2,60; $P<.05$).

Within personality comparisons using q tests showed that chance 1 internals felt more comfortable than chance 2 internals ($q = 4.386$; df 2,60, $P<.01$). Differences between skill internals and chance 2 internals approached significance ($q = 2.689$; df 2.60; $P<.10$). All the other differences were not significant. Internals accounted for most of the variability by reacting differently to chance 2 as compared to their reactions to skill and chance 1. Externals, on the other hand, did not react significantly differently across the three conditions.

vii Distraction Scores

Distraction ratings ranged from "testing situation distracted me very much" to "I wasn't distracted at all by testing situation".

Table 4.21

Mean ratings of the subjects' distraction during the experiment as a function of their locus of control and the three conditions.

	SKILL	CHANCE 1	CHANCE 2	COMBINED
Internals	7.83	7.79	5.04	6.89
Externals	7.08	8.10	7.36	7.51
Combined	7.46	7.95	6.20	7.20

Low score denotes more distraction, high score the reverse.

Analysis of variance for distraction scores resulted in only two significant differences: a highly significant conditions main effect ($F = 5.668$; df 1/60, $P<.006$), and a significant locus of control X conditions interaction ($F = 4.385$; df 1/60, $P<.02$). Inspection of the mean scores (Table 4.21) show that skill and chance 1 groups were less distracted than the chance 2 group. Investigating the significant interaction using q tests resulted in only one significant difference, namely that under chance 2 the internals felt more distracted than externals ($q = 4.549$; df 2,60; $P<.01$).

Within personality comparisons across the three conditions indicated that internals under skill and chance 1 were less distracted than internals in chance 2 ($q = 5.471$ - skill versus chance 2; $q = 5.392$ - chance 1 versus chance 2; $P<.01$ for both comparisons); chance 1 and skill internals were not significantly different; and no significant differences were obtained within the external groups across the three conditions.

Summary of the Reactions to the Experiment Results

The results showed that the internals seemed to be more motivated in skill conditions, and externals in pure chance conditions (as far as the subjects' interest and effort exertion

were concerned). Thus the personality situation locus of control congruency was supported.

Moreover, internals and externals did not differ in: their liking of the task; rating the task difficulty; and in rating their competence at finding the principle. Under chance 2 the internals felt less comfortable and more distracted than externals.

The most important finding was that the skill and chance 1 conditions elicited equivalent reactions, from subjects, which were different from those displayed in chance 2. These differences between chance 2 and either skill or chance 1 were solely accounted for by internals who seemed to be sensitive to the different conditions. Externals on the other hand, reacted as though the three conditions were not different.

4.5 DISCUSSION

The main purpose of the firststudy was the investigation of personality and situation locus of control interaction using skill, chance 1 (quasi chance), and chance 2 (pure chance) conditions, and studying internals' and externals' cognitive functioning under, and their reactions to, these conditions. While certain predictions were upheld, others were not confirmed and some very interesting, and important, differences between internals and externals were obtained. A summary of the major findings is presented below.

1. The experimental manipulations of skill, chance 1 and chance 2 conditions were highly effective suggesting that the subjects perceived the task in accordance with the instructions given.
2. Skill and chance 1 elicited similar performances and reactions which were different from those produced under chance 2. Thus the two types of chance conditions were essentially different from each other.
3. Externals, as compared to internals, employed and generated more solution hypotheses, changed them more frequently and returned more often to previous solution hypotheses. Externals also used more 'gambler's fallacy' sequences than internals.

4. Personality situation locus of control congruency was achieved for the interest, effort and distraction indices for the skill and chance 2 conditions. Reactions to the chance 1 condition were more variable. However, it was more liked by both groups relative to either the skill or chance 2 condition.

5. The internals reacted differently to the chance 2 condition as compared to their reactions to either the skill or chance 1 conditions. The externals' reactions on the other hand, were stable across the three conditions.

Results pertaining to the different nature of the two chance conditions are discussed first, followed by those involving the performance and reactions of internals and externals in the three experimental conditions. A discussion of the way internals and externals handled their solution hypotheses, to find the task principle, follows.

a. <u>The Nature of Chance Conditions</u>

It can be confidently said that the two types of chance conditions, one created by the extrinsic features of the task (i.e. difficulty of the task) and the other by its intrinsic

properties (pure chance), were perceived and responded to in a different manner by the subjects. Therefore, some of the inconsistencies that have characterised research on personality situation locus of control congruency may have been caused by confounding quasi and pure chance conditions. If the task or the instructions are ambiguous it may encourage the subjects to view the task as a challenge. In other words, some subjects could perceive it as being more skill determined than the experimenter intended. This was evident in the Lefcourt et al (1968) study where the chance condition was dictated mainly by task difficulty. A vague chance situation may have been created which rendered the validity of the chance instructions questionable, thus diminishing considerably any differences between internals and externals.

DuCette and Wolk (1973) argued that the 'active' nature of the internals' cognitive functioning, which is supplemented by their high level of motivation, provided the internals with better cue differentiation skills irrespective of the nature of the situation locus of control. Consequently, the externals, who lack such thorough cognitive functioning, may have failedto pick up cues irrespective of skill and chance conditions. As suggested in the introduction, DuCette and Wolk's chance condition was more representative of a quasi chance than a pure chance condition. Thus the better performance of DuCette and Wolk's internals was not irrespective of conditions, but was actually skill dependent.

Internals, therefore, are not motivated in all conditions, but only in those where they can infer a skill element. However, it may be argued that since the externals, in DuCette and Wolk's study, liked the chance situation more than internals and more than they liked the skill condition, they were responding to a genuine chance condition. The externals could not have inferred the skill element embedded in the chance condition because they lack the sharpness of internals in detecting subtle cues (Lefcourt, 1967; Lefcourt and Wine, 1969; Wolk and DuCette, 1974). However, since the skill element that rendered the chance condition ambiguous in the DuCette and Wolk study was more salient in the present study (chance 1), the externals perceived it as such and rated the task as not being entirely skill or chance determined. Future research, dealing with personality situation locus of control congruency should pay more attention to the design of the chance conditions.

b. Reactions to, and Performance under, the skill, chance 1 and chance 2 conditions

The reactions of internals to skill and externals to chance 2 fit Rotter's social learning theory, and in particular personality situation locus of control congruence (Rotter and Mulry, 1965). The internals found the task under skill more interesting than externals who found chance 2 more interesting

(supporting DuCette and Wolk's 1973 findings); both groups exerted more effort than the other under congruent conditions (supporting Srull and Karabenic's 1975 results). Morevoer, under chance 2, externals felt more comfortable and less distracted than internals. Thus it seems that internals and externals value situations where behaviour-reinforcement contingencies are similar to their beliefs about such contingencies.

The internals' and externals' performance in congruent situations does not provide clear support for Rotter and Mulry's (1965) conclusions that, under skill conditions, the performance of internals is better than that of externals. Contrary to the predictions, the externals introduced and employed more solution hypotheses than internals. If the mere number of solution hypothesis is a sign of superior performance, then it may be suggested that externals outperformed or were more flexible than internals in skill (a detailed discussion of the mode of solution hypothesis utilised by internals and externals is presented at the end of this section). If the aforementioned argument is valid then it appears that externals may do better under incongruent conditions than in congruent ones, a finding which contradicts the results for the interest and effort variables. It should be remembered that this was the argument of Petzel and Gynther (1970) who found that internals solved more anagrams than externals in the chance condition and externals solved more anagrams than internals in the skill condition. The incongruency

model of Petzel and Gynther is ambiguous due to the possibility that their chance condition resembled a "quasi" chance condition. Moreover, in the present study it was only the externals who produced more solution hypotheses under the skill condition, whereas according to the Petzel and Gynther model the internals should have introduced more solution hypotheses under the chance 2 condition. Further, both internals and externals were more motivated (in terms of their interest and effort) in congruent conditions. What was lacking in the Petzel and Gynther's study was a measurement of the motivational levels of the subjects besides their problem solving performance.

The utilisation of the 'gambler's fallacy' sequences by externals' in chance 1 and chance 2 gives further support to Rotter and Mulry's (1965) congruency model. Although the difference between internals and externals in the employment of these sequences was great in chance 1, it was even greater in chance 2. Internals rarely used such a spurious solution hypothesis in chance 1 and 2. The utilisation of the 'gambler's fallacy' sequence in chance 1 and 2 by externals is in line with previous research (e.g. Phares, 1957; Rotter et al, 1960). When externals find themselves in chance conditions their behaviour (i.e. gambler's fallacy) is reinforced, for their generalised expectancies about behaviour reinforcement outcome are compatible with these conditions.

An interesting finding in the present study was the

internals' failure to display more accurate estimation of their correct scores. Both groups were fairly accurate. The internals in the Stager et al (1973) and the Gilmor and Reid (1978) studies were more accurate in estimating their academic activities than externals. The results of Stager et al and Gilmor and Reid may be due to the relevance and value of the information in these studies. Since students value academic activities, and since the literature demonstrated the higher level of the internals' motivation (e.g. Wolk and DuCette, 1973) the estimation of such activities may be of greater relevance to the internals than to the externals.

An important finding obtained from the reaction to the experimental indices (interest, like, effort etc.), was that internals reacted differently to the chance 2 condition as compared to their reactions to the skill and chance 1 conditions[3]. The externals, on the other hand, were insensitive, or at least did not react differently, to skill, chance 1, and chance 2. These findings support those obtained by Lefcourt et al (1968) where they reported similar trends. Thus internals displayed greater variability in terms of their reactions to the experimental conditions, but in terms of solution hypotheses it was the externals

---

3 Except for the 'competence' index whose scores were low for all groups. The high level of task difficulty made the subjects feel incompetent, removing or obscuring any differences between internals and externals.

who exhibited greater variability by creating, using, and changing more solution hypotheses than internals.

c. Methods of Approaching the Task

Both internals and externals performed poorly in terms of deciphering the principle. This was expected since pilot subjects found the task very difficult. However, the task did provide a real opportunity for subjects to form solution hypotheses. Task difficulty clearly inhibited successful solutions and possibly obscured differences between internals and externals. The number of correct trials for internals and externals was not significantly different. Nevertheless, this does not diminish the value of the task, as it provided the most important and significant finding of the study; i.e. that internals and externals handle solution hypotheses in a quite different way.

Contrary to the predictions, the externals exceeded internals in the number of solution hypotheses used under skill. Also more externals, as compared to internals, introduced new solution hypotheses and spurious hypotheses (especially 'gambler's fallacy' sequences). Furthermore, significantly more externals than internals changed solution hypotheses frequently and returned to an already employed solution hypotheses. Thus, the externals seem to be more dynamic and flexible, while

internals seem more strict and cautious in their utilisation of hypotheses. These findings appear to contradict previous research which indicated that internals were more dynamic in their cognitive functioning and evidenced superior ability when compared with externals (cf. Lefcourt, 1976; Phares, 1976).

It is difficult to ascertain which of the two approaches adopted by internals and externals in this study was more efficient as neither approach entailed success in terms of finding the principle. Previous studies (e.g. Bartel et al, 1972; Lefcourt and Wine, 1969; Wolk and DuCette, 1974) have demonstrated that externals adopt less systematic and less organised strategies to handling information than internals. The externals approach to handling solution hypotheses may thus reflect lability, while the internals' approach may reflect concentration and rigorous testing. The notion of the lability of externals is rendered plausible when considering their 'gambler's fallacy' behaviour (left-right sequences of the response cards). More externals, relative to internals, used 'gambler's fallacy' sequences in chance 1 and chance 2. Adopting these sequences under chance 2 is conceivable, but chance 1 was less of a pure chance condition; 'gambler's fallacy' sequences are not associated with any rigorous attempt to solve the problem as they simply involve comparisons of the response words and ignore the stimulus words. They resemble a more indifferent or carefree approach. It seems therefore, that the introduction of, and shifting among, many

different solution hypotheses by externals, is not a sign of being flexible and creative but of a more superficial and perhaps less valuable approach. Perhaps this point will become more clear when discussing the testing of solution hypotheses below.

Each trial in the experiment provided evidence which indicated the correctness or falsity of a solution hypothesis. The more trials on which a subject persisted with a given solution hypothesis the more evidence he could gather regarding whether this particular solution hypothesis was correct. Externals used more solution hypotheses and changed them more frequently than internals who used relatively few hypotheses and changed them infrequently. What seemed to be happening was that externals rejected an hypothesis on the basis of minimal evidence suggesting that it was incorrect. They then tried other hypotheses which in turn were also proved incorrect. It appears that the externals then 'questioned' whether they had thoroughly tested earlier hypotheses and so returned to them again. The internals, however, used fewer solution hypotheses and rarely returned to them on later trials which suggests that they thoroughly convinced themselves of the falsity of an hypothesis before rejecting it. Thus both groups seem to set themselves a different criterion for testing and rejecting solution hypotheses.

This argument however raises further questions.

Theoretically, a subject only required one negative response to confirm for him that his solution hypothesis was incorrect. So why should internals persist in trying an hypothesis or externals return to hypotheses previously rejected? The answer possibly lies in the strict time factor and task difficulty. The subjects were given only 30 seconds per trial. Since the task was a very difficult one, 30 seconds might not have been sufficient for many subjects to determine the correctness or falsity of an hypothesis for themselves. Pines and Julian (1972) found that internals were more attuned to task difficulty and the consequent pressure it exerted on information processing, while externals were more affected by the social demand characteristics of the situation. Therefore, it may be speculated that internals in this study persisted until they could see for themselves that their solution hypothesis was incorrect whereas externals did not, but did return to the hypothesis later almost as if to verify again that it was incorrect. Thus, the relatively smaller number of solution hypotheses employed by the internals, compared to externals, in this experiment, appears to be a function of the task difficulty (including time constraint) and their more thorough approach to testing solution hypotheses, rather than a rigid approach.

What makes the results of the present study interesting is that internals' and externals' performance was not affected by differential reinforcement. Both groups did not differ

significantly in the number of correct answers for the first 10, 20 and 30 trials. Thus the task performance of internals and externals reflects different problem solving strategies and not the influence of differential reinforcement during the experiment.

The methods by which internals and externals approach a problem has not been adequately investigated in previous studies as they were mostly concerned with the discovery of the solution per se. This study showed that both groups adopted quite different approaches to discoveringthe principle underlying the experimental task. The results are novel, statistically highly significant and are not predictable from the findings of previous research.

One criticism might be raised against the author's interpretation of the results and concerns the fact that subjects had to recall the details of the number and kind of solution hypotheses used during the experiment, after completing the task. Thus, it could be suggested that the results reflect the recall ability of internals and externals rather than their actual performance. It is possible that the recall process may have affected the results, however both internals and externals were required to recall their performance. Therefore, for this argument to have any real validity it must be demonstrated how the recall process could systematically lead to clear-cut differences between the reported performance of

internals and externals. This does not seem readily possible and weighted against this argument are at least three points. First, the internals' and externals' perception of, and reactions to, the experiment are fairly consistent with predictions, although their task performance is not. Second, the differences in task performance are systematic and not random. Third, the differences are highly significant. However, a methodological weakness of the study was the lack of an adequate measure of the solution hypotheses following every trial. Nevertheless, the differences in the way internals and externals attempted to find the principle underlying the task clearly merit further investigation.

CHAPTER 5

SECOND STUDY

5.1 INTRODUCTION

A major finding of the first study was the differences in the way internals and externals utilised their solution hypotheses. Both groups did not differ in their deciphering of the principle, therefore it seems that the 'operations' that precede problem solving are different for internals and externals. The aim of the second study was to probe further into these different modes of processing information while attempting to solve a problem.

Externals as compared to internals, have been shown to be less adaptive to different experimental conditions (first study; Lefcourt et al, 1968), less vigilant (Sanders et al, 1976), recall information without organising it (Bartel et al, 1972), and less sensitive to environmental cues (Lefcourt, 1967; Lefcourt and Wine, 1969; Wolk and DuCette, 1974). Thus the method by which internals process information seems to be more structured and organised, while that of the externals seems to be more diffuse and disorganised.

In the studies by Lefcourt (1967), Lefcourt and Wine (1969), and Wolk and DuCette (1974) externals demanded more

'cues' than internals in order to assimilate information (ie. the information became more salient). Thus it seems that externals process information better when it is rendered more salient. One reason for the overdependence of externals on additional cues may reside in the fact that they are less able than internals to extract relevant information from the environment. Indeed in Seeman's studies (Seeman and Evans, 1962; Seeman, 1963) externals were less successful than internals in acquiring information about the immediate environment. Externals may not examine all the possibilities in the surroundings. It was argued, in the first study, that part of the reason why externals went back to a solution hypothesis was because they rejected hypotheses quickly, on the basis of minimal evidence, and then appeared to doubt their decision, whereas the more deliberate testing of a solution hypothesis by internals decreased the tendency to go back to it.

In the Lefcourt, Lefcourt and Wine, and Wolk and DuCette studies, the experimenter himself increased the task's saliency by providing the subjects with the necessary cues. This raises the question: if externals and internals were provided with the opportunity to increase task saliency, who would capitalise more on this opportunity? According to the aforementioned studies, the externals would seek to increase information saliency to make it more assimilable. But this should be less true of internals as they are better able to assimilate the same information

from their environment. There is indirect evidence to suggest that internals may scan information faster than externals. Internals, relative to externals, have been shown to be more verbally fluent (Brecher and Denmark, 1969), and "... fluent... individuals appear to be those who can rapidly scan stored data and withdraw quickly from the memory pool items of information that are needed..." (Payne, 1973, p.422).

The second study attempted to investigate the following question: what kind of differences would emerge between internals and externals when they are faced with a task which has to be solved using two sets of information which can be viewed separately but not simultaneously?

The task employed in the second study consisted of presenting subjects with a series of characteristics describing an object, on one slide, and then with a list of objects, only one of which was best described by the characteristics, on another slide. Since the list of characteristics and the list of objects were presented separately it was possible for subjects to switchback between the two lists to re-examine them (cf. Johnson, Lincoln, and Hall, 1961). The time subjects spent scanning the characteristics' lists and the objects' lists and using switchbacks (if any) was recorded. These times were used as measures of how efficiently subjects processed the information and of their need to increase the saliency of the information.

The high level of task difficulty and the time constraint for each trial of the first study may have removed or obscured any differences between internals and externals in their ability to solve the task. This second study utilised a relatively easy task to see if such differences would emerge.

5.2 PREDICTIONS

The dependent variables also fall under the same broad headings as those used in the first study: task performance, and perception of and reactions to the experiment.

A. Task Performance

1. Preparation and Solution Time

As internals have been shown to organise, assimilate and utilise information better, and are more verbally fluent than externals, it is hypothesised that internals' preparation and solution times will be significantly less than those of externals.

2. Switchbacks

Since switchbacks are considered to be modes of increasing

the task's saliency, which increases the time spent on the task, it is hypothesised that significantly more externals will employ switchbacks than internals.

3. Number of Errors

Since it is difficult to specify the accuracy of problem solving as a function of personality differences (first study; Goh and Farely, 1977), no predictions regarding the number of errors are made.

B. Perception of, and Reaction to the Task

The same indices as those employed in the first study were included to examine the subjects' perception of and reactions to, the experiment.

5.3 METHOD

a. General Synopsis

The study was conducted in two phases. During the first, carried out three months prior to the second, all the subjects answered Rotter's I-E scale to assess the dimensions of locus of control to which they belonged. In the second phase internals and externals were tested individually to determine their performance on the task. After completing the task, subjects received the post task questionnaire which included items pertaining to the task and to subjects' reaction to the experiment. The study was concluded by a debriefing session.

b. Assessment of Internal and External Locus of Control

The overall mean of the I-E scale (N = 92) was 11.64. The internals were defined as those subjects scoring 11 and below, while the externals were defined as those scoring 12 and above. This is the same allocation as that of the first study.

c. Experimental Design

Ninety-two subjects participated in the study, half were classified as internals (23 males and 23 females) and half

as externals (23 males and 23 females). Two experimental designs were employed. For the analyses of preparation and solution time a 2x2x7 split-plot factorial design (locus of control X sex X characteristics (3,4,5,6,7,8, and 9 characteristics)) with repeated measures on the last factor (Kirk, 1968) was used. As regards perception of, and reaction to, the experiment indices, a 2x2 (locus of control X sex) factorial design was employed. Correlations and chi square tests were carried out where applicable. The design of the experiment is presented in Table 5.1

Table 5.1

Experimental design of the second study

	SEX	
SUBJECTS	MALES	FEMALES
Internals	23 (28)*	23 (27)
Externals	23 (26)	23 (29)

( )* = The number of subjects originally assigned to this cell. Omitting subjects due to apparatus malfunctioning, where unsatisfactory data were obtained, or by random rejection, left 23 subjects per cell.

d. Selection of Subjects

The subjects were 92 (males and females) introductory psychology students (from 1976 class) at Stirling University. At the beginning of the academic year all the introductory

psychology students were given Rotter's I-E scale as part of routine testing. Originally, 110 subjects participated in the experiment. Eighteen subjects were excluded for the following reasons: 6 subjects could not complete the task due to apparatus malfunctioning; data from 3 subjects were rejected because of misunderstanding of the instructions; 9 subjects were randomly eliminated to provide for equal number of subjects in each cell. The last 9 subjects were: 6 externals (5 females and 1 male), and 3 internals (1 female and 2 males). Subjects were given a course credit each for taking part in the experiment.

e. Instruments

i Rotter's I-E Scale : see first study.

ii The Task

The task had to fulfill three criteria: 1) it must allow for rehearsing of information in preparation for a solution; 2) solution must be based on the information rehearsed; and 3) it must allow for switching back to the information already rehearsed.

The task was adapted from Johnson, Lincoln and Hall (1961). Johnson et al investigated the effect of the length of characteristics describing an object on the subject's preparation and solution

time. Preparation time is the time taken to study a list of characteristics describing an object, while solution time is the time taken to name an object best described by the characteristics. In Johnson et al's study the number of characteristics ranged from 3 to 11 inclusive and were presented on cards, while the number of objects was always 5 per card. The characteristics' and objects' cards were never presented simultaneously. The subjects first pressed a button which illuminated a card in a left compartment of a two-compartment box. That card contained a number of characteristics which the subject had to rehearse. The subject was allowed as much time as he/she wanted for rehearsal, and when he/she was ready for the objects' list, he/she pushed another button illuminating the right compartment and the light in the left compartment went out. The card in the right compartment contains 5 objects only one of which is fully described by the characteristics. The subject had to choose what he/she believed to be the appropriate object. Thus the preparation material must be carried in memory if solution is to be attained. The subject was also allowed to switch back to the left compartment if solution was not arrived at. Johnson et al found that as the number of characteristics increased from 3 to 9 so did preparation time; solution time was constant. It was also found that the number of switchbacks increased with the number of the characteristics probably indicating a failure in memory. Moreover, individual differences generated high variability in Johnson et al's results.

f. Pilot Studies

Pilot subjects were psychology lecturers, postgraduates, and first year psychology students. Since the items making up the preparation and solution lists in Johnson et al's experiments were not available, these items had to be constructed. This resulted in considerable testing and editing in order that: a) the characteristics describing an object were non-redundant; b) each characteristic had to provide more information towards the solution; and c) the 5 objects had to be similar yet only one of them satisfied all the characteristics describing it, so that choosing the appropriate object required rigorous processing of the characteristics.

The characteristics ranged from 3 to 9 inclusive and not from 3 to 11 as in the Johnson et al's (1961) study. The reason for not including 10 and 11 characteristics is that such amounts tend to satiate the subject and produce little differentation in the results (cf. Johnson et al). A total of 28 trials were obtained, made up of 4 of each number of the characteristics from 3 to 9 inclusive (i.e. 4 with 3 characteristics, 4 with 4 characteristics etc.).

g. Specific Features of the Task

The task employed in the experiment proper together with

introductory problems is presented in Appendix 2. An example of a problem of 5 characteristics is given below.

CHARACTERISTICS	OBJECTS
COVERING	LABEL
TRANSPORTABLE	FOLDER
LIGHT	ENVELOPE
FLAPPED	PAD
GUMMED	WRAPPER

Folder is ruled out because it is not 'gummed', and pad is ruled out because it is not 'covering'. Thus the choice remains between wrapper, label and envelope. Since 'flapped' is more associated with envelope, then envelope is the correct word because it satisfies all the characteristics.

The correct word was determined by giving a further group of pilot subjects the list of objects and asking them to write down as many characteristics as possible to describe a particular object. After editing the characteristics to reduce redundancy, another group of pilot subjects was presented with the characteristics and were asked to write down objects best described by each set of characteristics. Then a third pilot group was given both the characteristics and objects and were asked to determine the accuracy of the characteristics in describing their objects. An object was only considered correct when most of the subjects (99%) perceived it accordingly. Certain objects were more difficult to describe than others (e.g. stone, chalk, plastic, knob). These objects were chosen to render the task

more challenging.

h. Apparatus

A more sophisticated and accurate apparatus than that used in Johnson et al study was specifically designed for the present experiment. The apparatus measured not only preparation and solution time, but also the time taken to switchback. Two Kodak carousel slide projectors, one for the characteristics' material and the other for objects' material, were employed equipped with an electro mechanical shutter. The shutters were solenoid driven. The shutters were essential for presenting the characteristics' and objects' lists separately. A paper tape output data logger was used to log time (cumulative) and event (category). The data logger was a modified solartron D.T.U. with ten millisecond line base and a high speed paper punch. Subjects responded by pressing small keys. There were 4 keys: the first two keys were the trial keys and represent the characteristics and objects keys. The other two keys were the switchback keys, one for characteristics and one for objects (see Figure 5.1).

The two slide projectors were synchronised. At the beginning of the experiment the shutters of both projectors were

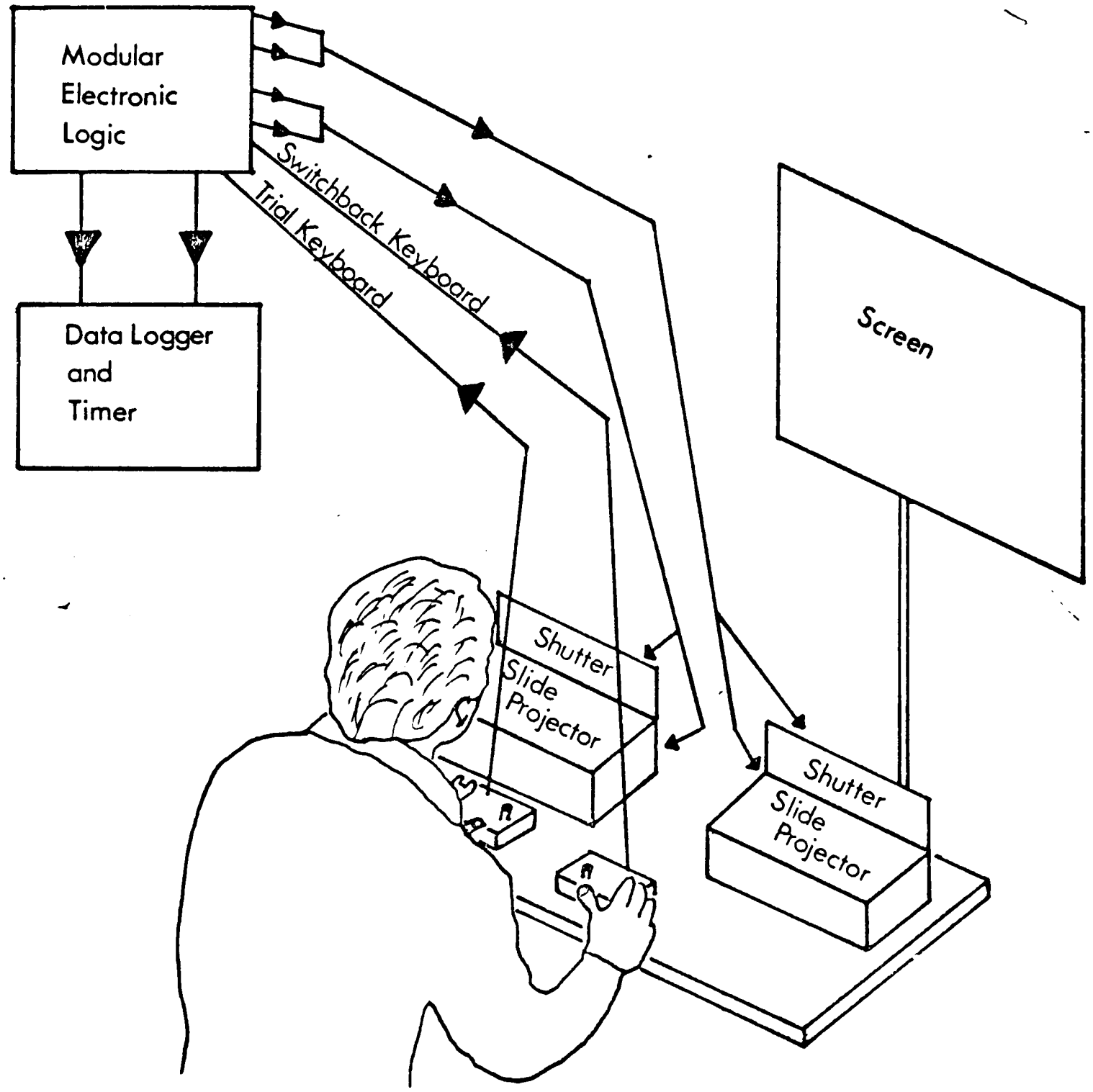


Figure 5.1

Apparatus employed in the second study.

closed. Pressing the characteristics trial key opened the shutter of projector number 1 and the characteristics list was projected on the screen. If the subjects want to see the objects list, they press the objects trial key which closes the shutter of projector number 1 and opens the shutter of projector 2, thus projecting the objects list. If the subjects name the appropriate object they push the trial characteristics list immediately which closes the shutter of projector number 2, moves the slides of projector number 1 a trial forward, and then opens the shutter of projector number 1. This whole sequence takes 4 seconds (labelled inter-trial interval). Pressing the objects' trial key closes the shutter of the first projector, moves the second projector one trial forward and then opens its shutter.

If the objects list is projected on the screen and the subject wants to switchback before naming the appropriate word, he/she presses the switchback characteristics key which closes the shutter of the objects' projector and opens that of the characteristics' without moving a trial forward. The subject can make endless switchbacks which he/she can terminate by pressing the trial characteristics' key which carries him/her to the next trial after the inter-trial interval.

Every time the subject presses a key, the paper tape of the data logger is punched registering a time (in seconds). When the paper tape is transcribed into a teleprinter, a print

of all the times, corresponding to the key presses, is printed on a paper, and by simple subtraction procedures based on special symbols on the printer paper, preparation time, solution time and switchback time (if any) are computed.

The sequence of the trials, the shutter control pulses, and input to data logger were co-ordinated by a system of modular electronic logic.

The reliability of the apparatus was tested using 21 high school students (final year). The apparatus was not employed in the experiment proper until all its mechanical failures had been resolved.

i. Post Task Questionnaire

The post task questionnaire (see Appendix 2) was made of two parts. The first part explored types of approaches used in solving the problems. These approaches were those most commonly used by pilot subjects. The other part dealt with subjects' perception of, and reaction to, the experiment using a number of 9-point rating scales similar to those employed in the first study. Subjects were asked "How interested were you in the task?"; "When trying to name the correct object, how hard did you try?"; "How much did you like the task?"; and "How much do you think this was a task which depended on skill or chance?"

The subjects also answered two additional questions concerning whether they found the task to be too easy or too difficult; and whether or not they possessed the ability to perform the task. These two questions were answered using a 9-point rating scale. At the end of the questionnaire subjects were given the option of writing comments about their performances or any aspects of the task.

j. Task Familiarity Check

During pilot studies 53 subjects answered a 9-point rating scale dealing with familiarity of the task. Subjects were asked "How familiar was this task to you?". It was important to determine the level of task difficulty to guard against any prior encounter with a task of similar nature to the one under investigation. The 53 pilot subjects were from the same population as those of the experiment proper (i.e. first year psychology students). They were also given the I-E scale and the allocation of internals and externals was as follows: 24 internals (10 males and 14 females), and 29 externals (16 males and 13 females). The task familiarity data were analysed using a 2x2 (locus of control X sex) factorial design with unequal number in cells (least square analysis).

k. Procedure

Subjects were tested individually. When the subject arrived he/she was seated in front of the apparatus and was given the following instructions to read:

INSTRUCTIONS

You will be presented with two lists of words, one at a time. List number 1 contains characteristics describing an object. The number of these characteristics ranges from 3 to 9 inclusive. List number 2 contains five objects of which only one possesses all the characteristics on list number 1. Your task is to name one object on list number 2 which you think possesses all the characteristics on list number 1.

You will not see both lists simultaneously. The first list will be projected on the screen when the characteristics' button is pressed. Examine the list carefully, and when you are ready for the second list (objects' list) press the objects' button, and that list will be projected on the screen. Examine the list carefully and then name the object which you think possesses all the characteristics on the first list. If you feel you want to switch back to the first list before making you final decision, press the switchback button number 1, and the first list (characteristics' list) will be projected on the screen. After re-examining the list, press switchback button number 2 so that you may see the second (objects') list again, and then name the appropriate object. You are allowed as much time and switchbacks as you wish, but remember that you can not see both lists simultaneously.

Once you have named the appropriate object, press the characteristics button immediately. If you name the correct object I will respond "correct", and if you name the wrong object I will respond "wrong" after you have named the appropriate object and pressed the characteristics' button. Please do not discuss the materials during the trials' phase. Once this phase has terminated you may discuss anything about the experiment. There will be 28 trials. Before starting the experiment proper, I will give you two trials to familiarise you with the task. Are there any questions?

Then the experimenter explained to the subject the nature of the task. The subject was given two problems to familiarize him/her with the task and the apparatus. These two problems were repeated many times (whenever needed by a subject) until the subject understood fully the mechanics of the experiment.

Since the punching of the paper tape made some noise, the subject was told to ignore the noise which was explained to be due to connections with the department's computer. The subjects were never under the impression that their responses were timed (this was clear during post task interviews). The apparatus functioned smoothly except for six sessions. During the experiment, the experimenter sat behind the subject and informed him/her during the inter-trial interval whether or not he/she named the appropriate object.

After the end of the 28th trial[1], the subject was escorted to a table and was handed the post-task questionnaire. When the subject finished answering the questionnaire, the experimenter inspected it to make sure all the items were answered adequately. Then the experimenter signed the course credit card, debriefed

---

1 The experimental session was one hour. No subject exceeded this time limit.

the subject, answered all his/her questions (if any), and told him/her not to discuss the experiment with his/her classmates.

5.4 RESULTS

The second study was designed to delineate differences between internals and externals in their preparation and solution time and tendency to switchback. Their perception of, and reaction to, the experiment were also investigated in order to complement the measures of their performance by measuring their involvement in the task.

It is important to determine whether or not the task was a familiar one to the subjects before conclusions are drawn from the results. Any past familiarity with the task would bias subjects' behaviour. Thus task familiarity check scores are presented first to be followed by distribution of I-E scores. Results of task performance come next, and reports on perception of, and reactions to, the experiment conclude the presentation.

a. Task Familiarity Check

Pilot subjects responded to the following question "How familair was this task to you?"

Table 5.2

Mean ratings of the subjects' perception of task familiarity as a function of their locus of control and sex.

	SEX		
	MALES	FEMALES	COMBINED
Internals	8.70	8.64	8.67
Externals	8.56	8.54	8.55
Combined	8.63	8.59	8.61

Low score indicates unfamiliarity, high score the reverse.

The analysis of variance for task familiarity scores (summary of which is presented in Table 5.3) did not result in any significant differences. All subjects construed the task to be unfamiliar (see Table 5.2)

Table 5.3

Summary of analysis of variance of the subjects' ratings of the task familiarity as a function of their locus of control and sex.

VARIATION	SS	DF	MS	F	P
A (locus of control)	.173	1	.173	.460	
B (sex)	.020	1	.020	.052	
AB	.004	1	.004	.009	
Within Cells	18.483	49	.377		

b. I-E Scores

Means and standard deviations of I-E scores for males and females and the combined sample are presented in Table 5.4.

Table 5.4

Means and standard deviations of the I-E scores

	MEANS	STANDARD DEVIATION
Internal Males	7.87	2.26
Internal Females	8.00	1.95
External Males	15.22	2.58
External Females	15.43	2.13
Internals	7.94	2.11
Externals	15.33	2.36
Combined Sample	11.64	4.32

Internality scores ranged from 2 to 11 inclusive, those of externality ranged from 12 to 21 inclusvie.

A. Task Performance

1. Reaction Time and Switchbacks

Initial preparation time commences when the characteristics' list is projected on the screen, and terminates when the subject

pushes the objects' trial key. Thus initial preparation time does not include time of switchback(s). Preparation time proper, on the other hand, includes initial preparation time plus additional time, if any, the subject took when switching back to the characteristic list after being exposed to the objects' list[2]. Solution time commences when the objects' list (not previously seen) is projected on the screen and terminates when the characteristics' trial key is pressed (i.e. with the termination of a trial). Solution time includes re-examination of objects (if any). Thus if a subject switched back to the objects after being exposed once again to the characteristics, the switch back time he/she spends re-examining the list is added to the previous time he/she spent looking at the objects. Solution time therefore, measures the whole process of studying the objects' list.

Data of initial preparation time are analysed first, followed by the analyses of switchbacks and the analyses of total preparation and solution time.

---

2 Preparation time proper will be labelled total preparation time hereafter.

i Initial Preparation Time

Since the main interest was to delineate differences between internals and externals in their processing of information, any discrepancies in their initial preparation time would reflect a difference in their ability of scanning and rehearsing information as a prerequisite for organising and assimilating the information. The means for initial preparation time are reported in Table 5.5.

Data of initial preparation time was analysed using a 2x2x7 split-plot factorial design with repeated measures on the third factor [3] (as indicated in the method's section). The analysis of variance (Table 5.6) resulted in a significant locus of control main effect, and highly significant characteristics main effect. All the other differences were not significant. The mean scores (table 5.5) reveal that, as predicted, internals' initial preparation time was faster than that of the externals; and that as the number of characteristics increase do did initial preparation time. This is in direct support of Johnson et al's (1961) results. Examination of the differences between internals and externals across the different number of characteristics indicate that for 3,4,5,8 and 9 numbers of characteristics, the internals were faster than externals ($t = 3.638$, df 528, $P<.0005$; $t = 3.362$; $P<.005$; $t = 1.936$; $P<.05$; $t = 2.737$, $P<.025$; and $t = 2.649$; $P<.025$ respectively).

---

3 The same design was used for the analyses of total preparation and solution time.

Table 5.5

Mean scores for initial preparation time as a function of locus of control, sex, and the seven numbers of characteristics.

Number of Characteristics	IM	IF	EM	EF	M	F	I	E	Combined
3	6.19	5.92	7.50	8.04	6.85	6.98	6.06	7.77	6.91
4	7.63	7.62	9.71	8.71	8.67	8.16	7.63	9.21	8.42
5	9.09	8.76	9.27	10.40	9.18	9.58	8.92	9.83	9.38
6	10.42	10.64	10.83	10.75	10.63	10.69	10.53	10.79	10.66
7	11.30	13.41	12.55	13.38	11.92	13.40	12.36	12.96	12.66
8	12.61	14.51	14.69	15.55	13.65	15.03	13.56	15.12	14.34
9	16.70	17.68	17.88	19.52	17.29	18.60	17.19	18.70	17.94
Combined	-	-	-	-	11.17	11.78	10.89	12.06	-

IM = Internal males
IF = Internal females
EM = External males
EF = External females
M = Males
F = Females
I = Internals
E = Externals

Table 5.6

Summary of analysis of variance of initial preparation time as a function of locus of control, sex, and the seven numbers of characteristics.

VARIATION	SS	DF	MS	F	P
Between People	2593.49	91			
A (locus of control)	218.07	1	218.07	8.29	<.01
B (sex)	59.62	1	59.62	2.27	
AB	0.40	1	0.40	0.02	
Subj. W. Groups	2315.40	88	26.31		
Within People	10865.71	552			
C (characteristics)	7973.85	6	1328.97	257.66	<.0001
AC	44.82	6	7.47	1.45	
BC	83.85	6	13.97	2.71	
ABC	39.79	6	6.63	1.29	
CXSubj. W. Gps.	2723.40	528	5.16		
Total	13459.20	643			

Although internals were faster than externals at numbers of 6 and 7, such differences were not significant. These trends are plotted in Figure 5.2.

ii Switchbacks

In the instructions the subjects were told they could make

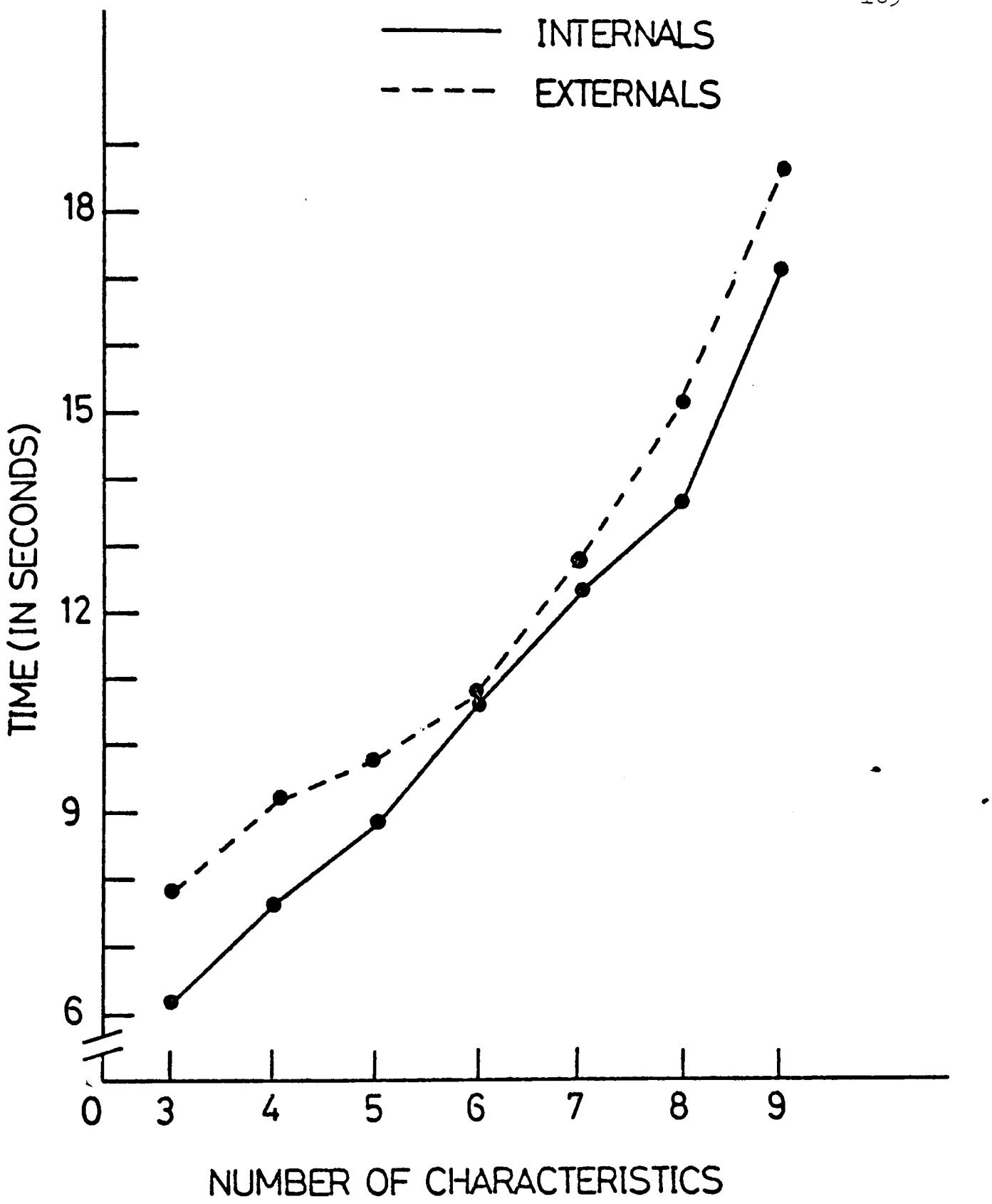


Figure 5.2

Initial preparation time as a function of locus of control and the seven numbers of characteristics.

as many switchbacks as they wished. However it was necessary to determine whether or not subjects construed switchbacks as a task demand characteristic. Subjects, who switched back, were asked about the causes of their switchbacks in a post-task interview following the completion of the questionnaire. As indicated in the method section, data of three subjects were rejected, because those subjects employed switchbacks even when they did not need it, thinking that switchbacks were part of the experiment. All the others who used switchbacks stated they actually needed them.

Examination of switchbacks used by the subjects resulted in the identification of four types of switchbacks:

i Standard Switchbacks: pertain to going back to the characteristics, then to the objects, and finally naming an object. Thus in a standard switchback situation the subject is exposed twice to the characteristics' and objects' lists in any given trial.

ii Half Switchbacks: when a subject switches back to the characteristics, after seeing the objects, and names an object without switching back to the objects, he/she has executed a half switchback. In this condition the subject seems to hold the objects in his/her memory while processing the characteristics for the second time. Thus he/she is exposed once to the objects and twice to the characteristics in any given trial.

iii Double Switchbacks: pertain to two standard switchbacks (i.e. going back to the characteristics, then to the objects, then to the characteristics, then to the objects and finally naming an object). In this condition the subject is exposed three times to the characteristics' and objects' lists in any given trial.

iv Double + Switchbacks: are any switchbacks exceeding double switchbacks in any given trial.

Table 5.7 presents the number of internals and externals utilising any of the four types of switchbacks across the seven numbers of characteristics.[4]

Considering the total number of switchbacks (the four types collapsed over the 9 numbers of characteristics), the externals used much more total switchbacks (771) than the internals (259). The externals also used more: a) standard switchbacks (597) as compared to the internals (105); b) double switchbacks (98 versus 7 by the internals); and c) double + switchbacks (33 versus none by the internals). Internals on the other hand, used more half switchbacks (147) as compared to the externals (43). It is interesting to note that as the number of characteristics increase so does the number of half switchbacks for internals reaching its peak at number of six characteristics and then slightly decreasing for the rest of the

---

4 Only one subject (an external male) made $1\frac{1}{2}$ switchback, and only two subjects (external females) made $2\frac{1}{2}$ switchbacks. Because of the very low incident of these switchbacks, they were treated as standard and double switchbacks respectively.

Table 5.7

Frequency of all the types of switchbacks as a function of locus of control, sex, and the seven numbers of characteristics.

Number of Characteristics		SWITCHBACKS SS	½S	DS	D+S	Combined
3	IM	0	0	0	0	0
	IF	1	1	0	0	2
	EM	17	1	0	0	18
	EF	11	0	2	0	13
	I	1	1	0	0	2
	E	28	1	2	0	31
4	IM	3	6	0	0	9
	IF	6	7	0	0	13
	EM	20	4	7	0	31
	EF	32	0	5	0	37
	I	9	13	0	0	22
	E	52	4	12	0	68
5	IM	5	8	0	0	13
	IF	8	9	0	0	17
	EM	37	7	4	0	48
	EF	40	3	4	0	47
	I	13	17	0	0	30
	E	77	10	8	0	95
6	IM	8	19	1	0	28
	IF	7	21	2	0	30
	EM	59	3	12	3	77
	EF	55	6	13	6	80
	I	15	40	3	0	58
	E	114	9	25	9	157
7	IM	8	12	1	0	21
	IF	14	14	1	0	29
	EM	55	5	7	3	70
	EF	60	5	5	1	71
	I	22	26	2	0	50
	E	115	10	12	3	141
8	IM	12	10	1	0	23
	IF	12	14	0	0	26
	EM	54	3	12	5	74
	EF	56	5	7	3	71
	I	24	24	1	0	49
	E	110	8	19	8	145

SS = Standard Switchbacks

½S = Half Switchbacks

DS = Double Switchbacks

D+S = Double + Switchbacks

IM = Internal Males

IF = Internal Females

EM = External Males

EF = External Females

I = Internals

E = Externals

Table 5.7 continued

Number of Characteristics		SWITCHBACKS				
		SS	½S	DS	D+S	Combined
9	IM	11	15	0	0	26
	IF	10	11	1	0	22
	EM	50	1	11	7	69
	EF	51	0	9	5	65
	I	21	26	1	0	48
	E	101	1	20	12	134
Combined Characteristics	IM	47	70	3	0	120
	IF	58	77	4	0	139
	EM	292	24	53	18	387
	EF	305	19	45	15	384
	I	105	147	7	0	259
	E	597	43	98	33	771

characteristics. The externals, on the other hand, show the opposite trend for half switchbacks. However, considering double switchbacks the externals displayed the same behaviour as that of the internals for half switchbacks. Thus the internals method of utilising half switchbacks was similar to that used by externals for double switchbacks. Both groups increased their employment of standard switchbacks as the number of characteristics increased. It is also interesting to note that the highest number of total switchbacks was displayed by the subjects when the characteristics numbered 6.

In order to investigate the significance of the differences between externals and internals in switchbacks,

data of the number of internals and externals who used any type of switchbacks were organised into contingency tables (see table 5.8) and analysed using X^2s corrected for continuity (Siegel, 1956).

More externals, relative to internals, employed total switchbacks, standard, double and double + switchbacks. However, more internals used half switchbacks than externals. All these results are highly significant. Thus internals and externals clearly adopted different methods in attempting to solve the problems.

Table 5.8

Number of internals and externals making any of the switchbacks; plus chi square values

	TYPE OF SWITCHBACK													
	TS			SS			½S			DS		DS+		
	a	b	c	a	b	c	a	b	c	d	e	d	e	
I	14	8	24	19	25	2	16	20	10	5	41	0	46	
E	1	3	42	2	3	41	32	13	1	29	17	15	31	
X^2	21.96* df = 2			66.42+ df = 2			14.18* df = 2			24.86* df = 1		16.29* df = 1		

* P<.001 two tailed

\+ P<.0001

TS = Total switchbacks
SS = Standard "
½S = Half "
DS = Double "
DS+ = Double + "
a = Number of switchbacks raning from 0 to 1.
b = Number of switchbacks ranging from 2 to 5.
c = Number of switchbacks over 5.
d = Number of subjects using the switchbacks.
e = Number of subjects not using the switchbacks.
I = Internals
E = Externals.

iii Total Preparation Time

As indicated earlier, total preparation time included the time subjects took in re-examining the characteristics.

The breakdown of sums of squares for total preparation time, presented in Table 5.10, indicates highly significant locus of control and characteristics main effects, and a significant sex main effect. Table 5.9 (next page) shows that as predicted, internals were faster than externals; total preparation time increased as the number of characteristics increased; and that males were faster than females. As Table 5.10 clearly demonstrates, the variability due to locus of control is much greater than that of sex.

Table 5.10

Summary of analysis of variance of total preparation time as a function of locus of control, sex and the seven numbers of characteristics.

VARIATION	SS	DF	MS	F	P
Between People	7411.19	91			
A (locus of control)	3775.20	1	3775.20	96.08	<.001
B (sex)	170.87	1	170.87	4.35	<.05
AB	7.24	1	7.24	0.18	
Subj W. Groups	3457.88	88	39.29		
Within People	17331.43	552			
C (conditions)	14274.35	6	2379.06	562.99	<.0001
AC	590.91	6	98.48	23.31	<.001
BC	168.50	6	28.08	6.65	<.01
ABC	66.46	6	11.08	2.62	<.05
C X Subj W. Gps.	2231.22	528	4.23		
Total	24742.62	643			

Table 5.9

Mean scores for total preparation time as a function of locus of control, sex, and the seven numbers of characteristics.

Number of Characteristics	IM	IF	EM	EF	M	F	I	E	Combined
3	6.19	5.99	8.27	8.78	7.23	7.38	6.09	8.52	7.30
4	7.77	7.93	11.41	11.24	9.59	9.59	7.85	11.32	9.59
5	9.29	9.26	11.44	13.22	10.37	11.24	9.27	12.33	10.80
6	10.83	11.14	15.90	15.05	13.36	13.09	10.98	15.47	13.23
7	11.70	14.29	17.85	19.37	14.78	16.83	13.00	18.61	15.80
8	13.50	15.35	19.98	22.36	16.74	18.86	14.43	21.17	17.80
9	17.36	18.39	24.20	27.72	20.78	23.06	17.88	25.96	21.92
Combined	-	-	-	-	13.26	14.29	11.36	16.20	-

IM = Internal males
IF = Internal females
EM = External males
EF = External females
I = Internals
E = Externals

The highly significant locus of control X characteristics interaction was investigated using t tests. At every number of the characteristics the internals were faster than externals ($t = -3.857$; -5.508; -4.857; -7.127; -8.905; -10.700; and -12.825 for numbers 3,4,5,6,7,8, and 9 of the characteristics respectively; all the t values are significant at .0005 level of significance). Thus as the characteristics increased from 3 to 9 so did the differences between internals and externals (except for 5 characteristics where the difference is slightly reduced).

Investigation of the sex X characteristics interaction using Tukey's q tests show that for numbers 5,7,8 and 9 of the characteristics males were faster than females ($q = 3.995$, $P<.01$; $q = 9.318$, $P<.001$; $q = 9.636$, $P<.001$; and $q = 10.364$, $P<.001$ respectively). There were no significant differences between males and females for numbers 3,4 and 6 of the characteristics. Thus as the characteristics increase in number (especially from 7 onwards) the differences between males and females also increased.

As the variability caused by locus X sex X characteristics triple interaction is so low compared to that due to locus X characteristics interaction, it did not warrant further examination.

iv Solution Time

Mean scores of solution time are presented in Table 5.11.

Table 5.11

Mean scores for solution time as a function of locus of control, sex, and the seven numbers of characteristics.

Number of Characteristics	IM	IF	EM	EF	M	F	I	E	Combined
3	8.44	9.90	15.52	17.88	11.98	13.89	9.17	16.70	12.93
4	10.18	11.33	15.08	15.84	12.63	13.58	10.75	15.46	13.11
5	6.59	7.00	11.05	10.58	8.82	8.79	6.79	10.81	8.80
6	7.31	7.82	11.12	10.07	9.22	8.95	7.57	10.60	9.08
7	6.16	7.76	10.47	8.97	8.31	8.36	6.96	9.72	8.34
8	6.36	8.23	9.60	9.29	7.98	8.76	7.30	9.44	8.37
9	6.29	8.33	9.85	12.19	8.07	10.26	7.31	11.02	9.17
Combined	-	-	-	-	9.57	10.37	7.98	11.96	-

IM = Internal males
IF = Internal females
EM = External males
EF = External females
I = Internals
E = Externals

An analysis of variance of solution time scoresproduced the following significant differences: highly significant locus of control and characteristics main effects; and significant locus X characteristics and sex X characteristics interaction (see Table 5.12).

Table 5.12

Summary of analysis of variance of solution time as a function of locus of control, sex, and the seven numbers of characteristics.

VARIATION	SS	DF	MS	F	P
Between People	7002.90	91			
A (locus of control)	2559.31	1	2559.31	52.35	<.001
B'(sex)	102.48	1	102.48	2.10	
AB	39.31	1	39.31	0.80	
Subj W. Groups	4301.81	88	48.88		
Within People	7553.76	552			
C (condition)	2449.92	6	408.32	48.21	<.001
AC	434.74	6	72.46	8.55	<.01
BC	129.08	6	21.51	2.54	<.05
ABC	67.71	6	11.29	1.33	
C X subj W. Groups	4472.31	528	8.47		
Total	14556.67	643			

Inspection of the mean scores indicate that solution time increased slightly as the characteristics increased from 3 to 4. However, when the characteristics increased from 4 to 5 solution time dropped sharply and remained relatively constant from 5 to 9

characteristics. This stability of solution type for the number of characteristics of >5 was also reported by Johnson et al (1961). Considering the differences between internals and externals, the prediction was upheld, the internals' solution time was faster than that of the externals'. Unlike total preparation time, the variability in solution time due to the locus of control main effect is greater than that of characteristics main effect.

Investigation of the locus X characteristics interaction using t tests indicatedthat for each number of the characteristics, internals were faster than internals (t = -17.512; -10.953; -9.349; -7.047; -6.419; -4.977; and -8.628 for numbers 3,4,5,6,7,8 and 9 of the characteristics respectively; all the t values are significant at the .0005 level). Thus the difference between internals and externals was greatest for 3 and 4 characteristics, then as the characteristics increased, the difference, though still significant, was reduced. However, at 9 characteristics the difference increased sharply. These results together with those of total preparation time are plotted in Figure 5.3.

Inspecting the sex X characteristics interaction, using q tests, show that males were faster at numbers 3 (q = 3.411; $p<.05$) and 9 (q = 3.911; $P<.01$) of the characteristics. All the other differences were not significant. Thus males solved the problems quicker than females only at the extreme ends of the range of characteristics.

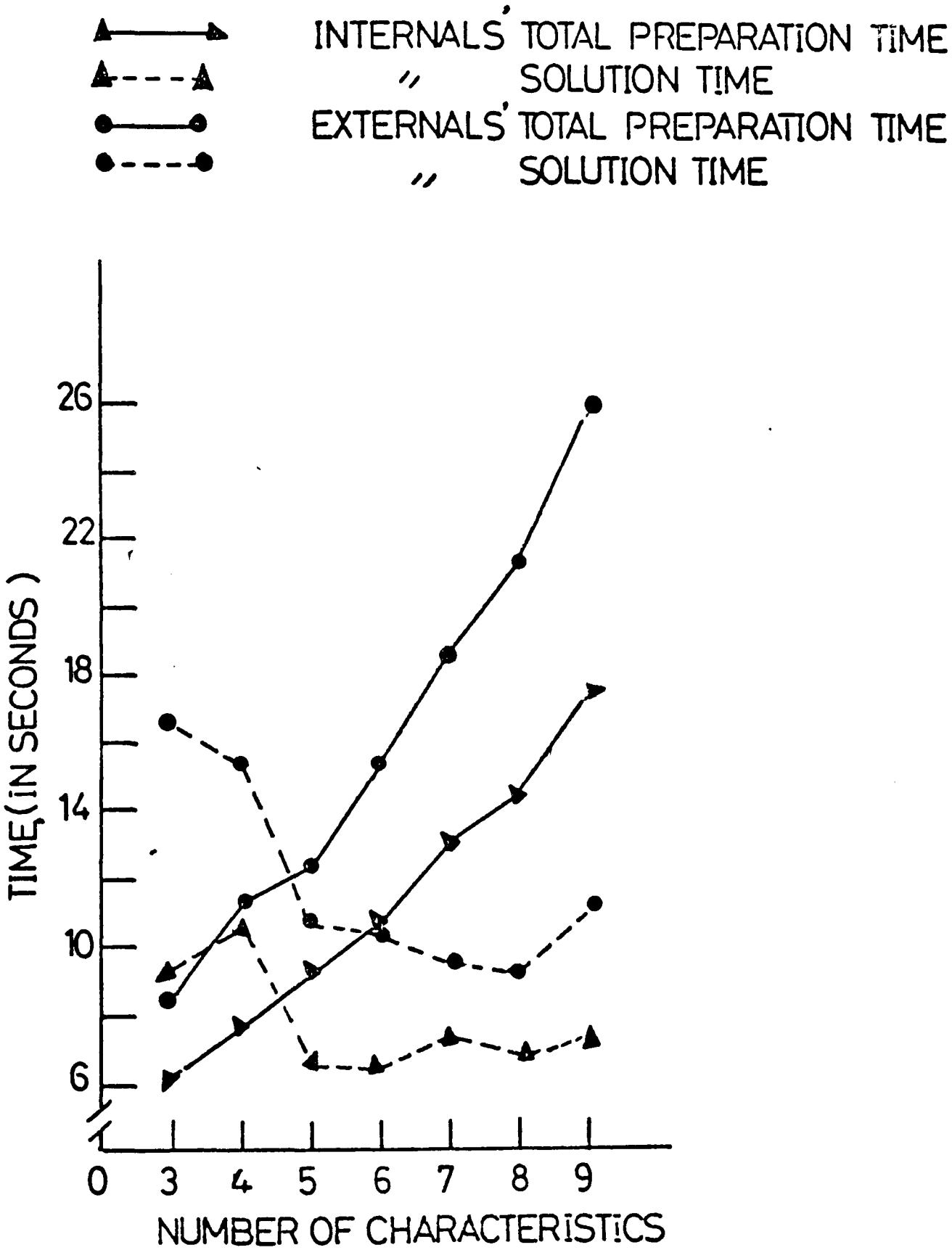


Figure 5.3

Interaction between locus of control and total preparation and solution times for the seven numbers of characteristics.

v Approaches to Solve the Problem

The first part of the post-task questionnaire dealt with two approaches subjects possibly might have used while working on the problems. Subjects responded to the following two approaches by putting a cross against the approach(es) they used: "Tended to conceptualise the appropriate object while examining the characteristics' list, and before looking at the objects' list" and "In addition to matching the appropriate object with characteristics, I tried to compare all the five objects with each other". Subjects were also asked whether or not they employed the "conceptualisation of the objects" approach for the obvious objects. It was expected that internals and externals would differ in utilising these two approaches.[5]

The number of internals and externals employing the two approaches was very close. Subjects tended to conceptualise obvious objects before being exposed to them more often than comparing the five objects, in any objects' list, with each other (see Table 5.13).

---

5 Subjects were observed to use these particular approaches in the pilot studies. This is why they were specified in the post-task questionnaire.

Table 5.13

Number of subjects using the listed approaches as a function of their locus of control and sex.

	APPROACHES			
Ss	a	b	c	d
IM	20	0	20	18
IF	21	0	21	17
EM	21	0	21	15
EF	23	0	23	18
I	41	0	41	35
E	44	0	44	33
Combined	85	0	85	68

a = Conceptualisation of objects.

b = 'a' but for all objects

c = 'a' but for obvious objects only

d = comparison of objects

iv Errors

The experimenter kept a record of all the errors (over the 24 trials) for each subject. Generally the errors were low for most subjects, indicating that the task was not a very difficult one. The frequency of errors, and the number of subjects making them, across the seven characteristics are presented in Table 5.14. The number of errors for internals and externals was not very different (96 versus 93 respectively). Results of the number of internals and externals making less than 4 or 4 and more errors were arranged in a contingency table and analysed using a X^2 corrected for continuity (Siegel, 1956).

Table 5.14

Frequency of errors and number of subjects making the errors as a function of locus of control, sex, and the seven characteristics.

		NUMBER OF CHARACTERISTICS						
	Ss	3	4	5	6	7	8	9
Frequency	IM	5	6	7	10	9	6	4
	IF	7	9	5	9	10	5	4
	EM	2	7	8	10	8	4	4
	EF	8	7	10	8	5	5	7
	I	12	15	12	19	19	11	8
	E	10	14	18	18	13	9	11
Number of Subjects	IM	5	3	6	6	4	4	3
	IF	5	7	3	7	6	4	3
	EM	2	6	6	9	6	3	4
	EF	7	5	8	7	3	5	6
	I	10	10	9	13	10	8	6
	E	9	11	14	18	9	8	10

IM = Internal males
IF = Internal females
EM = External males
EF = External females
I = Internals
E = Externals

Internals and externals did not differ significantly in the number of errors they made over the 24 trials (X^2 = .14;n.s.)

It is interesting to note that, once again as in the first study, although internals and externals differed considerably in their cognitive responses (i.e. switchbacks), the solution per se (naming the correct word) was the same for both groups.

Task performance measures (except approaches to solving the problem) were intercorrelated for internals and externals. The resulting matrix (Table 5.15) indicates that where as the correlations among total preparation time and all the types of switchbacks were highly significant and positive for internals, the same correlations were very low for externals. This indicates that for internals as preparation time increased so did the number of switchbacks; whereas these two variables were unrelated for externals. Thus for an internal the amount of time he spent scanning the characteristics is directly related to the number of switchbacks he made. Obviously the longer he took the more difficult he found the task and thus the more switchbacks he made between the lists. The number of switchbacks made by an external, however, was not contingent upon the time he spent studying the characteristics. Externals used switchbacks when their preparation time was short and the item described was relatively easy to identify, and when this time was long and the item described was more difficult to identify. Both groups appear to handle information differently. It is interesting to note that solution time and half switchbacks were significantly, positively correlated for internals only. Half switchbacks comprised the majority of switchbacks employed by internals. Moreover, the correlations between half switchbacks and either overall or standard switchbacks were only significant (and positive) for internals. This is expected since externals used very few half switchbacks as compared to internals. All the other significant correlations in Table 5.13 are obvious.

Table 5.15

Correlations among total preparation time (T.P.T.), solution time (S.T.), errors (E.) overall switchbacks (O.SW.), standard switchbacks (S.SW.), half switchbacks ($\frac{1}{2}$SW.), double switchbacks (D.SW.), and double + switchbacks (D. + SW.) for internals (INT.: N = 46) and externals (EXT.: N = 46).

		S.T.	E.	O.SW.	S.SW.	$\frac{1}{2}$SW.	D.SW.	D+SW.
T.P.T.	INT.	.821b	-.150	.526b	.490b	.439b	.457b	-*
	EXT.	.699b	.056	.196	.241	.037	.049	.149
S.T.	INT.		-.188	.311	.256	.299a	.234	-
	EXT.		.013	.195	.262	.005	.041	.119
E.	INT.			.060	.028	.047	.195	-
	EXT.			.084	.042	.149	.044	.104
O.SW.	INT.				.910b	.894b	.663b	-
	EXT.				.905b	.106	.891b	.768b
S.SW.	INT.					.638b	.665b	-
	EXT					-.101	.670b	.507b
$\frac{1}{2}$SW.	INT.						.436b	-
	EXT.						-.008	-.025
D.SW.	INT.							
	EXT.							-
D+SW.	EXT.							.876b

a = P<.05 b = P<.01

* Double + switchbacks are not included for internals as they did not employ any.

Summary of the Results of Task Performance

Task familiarity check indicated that subjects were unfamiliar with the task. The predictions regarding preparation and solution time and switchbacks were strongly supported: internals, as compared to externals, took shorter time to rehearse the characteristics and name the correct objects and utilised much less standard and double switchbacks (no internal used double + switchbacks). Internals also employed more half switchbacks than externals. Both internals and externals tended to conceptualise the obvious objects while scanning the characteristics and before viewing the objects. Both groups had identical number of errors which was low.

Preparation time and switchbacks were positively related for internals and were independent for externals. Therefore, it is clearly demonstrated that internals and externals dealt with the task in different ways, without there being any significant differences in their success in naming the correct objects. Sex differences in preparation and solution time were small compared with those due to locus of control and the different number of characteristics.

B. Perception of, and Reactions to, the Task

The second part of the post task questionnaire was concerned with the subjects' involvement in the experiment and their perception of skill versus chance determination of the task. As indicated in the method section all the indices pertaining to subjects perception of, and reaction to, the task were measured using a 9 point rating scale.

i Interest Scores

Subjects responded to the following question: "How interested were you in the task?". The mean scores are reported in Table 5.16.

Table 5.16

Mean ratings of the subject's interest in the task as a function of locus of control and sex.

	SEX		
SUBJECTS	MALES	FEMALES	COMBINED
Internals	7.74	7.91	7.83
Externals	7.70	7.74	7.72
Combined	7.72	7.83	7.78

Low score indicates disinterest, high score the reverse.

The data were analysed using a 2x2 factorial design (locus of control X sex). This design is used for all subsequent analyses in this section. A summary of the analysis of variance of interest scores is presented in Table 5.17.

Table 5.17

Summary of the analysis of variance of the subjects' ratings of their interest in the task as a function of locus of control and sex.

VARIATION	SS	DF	MS	F	P
A (locus of control)	0.27	1	0.27	0.29	
B (sex)	0.27	1	0.27	0.29	
A X B	0.10	1	0.10	0.11	
Within cell	81.57	88	0.93		
Total	82.21	91			

No significant effects were obtained, and as Table 5.16 shows subjects found the task to be reasonably interesting.

ii Effort Scores

The mean scores for the subjects' responses to the question "When trying to name the correct object, how hard did you try?" are presented in Table 5.18.

Table 5.18

Mean ratings of the subjects' effort exertion while working on the task as a function of locus of control and sex.

	SEX		
SUBJECTS	MALES	FEMALES	COMBINED
Internals	8.61	8.48	8.54
Externals	8.09	8.68	8.37
Combined	8.35	8.58	8.46

Low score denotes less effort, high score the opposite.

Analysis of variance of effort scores produced significant locus X sex interaction ($F = 4.87$; df 1/88, $P<.05$) which was the only significant difference obtained. Generally, all subjects expended great effort while working on the task (see Table 5.16). Inspecting the significant interaction using Tukey's q tests indicated: that internal males exerted more effort than external males ($q = 3.250$; $P<.05$), and that external females expended greater effort than external males ($q = 3.688$; $P<.05$). The external males had the lowest effort score, while external females scored the highest. These differences are relative to each other as all subjects had high effort scores.

iii Like Scores

The subjects responded to the question "How much did

you like the task?" Table 5.19 shows mean scores for 'like' scores.

Table 5.19

Mean ratings of the subjects' liking of the task as a function of locus of control and sex.

	SEX		
SUBJECTS	MALES	FEMALES	COMBINED
Internals	7.91	7.48	7.70
Externals	7.43	7.61	7.52
Combined	7.67	7.55	7.61

Low score denotes dislike, high score the opposite.

No significant effects were obtained from the analysis of variance of 'like' scores and, as Table 5.17 indicates, all the subjects liked the task.

Mean scores for 'like' and 'interest' (see tables 5.16 and 5.19) are very similar suggesting that these two indices measure much the same thing. These results contradict those obtained in the first study where 'interest' scores were higher than 'like' scores.

iv Task Perception Scores

This index measures the subjects own perception of task

control. The mean scores for the subjects' responses to the question "How much do you think this was a task which depended on skill or chance?" are shown in Table 5.20.

Table 5.20

Mean ratings of the subjects' perception of the task control as a function of locus of control and sex.

	SEX		
SUBJECTS	MALES	FEMALES	COMBINED
Internals	8.13	7.74	7.54
Externals	6.96	7.13	7.09
Combined	7.55	7.44	7.32

Low score indicates chance control, high score the reverse.

The analysis of variance of task perception scores resulted in a highly significant locus of control main effect ($F = 14.03$, df 1/88, $P<.001$). The other differences were not significant. The mean scores (Table 5.20) reveal that internals perceived the task as being more controlled by skill than externals. Most of the variability was caused by internal and external males. Internal males scored the highest while external males scored the lowest. Generally all the subjects construed the task to be skill controlled.

v. Task Difficulty Scores

Task difficulty rating ranged from "the task was too easy for me" to "the task was too difficult for me". Mean scores for task difficulty are presented in Table 5.21.

Table 5.21

Mean ratings of the subjects' perception of task difficulty as a function of locus of control and sex.

	SEX		
SUBJECTS	MALES	FEMALES	COMBINED
Internals	3.61	4.35	3.98
Externals	5.13	5.17	5.15
Combined	4.37	4.76	4.57

Low score indicates less difficulty, high score the opposite.

The analysis of variance of task difficulty scores produced a highlysignificant locus of control main effect ($F = 17.81$; df 1/88, $P<.001$) which was the only significant difference obtained. Inspection of the means (Table 5.21) indicated that internals construed the task to be easier than externals. However, again these differences are relative to each other as all the subjects considered the task to be easy. Thus the ease of the task was reflected by both the subjects' own ratings and their low error rates.

vi Ability Scores

Ability ratings ranged from "I lack the ability to perform such a task" to "I am very able to perform such a task". Mean scores for ability are shown in Table 5.22.

Table 5.22

Mean ratings of the subjects' perception of their ability to solve the task as a function of locus of control and sex.

	SEX		
SUBJECTS	MALE	FEMALE	COMBINED
Internals	7.04	6.65	6.85
Externals	6.70	5.91	6.30
Combined	6.87	6.28	6.58

Low score denotes inability, high score the reverse.

The sex main effect was the only significant difference ($F = 4.50$; df 1/88, $p<.05$) obtained from the analyses of variance of ability scores. As the mean scores indicate males felt that they were more able to perform the task than females. Further, internal males exhibited the highest scores, while external females displayed the lowest scores. Generally, the subjects were not quite sure that they possessed the full ability to perform the task.

vii Number of Internals and Externals who wrote Comments

At the end of the post-task questionnaire, the subjects were given the option of writing their comments about their performance or any aspects of the task. Sixty-nine subjects wrote comments. The number of internals who wrote comments was 40 (21 males and 19 females) while the number of externals who wrote comments was 29 (15 males and 14 females). These results were arranged into a contengency table and analysed using a X^2 corrected for continuity. More internals wrote comments than externals $X^2 = 5.797$, df = 1, $P<.02$, two-tailed). Most of the subjects' comments were about the nature of the task (i.e. remarks on certain words, how well the experiment was controlled etc).

Summary of the Results of the Subjects' Reaction to the Experiment

The subjects liked the task, found it interesting, worked hard at it, construed it as skill controlled, perceived it as easy, and were not completely positive about their ability to perform the task. However, the internals, relative to externals, viewed the task as being more self controlled and easier. They also wrote more comments about the task than externals.

5.5 DISCUSSION

The different approaches adopted by internals and externals in handling their solution hypotheses (first study) were further investigated by the present study. Below is a summary of the results obtained.

1. All subjects construed the task to be a completely unfamiliar one.
2. Predictions regarding preparation and solution time and switchbacks were strongly supported; internals were significantly faster than externals who employed many more switchbacks than internals. Moreover, the correlations between preparation and solution time and switchbacks were significantly positive for internals only.
3. No significant differences in errors between internals and externals were obtained. Both groups were equally successful in naming the correct words.
4. Internals rated the task as being significantly more controlled by skill and significantly less difficult than externals. Effort and ability ratings were affected by sex differences. All the subjects found the task to be an interesting one.
5. Significantly more internals than externals wrote

comments about either their performance and/or the task.

The second study has further demonstrated that internals and externals differ in their assimilation and processing of information, although attainment of the solution per se was the same for both groups. These findings not only corroborate those by Bartel et al (1972), Lefcourt and Wine (1969), Phares (1968) and Wolk and DuCette (1974), but have also demonstrated that the ability to solve the task does not identify differences between internals and externals as readily as their approaches to the task. Except for the Bartel et al study, the other studies drew their conclusions about the cognitive activity of internals and externals from results concerning solution attainment. The results pertaining to task performance are discussed below, first, followed by those relating to the subjects' perception of, and reactions to the experiment.

a. Task Performance

i Initial and Total Preparation Time and Solution Time

The internals in the second study had shorter initial preparation times than the externals. Thus they may be regarded

as faster in scanning information than externals. They seem to assimilate the same information necessary for an adequate solution as externals, but more quickly. Since the task employed in the second study was relatively easier than that used in the first study, and the time constraint was absent, it could be argued that the internals' scanning of information may be more efficient than that of the externals when working on an easy task and at their own pace. The externals, on the other hand, clearly deliberated on the information longer in order to assimilate it. Perhaps the externals' inability to pick up subtle cues in ambiguous conditions (cf. Lefcourt and Wine, 1969) is due to the fact that they need more time than internals to assimilate these cues. Task difficulty and the time factor appear to be significant factors in influencing the problem solving behaviour of internals and externals.

The second study has also demonstrated that the externals' total preparation and solution time was much longer than that of the internals. Thus internals not only scan information faster than externals, but also process it more quickly. This is one sense in which internals are more cognitively 'active' than externals. They seem to possess the ability of rapidly acquiring the elements of a relatively easy task, and solving it almost effortlessly.

ii Switchbacks

The externals utilised more switchbacks than internals. The externals' longer preparation time and greater number of switchbacks could be regarded as means of increasing the saliency of information to facilitate assimilation. This process allows the externals to ponder and extract more information which, if processed at a faster speed and with less switchbacks, especially standard and double switchbacks, offer an easy way of strengthening the saliency of preparation and solution items, and it was the externals who employed these latter types of switchbacks more than internals. Thus externals, relative to internals, not only require more explicit cues to facilitate their problem solving abilities (Lefcourt, 1967; Lefcourt and Wine, 1969; Wolk and DuCette, 1974), but would themselves increase the saliency of information if allowed to do so. The externals' ability to relate to their environment is more dictated by its prominent features than is true of internals who are also sensitive to less prominent ones. Thus it is not surprising that both internals and externals performed equally well (in terms of their low number of errors). It seems that the more salient a task becomes, the more likelihood that externals would perform as well as internals. The lack of any significant differences between the two groups as far as solution per se is concerned, therefore, may be due to the availability

of switchbacks for the externals and the lack of any time constraints. How they would perform if not given the opportunity to switchback is an open question and deserves further investigation.

Another important difference between internals and externals is in the types of switchbacks employed. More internals used half switchbacks than externals. In a half switchback subjects 'hold' the objects' list in their head (or immediate memory) while scanning the characteristics' list for the second time, and then name the appropriate object without switching to the objects' list. This kind of switchback is certainly less redundant than standard switchbacks, or even double and double plus switchbacks. The issue is not merely that internals used more half switchbacks than externals, but that they employed fewer total switchbacks. Internals seem to be more able to <u>hold</u> certain information in their head while processing other information. It is important to realise that the nature of the the task, task difficulty, and time constraints seem to affect the cognitive functioning of internals and externals differently.

It was argued in the first study that internals and externals set themselves different criteria for testing and rejecting their solution hypotheses. The internals in that study used relatively more trials per solution hypothesis, while the externals seemed to abandon an hypothesis without

fully exploring it and they often returned to it later. It was also argued that such different criteria were the result of the time constraints and the high level of task difficulty. In the present study there were no time constraints as subjects worked at their own pace. Moreover, the task in this study was relatively easier than that employed in the first study as manifested by the subjects' ratings and low error rates. Therefore, when the time constraints are minimal and the nature of the task is easy, then internals' capacity for processing information effectively is superior to that of the externals.

The results also showed that as the number of characteristics increases, the object being described becomes more obvious. This can be seen in Figure 5.3 which indicates that as the number of characteristics increased from 3 to 5, the solution time dropped sharply. When the number of characteristics was small (3 or 4), little information was conveyed and subjects required more time to name the object. What is puzzling is that externals employed many switchbacks even when the number of characteristics was 3 and 4, while internals rarely used them for that number of characteristics. This raises the question whether externals failed to hold in their memory as few as 3 characteristics. What is also interesting is that although both internals and externals conceptualised obvious objects while scanning the characteristics and before being exposed to the objects' list, the externals

nevertheless switched back more than externals. Does this mean that externals forgot the conceptualised object when being exposed to the objects' list and/or that they conceptualised the wrong object?

The externals whenfaced with the objects' list might attempt to test each characteristic in their head against an object. In doing so they increase the chances of forgetting the remaining characteristics because they are dealing with them in a discrete manner. Thus they switched back to the characteristics, refreshed their memory, and then switched to the objects' list. Indeed the externals' employment of many more double and double plus switchbacks than internals supports the above line of thought. In double and double plus switchbacks subjects went back and forth more than once between the characteristics and the objects. These switchbacks seem to transfer the characteristics' and objects' lists from being separate into being simultaneous. In other words, double and double plus switchbacks render both lists so salient that they do not look separate.

The internals, on the other hand, when examining the objects' list, seemed to be comparing <u>all</u> the characteristics with the five objects thus rendering a switchback unnecessary. They did not appear to handle information discretely, but treated the characteristics' and objects' lists as a whole. Externals, relative to internals, have been shown to deal with the components

of a task in a discrete fashion and with inefficient allocation of attention and structuring of stimuli (Wolk and DuCette, 1974). In the first study of this research, the externals utilised more solution hypotheses and changed them more frequently than internals, who used only a few solution hypotheses because of their different criterion for rejecting them. This cautious thoroughness approach of the internals in the first study is not evident in the second study because the task was easy and internals processed the information quickly and accurately. However, the externals' approach in the first study which was explained as "labile" seems to have manifested itself again in the second study in the sheer number of switchbacks utilised by the externals.

Moreover, the correlations between decision time (preparation and solution time) and switchbacks further buttresses the above argument. These correlations were low and non-significant for externals, while they were highly significant and positive for internals. Thus as preparation and solution time increased for internals they used more switchbacks, but the externals' use of switchbacks evidenced no such consistency (cf. p.186).

It is interesting to note that the majority of the subjects' switchbacks occured when the number of characteristics was 6 (see Table 5.7), although their total preparation time was not longer for those characteristics as compared with 7, 8 and 9 characteristics. This was due to the fact that the subjects' initial preparation time for 6 characteristics was shorter than

that for 7, 8 or 9 characteristics. Also the subjects' switchbacks' time for 6 characteristics was shorter than that for 7, 8, or 9 characteristics. The peak of the number of switchbacks used at 6 characteristics is difficult to explain and may be an artefact due to the specific items made up of 6 characteristics.

Other explanations of the differences in switchbacks between internals and externals are failure of memory and/or low confidence. It may be argued that externals switched back simply because they forgot the materials. However, it is the causes of this "forgetting" which makes the differences between internals and externals interesting, and a probable reason for this "forgetting" has already been explored (i.e. the tendency to handle the information in a discrete manner). If externals are characterised by a less effective memory (for whatever reason) then switchbacks will help by increasing task saliency.

It may also be argued that externals' employment of many switchbacks was a means of assuring themselves of the appropriate object. In other words, externals lacked the confidence of naming an object without switchbacks. Again this is a valid issue, however, the task was rated as being easy by externals. Still it may be that externals construed the task to be an easy one because they switched back. Confidence may not be very meaningful if taken out of the context of externals'

performance on the task. If switching back increased the externals' confidence, the question becomes why? Is the externals' confidence contingent upon information saliency? That is to say, are externals only confident in situations where events are less subtle? It may be that they lack confidence in ambiguous conditions due to their inability to extract task relevant information.

It is interesting to note that sex differences were only significant in total preparation time. Males were found to be faster than females. It is a typical finding that males' reaction time is faster than their female counterparts' for these kinds of tasks (Woodworth and Schlosberg, 1954). Moreover, sex differences did not seriously affect total preparation time data as the variability due to sex was much smaller than that caused by locus of control differences.

b. Perceptions of, and Reactions to, the Experiment

Turning now to the subjects' perception of, and reactions to the experiment: internals construed the task as being more skill controlled and rated it as easier than externals. These results are in line with the internal's perception of themselves as determining their own behaviour. It is also understandable that they should regard the task as very easy since their preparation and solution times were fast and their error rates

were low. However, both internals and externals conceived the task to be skill determined and easy to perform, although this was significantly more true of the internals. It seems that task difficulty and situation locus of control (skill versus chance) affect reaction times differently. In the Rotter and Mulry (1965) and Lefcourt et al (1968) studies internals had longer decision times when the task was difficult and skill determined. However, in the present study, when the task was easy and determined by skill, internals' reaction times became faster than those of the externals. Thus it may not only be the nature of situation locus of control which influences reaction times (as suggested by Lefcourt et al, 1968), but also the level of task difficulty.

It could be that externals construed the task as being self determined because they were allowed to employ switchbacks (i.e. switching back gave the externals more sense of mastery). It may be conjectured that as the task becomes more salient (either by cue explication or switchbacks) the externals might develop internally controlled expectancies. Lefcourt (1967) offered some support for this line of thought.

Both internals and externals rated the task to be interesting, and demanding high effort. Thus it seems that both groups were motivated to work on the problem. Sex differences affected the effort and ability ratings. External females reported the highest effort ratings and the lowest

ability ratings. External females may have worked harder because they thought that they lacked the ability to perform the task. Internal males, on the other hand, displayed the highest ability scores. They seemed to be highly confident of performing well on the task. Although Rotter (1966) maintained that sex interactions with locus of control were minimal, Lefcourt and Wine (1969) argued that the males' desire to appear as the controller of their actions may affect such an interaction.

Significantly more internals than externals wrote comments about either their performance and/or the task. Writing comments may be regarded as a sign of greater involvement. Thus although both internals and externals rated the task as being equally interesting, the internals seem to have been more involved in the task than the externals. Although it is purely conjectural that writing comments is a measure of involvement, it is a typical finding that internals are more involved in the tasks they engage in (Karabenick, 1972).

c. Conclusions

Internals and externals are characterised by distinctive approaches to problem solving. The ways in which they handled their solution hypotheses (first study), and processed information (second study) were different. Most significant is the fact

that in both these studies, where different tasks were employed, internals and externals displayed the same problem solving behaviour characteristic of each group.

CHAPTER 6

THIRD STUDY

6.1 INTRODUCTION

The aim of the third study was two fold: first, to attempt to overcome some methodological problems that were associated with the first study; and second, to investigate further the generalisability of the cognitive responses of internals and externals which were identified in the first two studies.

The recording of solution hypotheses used in the first study lacked some reliability, due to the fact that subjects indicated their solution hypotheses at the end of the experiment, and hence depended on the accuracy of their recall.

Although internals and externals approached the tasks of the first and second studies differently, it made no difference to their performance (i.e. solution per se). The task of the first study was too difficult and the one employed in the second study was relatively easy. Therefore, for this present study, a concept formation task was devised which was of more intermediate difficulty and allowed subjects to indicate the solution hypothesis they used following each trial. In this way the manner of hypotheses utilisation was more closely

monitored. The task lasted for twenty four trials. On each trial subjects were shown a "set" made up of two letters and two numbers (e.g. CA16) and they were required to find a common principle (or concept) which was used in the construction of some of the sets.

Measurement of the degree of the subjects' confidence in identifying the principle was also taken, as the wide-spread use of switchbacks by externals in the second study might have reflected their low level of confidence. There were three confidence indices: one before commencing the task (initial confidence); one while working on the task (middle confidence); and one after completing the task (post confidence). These three indices were included to account for any differential confidence shifts between internals and externals. Previous studies have shown the internals' initial confidence to be higher than that of the externals (Ryckman, Gold, and Rodda, 1971; Johnson and Kilmann, 1975). No differences in confidence shifts were found in these studies between internals and externals (i.e. all subjects raised their confidence following success and lowered it after failure).

As regards performance, it was difficult to tell which of the two groups (internals or externals) would be better at deciphering the principle. Hickey (1976), after finding that internals outperformed externals in solving anagrams, argued that internals tended to perceive the problem as a whole and

manipulated the stimuli within that whole better than externals, who failed to construe the task in a coherent way.

Wolk and DuCette(1974) offered the same line of thought. These differences may be due to the different methods by which internals and externals approach a problem; the internals' more systematic way of processing information, and the externals' more labile handling of the task's components. However, since the solution of the problem was the same for internals and externals in the first and second studies, there is no clear precedent for predicting which, if either, of the two groups would be better at discovering the principle underlying the construction of the sets.

6.2 PREDICTIONS

Although there is strong evidence to suggest that internals solve problems better than externals (DuCette and Wolk, 1973; Hickey, 1976; Lefcourt et al, 1973; Lefcourt and Wine, 1969; Phares, 1968; Wolk and DuCette, 1974) the results of the first two studies make clear-cut predictions somewhat equivocal. Therefore, no specific predictions are made concerning differences between internals and externals in their ability to discover the principle. Differences between the groups in the number and use of solution hypotheses are also difficult to predict as this task is only of intermediate difficulty, however,

similar trends to those found in the first study seem possible as the tasks are similar.

As regards confidence ratings, it is predicted that internals initial confidence will be higher than that of the externals. No predictions for middle and post confidence were made since it was not known at what stage of the trials the subjects would find the principle.

Perceptions of, and reactions to the experimental indices (similar to those employed in the first and second studies) were also included to supplement the data for task performance. It is expected that internals, relative to externals, will perceive their performance and the task to be more skill oriented.

6.3 METHOD

a. General Synopsis

The study consisted of two phases. During the first, conducted two months prior to the second, all the subjects completed Rotter's I-E scale in order to determine their locus of control. In the second phase internals and externals were tested in group sessions to assess their performance on the task. When they finished the task, the subjects were given the post-task questionnaire which contained items related to their perception of, and reactions to, the experiment. A debriefing session concluded the study.

b. Assessment of Internality and Externality

The overall mean of the I-E scores (N = 40) was 11.47. Internals were defined as those subjects scoring 11 and below, while externals were those subjects scoring 12 and above. Thus in the three studies the criterion of allocation of I-E scores was the same.

c. Experimental Design

The sample was comprised of 40 subjects, half were

classified as internals (11 males and 9 females), and the other half as externals (8 males and 12 females). Data were analysed using 2x2 factorial design (locus of control X sex) with unequal number in cells (least square analysis). This design is presented in Table 6.1

Table 6.1

Experimental Design of the Third Study

	SEX	
SUBJECTS	MALES	FEMALES
Internals	11	9
Externals	8	12 (13)*

( )* = The number originally assigned to this cell. The subject was omitted as she refused to perform the task.

d. Selection of Subjects

Subjects were introductory psychology students (from the 1977 class) at Stirling University. Early in the academic year the whole class was administered Rotter's I-E scale. Two months later subjects were solicited via a notice board and received a course credit each for their participation. However, since the number of those volunteered contained more externals than internals (17 versus 12), 11 (8 internals and 3 externals)

from the same population were offered one pound for acting as subjects in the experiment. The 11 students were sent letters urging them to participate. All of them reacted positively to the letter. One subject (an internal female) refused the one pound asserting that she just wanted to help.

Originally 41 subjects took part. However, one subject (an external female) refused to do the experiment, after reading the instructions, claiming that she lacked the ability to perform the task.

e. Instruments

i Rotter's I-E Scale: (see the first study).

ii The Task

The task employed in the first study was almost impossible to solve, but allowed for the formation of solution hypotheses, while in the second study, the task was relatively easy and generated specific behaviour (i.e. switchbacks) particularly with the externals. The main aim in constructing the present task was to strike a balance between these two extremes of difficulty and ease. In other words, a task whose solution is more accessible to certain subjects than others. The task should also provide some room for creating solution hypotheses.

f. Pilot Studies

Numerous pilot studies were carried out to arrive at a task that would satisfy the above specifications. The chosen task was loosely based on the one adopted by Mandler, Cowan and Gold (1964). Mandler et al investigated the effect of prior training when a concept was present (a positive instance) and when it was not present (a negative instance) on performance. The dimensions of the concept employed by Mander et al were: 4 letters of the alphabet; 4 numericals, and 2 types (upper and lower case).

The dimensions employed in the present study were: 2 letters of the alphabet and 2 numericals (for example CA16). Many different principles were tested and proved to be either too difficulty or too easy. However, one principle produced a 50% chance of being detected (i.e. almost half of subjects discovered it and the other half could not). The principle was that whenever "A" and "3" were present in a set, the set contained the principle. Thus the sets AC13 and BA43 contain the principle while the sets CD26 and DB16 do not contain the principle. The subjects were presented with 24 sets some of which contained the principle (positive instances) and some of which did not contain the principle (negative instances).

g. Specifications of the Task Employed in the Experiment Proper

There were 24 trials comprised of 24 sets. All these sets are presented in Appendix 3. There were 15 positive sets (i.e. containing the principle) and 9 negative sets (i.e. not containing the principle), following Mandler and Cowan's (1962) and Mandler et al's (1964) findings that when the positive instances exceed the negative ones the concept becomes more approachable. The positive and negative instances were randomly distributed except for the first two sets. This was necessary to influence the formation of solution hypotheses at the early stages of the trials, for during pilot studies subjects attached great importance to the order of numbers and letters (e.g. in the set CD12, "C" comes before "D" and so does "1" and "2"). An "A" or a "3" were never included in a negative set[1].

The task was designed for group testing, and thus was presented in a booklet form. The booklet contained 24 trial sheets, feedback sheets, and confidence rating scales. A sample of a trial page is presented overleaf.

---

1 Including "A" or "3" in negative sets confused many pilot subjects and rendered the task more difficult.

Sample

DA23

_____ This set contains the principle

_____ This set does not contain the principle

Please write down the strategy[2](ies) that you used:

Thus in a trial page a set was printed on the top with two statements underneath, and the subjects were required to tick one of them. After ticking one statement the subjects had to write down any solution hypothesis they employed. The subjects were told to write down guesses or any relevant reasons for choosing a particular statement. The next page (feedback sheet) informed the subjects whether or not the previous set contained the principle. Thus a positive feedback sheet contained the following statement: "The set contained the principle", and a negative feedback sheet contained the following statement "The set did not contain the principle". The subjects were exposed to only one feedback sheet at a time.

---

2 The term 'strategy' was used in the task instead of solution hypotheses so as not to confuse the subjects.

Three 9-point scales were presented before the first trial (labelled initial confidence), after the 12th trial (labelled middle confidence), and after the 24th trial (labelled post confidence). Post confidence was answered by those who failed to find the principle; it dealt with the degree of confidence in finding the principle if the number of trials was doubled. These scales are presented in Appendix 3.

h. Post-Task Questionnaire

The post-task questionnaire of the third study dealt solely with perception of, and reaction to, the experiment using a 9-point rating scale similar to that utilised in the first study. Subjects were asked: "How much do you think this was a task which depended on skill or chance?"; "How much do you think your performance on the task depended on skill or chance?"[3]; "How familiar was this task to you?"; "How difficult was this task for you?"; and "How interesting was the task?". One measure (task familiarity) served as a treatment check to find out whether or not the subjects had previous experiences with a similar task.

---

3 Performance perception was included to find out whether or not it would yield different reactions from the subjects as compared to their reactions to task perception. Performance perception may be more sensitive to differences between internals and externals as it directly involves their own behaviour.

At the end of the questionnaire the subjects were given the option of writing down comments about the task or their performance.

i. Procedure

Subjects were tested in groups. Originally groups of 8 subjects per session, were solicited, but this did not always materialise. The minimum number of subjects in a group was 4, and the maximum number was 8. Each testing session lasted for one hour.

Subjects were tested in a communications research laboratory which was made of a central area and 8 small cubicles, each equipped with a table and a chair. The central area allowed the experimenter to monitor each cubicle.

When the subjects arrived, each one was seated in a cubicle and was given the following instructions to read:

INSTRUCTIONS

This is a learning task and not an intelligence test. On each page of the booklet there is a set of two numbers and two letters (for example DC14). There are 24 instances of these sets (i.e. 24 trials). An underlying principle was used in constructing certain sets. In other words, certain sets contain a principle common to all these sets. The other sets were constructed in such a way so as not to contain the principle. Thus each set may or may not contain the principle. Your task is to find or learn the principle.

Under each set the following two statements are printed: "This set contains the principle" and "This set does not contain the principle". Examine each set (one at a time) and then indicate whether or not that set contained the principle by ticking (✓) the space on the left hand side of one of the above mentioned statements. Please make sure to tick an appropriate space each time you examine a set. After doing so, please write down the strategy or strategies which you adopted and which made you tick one of the spaces. For example, after ticking "This set does not contain the principle" state briefly the type of strategy(s) you used and which influenced your decision. Once you ticked an appropriate space and wrote the strategy(s) adopted, turn over the page immediately. On the following page you will be told whether or not the previous set contained the principle. Thus the page will read "THE SET CONTAINED THE PRINCIPLE" or "THE SET DID NOT CONTAIN THE PRINCIPLE". This page will be labelled the feedback sheet.

You are not allowed to look back at a previous set once you are exposed to the feedback sheet. Once you have read the feedback sheet please turn over the page immediately. On the following page you will find another set. Do the same as you did for the previous set (i.e. ticking the appropriate space, writing down the strategy(s) that influenced your decision, and then turning over to the feedback sheet). This procedure is to be repeated throughout the 24 trials. Please make sure to write down the strategy(s) adopted for each set. Remember that you cannot go back to a set once you are exposed to the feedback sheet.

Please examine and answer each set carefully, but do not spend too much time on any set. When you reach the last feedback sheet (the one following the last - or 24th - set) indicate on that sheet whether or not you found the principle by ticking one of the spaces provided. Also please write down the nature of the principle in case you found it.

If you think you found the underlying principle during the early stages of the trials, please continue answering each set in the manner described above until you reach the last trial. Do this even if you found the principle as early as the 5th trial.

Are there any questions? Please do not start until you are told to do so. I will further explain the nature of the task before you start.

When all the subjects finished reading the instructions, they were gathered in the laboratory's central area and the experimenter showed them a sample of the booklet explaining fully what was expected of them. The experimenter answered all the subjects' questions, and the experiment proper did not commence until it was clear that all the subjects understood all the instructions. Although it was not specified in the instructions, that the subjects should write down "guessing", the subjects were verbally instructed that if they guessed to write down "guessing". The subjects were also made aware of the confidence ratings scales. Subjects were asked to remain seated and not make any noise even if they had deciphered the principle before the end of the experimental session.

After this, subjects returned to their cubicles and were handed the booklets. On finishing the task, the booklets were withdrawn, and the subjects were given the post-task questionnaire[4]. While the subjects were answering the post-task questionnaire, the experimenter examined the booklets to check if they were answered appropriately. Subjects were then assembled in the laboratory's central area and were debriefed and told not to discuss the experiment with their classmates. Those who

---

4 If a subject finished before the others, his/her booklet was taken and was given the post-task questionnaire. After answering the questionnaire, the subject was told to remain seated and wait till all the subjects had finished.

volunteered had their course credit cards signed, while the others were paid one pound.

6.4 RESULTS

The third study was an attempt to continue some of the findings of the first study (i.e. mode of utilising solution hypotheses) with tighter experimental controls (mainly to safeguard against the effects of delayed memory on recalling solution hypotheses). Indices pertaining to the subjects' reactions to, and perception of, the experiment were also included to supplement the findings on task performance.

As in the case of the second study, a measure of task familiarity was taken in order to control for any past experience with the task. Hence, task familiarity check scores are presented first followed by distribution of I-E scores. Reports on task performance come next, and results of perception of, and reactions to, the experiment conclude the presentation.

a. Task Familiarity Check

One index of post-task questionnaire contained the following question: "How familiar was this task to you?". The mean scores of the subjects responses to the above question are

shown in Table 6.2. The data were analysed using a 2x2 (locus of control X sex) factorial design with unequal number in cells (least square analysis). This design was used for all subsequent analyses unless otherwise indicated.

Table 6.2

Mean ratings of the subjects' perception of the task's familiarity as a function of locus of control and sex.

	SEX		
SUBJECTS	MALES	FEMALES	COMBINED
Internals	8.00	8.11	8.06
Externals	8.13	8.83	8.48
Combined	8.07	8.47	8.27

Low score indicates fmailiarity, high score the reverse.

Analysis of variance of treatment check scores (summary of which is presented in Table 6.3) did not produce any significant differences, and as the mean scores show (Table 6.2) all the subjects considered the task to be a novel one. The externals displayed slightly higher scores than the internals.

Table 6.3

Summary of analysis of variance for the subjects' ratings of their familiarity with the task as a function of locus of control and sex.

	SS	DF	MS	F	P
A (locus of control)	2.500	1	2.500	2.863	
B (sex)	1.600	1	1.600	1.833	
AB	.869	1	.869	.996	
Within cells (error)	31.431	36	.873		

b. I-E Scores

Table 6.4 reports means and standard deviations of I-E scores for males, females and the combined sample.

Table 6.4

Means and standard deviations of the I-E scores

	MEANS	STANDARD DEVIATION
Internal Males	7.36	2.69
Internal Females	7.33	3.08
External Males	14.75	1.83
External Females	16.42	2.64
Internals	7.35	2.80
Externals	15.59	2.45
Combined	11.47	4.89

Internality scores were from 3 to 11 inclusive, and externality scores were from 12 to 21 inclusive. It is interesting to note that the overall means of the I-E scale across the three studies were very similar ($\bar{X}$ = 11.42; 11.64; and 11.47 for the first, second and third studies respectively).

c. Comparisons of Paid Versus Volunteer Subjects

Since it may be argued that paid subjects (9 males and 2 females) and volunteer subjects (10 males and 19 females) might have performed differently on the task, it was decided to compare these two groups. This resulted in a 2x2 (subjects, paid versus volunteer, X sex) factorial design with unequal number in each cell (least square analysis). Mean scores and analyses of variance of number of correct trials, number of different solution hypotheses, and initial confidence are presented in Appendix 3. The analyses of variance did not result in any significant differences between paid and volunteer subjects for the aforementioned three measures.

Since paid subjects comprised mainly internals (N = 8), it was decided to run the same analyses as above (subjects, paid versus volunteer internals, X sex) to account for any differences that might exist between the two groups. Mean scores and summaries of analyses of variance for the number of correct trials, number of different solution hypotheses, and initial

confidence are presented in Appendix 3. The analyses did not produce any significant effects between paid and volunteer internals.

Since all the above comparisons were not significantly different, paid and volunteer subjects were treated as one group.

A. Task Performance

i Decipherment of the Principle

Since the principle was whenever 'A' and '3' were present in a set, the decipherment of the principle was considered valid if the subject picked either 'A' or '3', or 'A' and '3' together as always being present in a positive set.

Only 4 internals (one male and 3 females) found the principle (3 picked 'A' and '3', and another, a female, picked 'A' only). Whereas 13 externals (5 males and 8 females) deciphered the principle (one concentrated on '3' only, and another female concentrated on 'A' only; all the others picked 'A' and '3'). In order to test whether or not this difference was significant, the data were arranged in a contingency table and analysed using a X^2 corrected for continuity (Siegel, 1956). Contrary to the expectation more externals found the principle than internals ($X^2 = 7.53$; $P<.005$, two-tailed).

The means of the number of trials on which subjects found the principle were 8.92 for externals, and 10 for internals, and the overall mean for both groups was 9.46 trials. Thus, in order to obtain common grounds for comparisons between internals and externals, two sets of analyses were carried on particular indices: one based on the first 6 trials, and the other based on the first 9 trials. Below are the indices that were used in analysing subjects' performance:

1 - Number of correct trials.

2 - Number of different solution hypotheses. A solution hypothesis was defined as any attempt relating the letters to the numbers in a particular set, or the numbers and letters of different sets. Thus guessing or gambler's fallacy (explained below) were not considered as solution hypotheses and werelabelled spurious solution hypotheses.

3 - Number of trials on which subjects guessed.

4 - Average number of trials per solution hypotheses. This variable was obtained by dividing the number of trials on which solution hypotheses were used by the number of different solution hypotheses used in these trials. This index measured the overall subjects persistence with solution hypotheses.

5 - Maximum number of trials per solution hypothesis. This index measured persistence with a particular solution hypothesis. It was obtained by counting the number of maximum trials on which a subject stayed with a particular solution hypothesis.

ii Comparing successful Externals to unsuccessful Externals

Before comparing interals to externals, it is essential to determine whether or not externals who deciphered the principle (5 males and 8 females) were different from externals who did not find the principle (3 males and 4 females). These data were analysed using a 2x2 factorial design (successful versus unsuccessful externals, X sex) with unequal number in each cell (least squares analysis). Mean squares and summaries of analyses of variance for initial confidence, middle confidence, average number of trials per solution hypothesis, maximum number of trials per solution hypothesis, number of different solution hypotheses, and number of correct trials are presented in Appendix 3[5]. The analyses of variance resulted in a significant main effect for middle confidence ($F = 7.621$; d 1/16, $P<.01$), for the external factor, which was the only significant difference obtained. Inspection of the mean scores indicated that successful externals as compared to unsuccessful externals, were significantly more confident of finding the principle after trial number 12. This is expected since the mean of the number of trials on which

---

5 Apart from initial and middle confidence, all the other indices were based on the first 6 and 9 trials.

externals found the principle was 8.92 trials. Therefore, no significant differences in performance existed between successful and unsuccessful externals; and the two groups are treated as one.

iii Number of Correct Trials for Internals and Externals

The number of correct trials could easily be determined from the subjects' booklets. In any given trial page of the booklet, if a subject ticked "The set contains the principle" and the set actually contained the principle, or he ticked "The set does not contain the principle" and the set actually did not contain the principle, then on both occasions the subject was correct.

The number of correct trials was analysed based on 24 trials, the first 6 and 9 trials respectively.

Table 6.5

Mean scores for the number of correct trials based on 24 trials as a function of locus of control and sex.

	SEX		
LOCUS	MALES	FEMALES	COMBINED
Internals	15.00	16.78	15.89
Externals	16.50	17.58	17.04
Combined	15.75	17.18	16.46

The analysis of variance of correct trials for 24 trials produced no significant effects. As the mean scores indicate (Table 6.5) all subjects achieved a high number of correct trials, (on the average 8 trials out of 24 were incorrect). The internal males had the lowest mean, while the external females had the highest mean. Internal females and external males were almost identical.

Thus, although more externals than internals deciphered the principle during the early stages of the trials, they did not significantly exceed internals in terms of the correct number of trials.

The analysis of variance of the correct number of trials based on the first 6 and 9 trials again did not result in any significant differences.

Table 6.6

Mean scores for the number of correct trials based on the first 6 and 9 trials as a function of locus of control and sex.

		SEX		
TRIALS	LOCUS	MALES	FEMALES	COMBINED
First 6 Trials	Internals	3.18	3.44	3.31
	Externals	2.50	3.42	2.96
	Combined	2.84	3.43	3.14
First 9 Trials	Internals	5.00	5.33	5.17
	Externals	4.50	5.00	4.75
	Combined	4.75	5.17	4.96

The means (Table 6.6) show that the scores of internals and externals were generally similar, with internals exhibiting a higher number of correct trials in the first 6, as well as the first 9 trials.

iv Solution Hypotheses

As indicated earlier, a solution hypotheses was defined as any attempt at relating the letters to the numbers in a particular set or different sets.

Types of Solution Hypotheses

A set was made up of two letters and two numbers. The scope of solution hypotheses relating the letters to the numbers was rather limited. The same two independent judges used in the first study were assigned the task of the categorisation of solution hypotheses. The three judges (including the author) agreed unanimously on three categories in which all the solution hypotheses written by the subjects could fit. The three categories are as follows:

1- Simple solution hypotheses: are those that involve paying attention to a letter(s) or number(s) in a set (e.g. 'B' or '3', or 'C' and 'D'). In other words the principle was a simple one.

2- Intermediate solution hypotheses: are those pertaining to assigning a number to a letter or relating numbers and letter according to their natural sequences (e.g. A = 1; D = 4; or 'A' comes before 'B' and so do '3' and '4').

3- Complex solution hypotheses: pertain to adoption of more rigorous and mathematical combinations of letters and numbers (e.g. dividing the numbers of a set by a constant, and then on the basis of the result establishing a relation within the set).

The above three types of solution hypotheses contain within them <u>different</u> solution hypotheses. For example, if a subject was concentrating on number '4' and then shifted to '1' or 'D', he is considered to have adopted two different solution hypotheses because he has shifted his attention to a different linking principle. On the other hand, if a subject divided the numbers of a set (e.g. 34) by a constant (e.g. 2) and then used the same constant to divide numbers of another set, he is considered to have used the same solution hypothesis. Delineation of different solution hypotheses was made easy by the fact that most subjects wrote under a set "as previous" indicating a persistence with a solution hypothesis used in previous sets.

The Number of Internals and Externals who employed the Three Types of Solution Hypotheses

1- Simple solution hypotheses: 18 internals (8 males and 10 females) and 19 externals (8 males and 11 females) used simple solution hypotheses. Thus the number of internals and external utilising these solution hypotheses was almost identical.

2- Intermediate solution hypotheses: almost all the subjects (N = 39) employed this type of solution hypothesis. It seems that such a type is most commonly used with the present task.

3- Complex solution hypotheses: 12 internals (5 males and 7 females) employed complex solution hypotheses, while only 4 externals (3 males and 1 female) used them. These data were arranged in a contingency table for analysis using a chi square test corrected for continuity in order to test the significance of the difference. More internals than externals employed complex solution hypotheses ($X^2 = 6.67$; df = 1, $P<.01$, two-tailed).

Spurious Solution Hypotheses

Any attempts by the subjects dealing with the sets that did not satisfy the definition of a solution hypothesis are

labelled 'spurious solution hypotheses'. Three types of these solution hypotheses emerged: guessing, 'gambler's fallacy' and 'negation'.

v. Number of Internals and Externals who Guessed

Subjects wrote down the word 'guessing' or equivalent under the set where they guessed whether it contained the principle or not. Thirteen internals (7 males and 6 females) guessed at least once during the 24 trials as compared to 18 externals (10 males and 8 females). Testing this difference by organising the data into a contingency table, and employing a chi square test corrected for continuity showed that the difference approached significance ($X^2 = 2.29$; df = 1, $P<.10$, two-tailed). Thus it seems that more externals guessed over the 24 trials than internals.

Number of trials on which Internals and Externals Guessed

The number of trials on which internals and externals guessed[6] was recorded and analysed based on 24 trials as well as the first 6 and 9 trials.

---

6 The number of trials on which subjects guessed is labelled guessing trials hereafter.

Table 6.7

Mean scores for the number of the guessing trials based on 24 trials as a function of locus of control and sex.

	SEX		
LOCUS	MALES	FEMALES	COMBINED
Internals	3.29	4.00	3.65
Externals	6.25	4.70	5.48
Combined	4.77	4.35	4.57

Analysis of variance of guessing trials over the 24 trials did not result in any significant differences. The means (Table 6.7) are generally low. External males' scores were the highest, while those for internal males were the lowest. Internal and external females' scores were close.

However, the analyses of variance for guessing trials based on the first 6 and 9 trials produced significant locus of control main effect ($F = 6.728$; df 1/36, $P<.01$; $F = 5.753$; df 1/36, $P<.02$ for the first 6 and 9 trials respectively).[7] Thus internals and externals were different in their guessing trials for the first 6 and 9 trials; and as Table 6.8 shows, the internals guessed on less trials than externals. The locus X sex interaction for the first 6 trials approached significance ($F = 3.737$; df = 1/36, $P<.06$). Investigating the means using Tukey's q test indicated that the external males guessed on more trials than internal males ($q = 6.871$; df 2,36, $P<.01$), internal

7 See page 229 for the rationale of these analyses.

Table 6.8

Mean scores for the number of the guessing trials based on the first 6 and 9 trials as a function of locus of control and sex.

TRIALS	LOCUS	SEX MALES	SEX FEMALES	SEX COMBINED
First 6 Trials	Internals	1.00	1.44	1.22
	Externals	3.13	1.83	2.48
	Combined	2.07	1.64	1.85
First 9 Trials	Internals	1.27	1.44	1.36
	Externals	3.50	2.25	2.88
	Combined	2.39	1.85	2.12

females ($q = 6.161$; df 2,36, $P<.01$), and external females ($q = 4.194$; df 2,36, $P<.01$).

All the other differences for the first 6 and 9 trials were not significant.

vi. 'Gambler's Fallacy'

This spurious solution hypothesis is identified as anticipating the occurrence, or non-occurrence of the principle in a set, based on previous frequencies. It is an "if three sets in a row contained the principle, it is about time that the fourth set would not" kind of thinking. The subjects were explicit in stating their utilisation of this spurious solution hypothesis. Eight externals (2 males and 6 females) adopted the 'gambler's fallacy' as opposed to 3 internals (all males)

based on 24 trials. This difference was investigated by arranging the data into a contingency table and employing a chi square test corrected for continuity, which indicated that the difference approached significance (X^2 = 2.09, df = 1, P<.10, two-tailed). Thus the findings of the first study regarding 'gambler's fallacy' were almost repeated.

vii. Negation

Certain subjects, after failing to establish any relationship between the numbers and letters of a set, wrote "no relationship" indicating that they could not specify precisely the reasons for their decision. This spurious solution hypothesis was labelled 'negation'. The number of internals and externals employing negation was identical except for sex within personality (7 internal males, 3 internal females, 4 external males and 6 external females).

viii. Number of Different Solution Hypotheses

The main aim of the third study was to extend the finding of the first study regarding solution hypotheses by controlling the effects of memory. The booklet format employed in the third study allowed for a more accurate measurement of solution hypotheses. The number of different solution

hypotheses (see page 119) could be obtained easily as the subjects had available to them the opportunity of writing their solution hypotheses while forming them.

Table 6.9

Mean scores for the number of different solution hypotheses based on 24 trials as a function of locus of control and sex.

	SEX		
LOCUS	MALES	FEMALES	COMBINED
Internals	4.27	4.33	4.30
Externals	3.38	4.08	3.73
Combined	3.83	4.21	4.02

Analysis of variance for the number of solution hypotheses based on 24 trials produced no significant effects. Subjects, on the whole, generated few solution hypotheses, and internals and externals were almost equal with internals using slightly more different solution hypotheses than externals (see Table 6.9). But, when the analysis was based on the first 6 and 9 trials, a remarkable difference occurred.

For both the first 6 and 9 trials locus of control main effects were highly significant ($F = 19.236$, df 1/36, $P<.001$; $F = 15.762$, df 1/36, $P<.001$). All the other differences were not significant. Inspection of the means (Table 6.10) indicated that

Table 6.10

Mean scores for the number of different solution hypotheses based on the first 6 and 9 trials as a function of locus of control and sex.

		SEX		
TRIALS	LOCUS	MALES	FEMALES	COMBINED
First 6 Trials	Internals	1.09	1.92	1.16
	Externals	2.00	2.25	2.13
	Combined	1.55	2.09	1.65
First 9 Trials	Internals	1.73	2.00	1.87
	Externals	2.75	3.42	3.09
	Combined	2.24	2.71	2.48

externals produced more solution hypotheses in both the first 6 as well as the first 9 trials. The findings of the first study that externals generated and utilised more different solution hypotheses than internals were, therefore, strongly supported. The externals seem to possess the ability of generating a multiplicity of solution hypotheses, while internals produce a restricted number of solution hypotheses and explored them more fully.

ix. Average Number, and Maximum Number, of trials per Solution Hypothesis

The first study not only demonstrated that internals and externals were different in the number of solution hypotheses they employed, but also in the way they handled these hypotheses.

Thus it was important to attempt to extend these results. In order to determine the way solution hypotheses were employed, two measures were used: average number and maximum number of trials per solution hypothesis. These measure persistence with, or frequent change, of a solution hypothesis.

As indicated earlier the average number of trials was obtained by dividing the number of trials on which solution hypotheses were used by the number of solution hypotheses (note that spurious solution hypotheses were not included in these measures).

Table 6.11

Mean scores for the average number of trials per solution hypothesis based on the first 6 and 9 trials as a function of locus of control and sex.

		SEX		
TRIALS	LOCUS	MALES	FEMALES	COMBINED
First 6 Trials	Internals	4.14	3.28	3.71
	Externals	1.16	1.32	1.24
	Combined	2.65	2.30	2.48
First 9 Trials	Internals	4.64	4.00	4.32
	Externals	1.63	1.72	1.68
	Combined	3.14	2.86	3.00

Analysis of variance of the average number per solution hypothesis scores for both the first 6 and 9 trials produced highly significant locus of control main effects ($F = 62.050$, df 1/36, $P<.001$; $F = 31.906$, df 1/36, $P<.001$ for the first 6 and 9 trials respectively. No other significant effects were obtained.

As the mean scores clearly demonstrate (Table 6.11) the externals stayed with a particular solution hypothesis for fewer trials than did internals.

A more direct assessment of high persistence versus low persistence with a solution hypothesis is the maximum number of trials per hypothesis. This index is obtained simply by counting the number of trials on which a subject stayed with a solution hypothesis (and not with a spurious hypothesis).

Table 6.12

Mean scores for the maximum number of trials per solution hypothesis based on the first 6 and 9 trials as a function of locus of control and sex.

		SEX		
TRIALS	LOCUS	MALES	FEMALES	COMBINED
First 6 Trials	Internals	4.18	3.33	3.76
	Externals	1.38	1.67	1.53
	Combined	2.78	2.50	2.65
First 9 Trials	Internals	5.73	5.11	5.42
	Externals	2.50	2.58	2.54
	Combined	4.12	3.85	3.98

The analysis of variance of maximum number of trials per hypothesis for both the first 6 and 9 trials resulted in exactly the same significant effects as those of average number of trials per solution hypothesis. Highly significant locus of control main effects were obtained ($F = 45.361$, df 1/36, $P<.001$;

F = 36.048, df 1/36, P<.001 for the first 6 and 9 trials respectively), which were the only significant differences. The mean scores (Table 6.12) indicate that internals persisted more with a hypothesis than externals.

It is clear that the findings of the first study regarding the more frequent mobility by externals among solution hypotheses were supported and clarified. Externals, relative to internals, not only returnd to already utilised hypotheses more frequently (first study), but they also persisted less with them. The internals, on the other hand, rarely used old hypotheses (first study) and persisted much longer (in terms of trials) with an hypothesis. Thus the results of the first and third studies complement each other.

Summary of Task Performance Results

Subjects perceived the task as being unfamiliar. Paid subjects and volunteer subjects did not differ in their performance on the task. With respect to decipherment of the principle the externals outperformed the internals. Externals who found the principle were not significantly different from externals who did not find the principle except in middle confidence. Successful externals were more confident than unsuccessful externals. Internals and externals did not differ significantly in the number of correct trials (based either on the whole trials, or the first 6 and 9 trials). More internals employed complex solution

hypotheses than externals. Although internals and externals did not differ significantly in the number of guessing-trials when considering their performance over the 24 trials, externals did exceed internals for guessing-trials in the first 6 and 9 trials. Externals also displayed a tendency to employ gambler's fallacy behaviour.

As regards the number of different solution hypotheses, the internals and externals exhibited similar scores when their performance over the 24 trials is considered. However, in the first 6 and 9 trials the externals produced significantly more different solution hypotheses. The externals, relative to internals, also used much fewer trials per solution hypotheses during the first 6 and 9 trials. Thus, the findings of the first study regarding the problem solving behaviour of internals and externals were supported.

It is interesting to note that all the variability was caused solely by locus of control (except in guessing-trials where it interacted with sex).

Confidence Ratings

The experimental booklet contained three confidence rating scales in an attempt to measure the subjects' confidence before, during, and after their performance on the task. Subjects responded to the following question: "How confident are you of

finding the principle?". Confidence was an important index for establishing the subjects' beliefs in their abilities and may help to explain the differences between internals and externals in switching back, as found in the second study.

1. Initial Confidence

This index measured the subjects' confidence in finding the principle before starting to solve the task.

Table 6.13

Mean ratings of the subjects' perception of their initial confidence of finding the principle as a function of locus of control and sex.

	SEX		
LOCUS	MALES	FEMALES	COMBINED
Internals	5.73	4.00	4.87
Externals	3.88	2.92	3.40
Combined	4.81	3.46	4.14

Low score indicates low confidence, high score the reverse.

Analysis of variance of initial confidence scores resulted in a highly significant locus of control main effect ($F = 15.320$, df 1/36, $P<.001$) and a sex main effect ($F = 9.980$, df 1/36, $P<.003$). The locus X sex interaction was not significant. The means (Table 6.13) show that, as predicted, internals were more confident than externals

of finding the principle. Further, males were more confident than females. It should be stated that these differences were relative to each other, as all the means were low. The internal males scored the highest, while external females scored the lowest.

2. Middle Confidence

Subjects responded to another confidence rating scale following the 12th trial..

Table 6.14

Mean ratings of the subjects' perception of their middle confidence of finding the principle as a function of locus of control and sex.

LOCUS	SEX MALES	FEMALES	COMBINED
Internals	4.00	4.00	4.00
Externals	3.63	4.17	3.90
Combined	3.82	4.09	3.95

Low score denotes low confidence, high score the reverse.

Analysis of variance of middle confidence scores did not produce any significant effects. The combined mean scores (Table 6.14) are all low, and lower than for initial confidence (cf. Table 6.13), indicating that the subjects' confidence tended to decrease as trials

went on. Thus, although most of the externals found the principle before the 12th trial, their confidence following that trial was not altered. However, as indicated earlier, since the successful externals were more confident than unsuccessful externals following the 12th trial, a further analysis of variance for middle confidence score was carried out (successful externals (N = 13) versus unsuccessful internals (N = 16)).

Table 6.15

Mean ratings of the subjects' perception of their middle confidence of finding the principle as a function of successful externals (succ. ext.) versus unsuccessful internals (unsecc. int.)

	SEX		
LOCUS	MALES	FEMALES	COMBINED
Succ. Ext.	4.10	3.83	3.92
Unsucc. Int.	4.00	5.38	4.69
Combined	4.05	4.61	4.31

Low score indicates low confidence, high score the reverse.

Again the analysis did not result in any significant differences. The means (Table 6.15) are low. External females had the highest scores and internal females the lowest scores.

In order to investigate whether or not externals' confidence increased after the 12th trial relative to their initial confidence, a 2x2x2 split-plot factorial design (locus

of control X sex X confidence (initial versus middle)) with repeated measures on the last factor was performed.

Table 6.16

Mean ratings of the subjects' perception of their initial and middle confidence of finding the principle as a function of locus of control and sex.

	INITIAL CONF.	MIDDLE CONF.
Internal Males	5.73	4.00
Internal Females	4.00	4.00
External Males	3.88	3.63
External Females	2.92	4.17
Males	4.81	3.82
Females	3.46	4.09
Internals	4.87	4.00
Externals	3.40	3.90

Low score denotes low confidence, high score the opposite.

The summary of the analysis of variance for initial versus middle confidence scores is presented in Table 6.17. The significant locus of control main effect indicates (see Table 6.16) that overall, the internals were more confident than externals. Investigation of the locus X confidence and sex X confidence interactions using Tukey's q tests indicatedthat: internal males decreased their confidence following the 12th trial as compared with their initial

Table 6.17

Summary of analysis of variance of the subjects' ratings of their initial versus middle confidence of finding the principle as a function of locus of control and sex.

VARIATION	SS	DF	MS	F	P
Between People	137.801	39			
A (locus of control)	14.450	1	14.450	4.503	<.03
B (sex)	5.708	1	5.708	1.779	
AB	2.093	1	2.093	.652	
Subj. W. Groups	115.550	36	3.209		
Within People	134.034	40			
C (confidence)	.450	1	.450	.150	
AC	12.800	1	12.800	4.267	<.05
BC	12.721	1	12.721	4.240	<.05
ABC	.063	1	.063	.021	
C X Subj. W. Groups	107.970	36	3.00		

confidence ($q = 4.436$, $P<.01$); external females increased their confidence following the 12th trial relative to their initial confidence ($q = 3.205$, $P<.05$); and males (as a whole) decreased their confidence after the 12th trial in comparison to their initial confidence ($q = 3.414$, $P<.05$). Thus it was mainly the external females' confidence that was affected by their success at deciphering the principle. It is interesting to note that the internal females' initial and middle confidence ratings were identical.

3. Post Confidence

The subjects who failed to find the principle rated their confidence in finding the principle if the trials were doubled. It was expected that this index would measure persistence and yield some differences between internals and externals.

Table 6.18

Mean ratings of the subjects' perception of their post confidence of finding the principle as a function of locus of control and sex.

	SEX		
LOCUS	MALES	FEMALES	COMBINED
Internals	3.40	2.67	3.04
Externals	3.33	2.25	2.79
Combined	3.37	2.46	2.92

Low score indicates low confidence, high score the reverse.

Analysis of variance of post confidence scores produced no significant differences. The means (Table 6.18) are very low indicating that failure had affected the confidence of all those who failed. Internal males had the highest scores while external females had the lowest scores.

B. Perception of, and Reaction to, the Experiment.

The post-task questionnaire of the third study was concerned with the subjects reaction to, and perception of, the experiment. These indices were measured using a 9-point rating scale, and it was expected that they would complement the results of the task performance.

1. Task Perception

The mean scores of the subjects' response to the question "How much did you think this was a task which depended on skill or chance?", are presented in Table 6.19

Table 6.19

Mean ratings of the subjects' perception of task control as a function of locus of control and sex.

	SEX		
LOCUS	MALES	FEMALES	COMBINED
Internals	6.36	6.33	6.35
Externals	4.75	5.58	5.17
Combined	5.56	5.96	5.76

Low score indicates chance control, high score skill control.

Analysis of variance of task perception scores produced a marginally significant locus of control main effect ($F = 3.601$; df 1/36, $P<.07$). The other differences were not significant. Inspection of the means (Table 6.19) using Tukey's q test indicated that internals viewed the task to be more skill controlled than externals ($q = 4.069$, $P<.01$). The externals' scores were around the scale's middle point while the internals were one point above the middle point. In general, subjects were not quite sure that the task was purely skill determined.

2. Performance Perception

It was expected that the subjects perception of the agency of control of their performance might furnish more differences between internals and externals than task perception since it involved their own behaviour. Subjects responded to the question "How much do you think your peformance on the task depended on skill or chance?".

Analysis of variance of performance perception scores resulted in asignificant locus of control main effect ($F = 5.365$; df 1/36, $P<.03$) which was the only significant difference. The means (Table 6.20) are generally low with the highest score (internal males) just above the middle point. The internals construed their performance to be more controlled by their own skill than externals. Thus although the externals were more

Table 6.20

Mean ratings of the subjects' perception of their performance control as a function of locus of control and sex.

	SEX		
LOCUS	MALES	FEMALES	COMBINED
Internals	5.55	5.00	5.28
Externals	4.63	3.42	4.03
Combined	5.09	4.21	4.66

Low score denotes chance control, high score skill control.

successful than internals in deciphering the principle, they nonetheless perceived their performance as controlled by chance.

3. Task Difficulty

The subjects responded to the question "How difficult was this task for you?". The means of task difficulty scores are presented in Table 6.21.

The analysis of variance of task difficulty scores did not result in any significant differences. The means are low and very close indicating that all the subjects considered the task to be fairly difficult. The lowest ratings were by

Table 6.21

Mean ratings of the subjects' perception of the task's difficulty as a function of locus of control and sex.

	SEX		
LOCUS	MALES	FEMALES	COMBINED
Internals	3.36	3.22	3.29
Externals	3.75	3.83	3.79
Combined	3.56	3.53	3.54

Low score indicates high difficulty, high score the reverse.

internal females and the highest by external females.

4. Interest in the Task

Table 6.22 presents the mean scores of the subjects' response to the question "How interesting was the task?"

Table 6.22

Mean ratings of the subjects' interest in the task as a function of locus of control and sex.

	SEX		
LOCUS	MALES	FEMALES	COMBINED
Internals	7.55	7.00	7.28
Externals	5.75	6.17	5.96
Combined	6.65	6.59	6.62

Low score denotes disinterest, high score the opposite.

Only the locus of control main effect produced a significant difference as a result of analysis of variance of interest scores ($F = 6.345$; df 1/36, $P<.02$). The means (Table 6.22) show that internals found the task to be more interesting than externals. The externals' mean was reasonably close to the mid-point of the scale, while the internals' mean is near to the high interest pole. Thus although internals, relative to externals, were less successful in their performance, they nonetheless were more interested in it. It seems that the internals were more motivated in the task.

Number of Subjects who wrote Comments

At the end of the post-task questionnaire, subjects were given the option of writing down any comments about the task or their performance. Seventeen internals (6 males and 11 females) and 11 externals (5 males and 6 females) wrote comments. In order to test this difference the data were arranged in a contingency table and analysed using a X^2 corrected for continuity. The difference between internals and externals approached significance ($X^2 = 3.247$, df = 1, $P<.10$, two-tailed). The finding of the second study regarding the number of internals and externals who wrote comments was almost repeated. Most of the comments were about the task (e.g. those who deciphered the principle, and wrote comments, saw the task as trivial, while

those who did not find the principle were anxious to know it).

Summary of Confidence Indices, Perception of, and Reactions to, the Task Results

Internals displayed higher initial confidence than externals. Only external females increased their middle confidence relative to their initial one. No significant differences were found between internals and externals in middle and post confidence ratings.

Internals tended to construe the task and their own performance as skill determined more than externals who perceived the task and their performance to be under chance control. All subjects considered the task to be difficult. With respect to interest in the task externals found the task less interesting than internals.

More internals than externals wrote comments in the post-task questionnaire, although the difference only approached significance.

6.5 DISCUSSION

The third study was developed mainly out of the first study with more stringent control on the method of assessing subjects' utilisation of solution hypotheses. A major finding of the study was the decipherment of the principle as a function of locus of control. In both the first and second studies internals and externals did not differ in the solution of the task. In the present study, and contrary to much previous research, it was the externals who were more successful in finding the principle than internals. Below is a summary of the other findings of the third study.

1. All subjects perceived the task to be completely unfamiliar to them.
2. Externals, as compared to internals, used more solution hypotheses, changed them more frequently (i.e. lower persistence), guessed on more trials, and used less complicated solution hypotheses. Moreover, there were no significant differences between the two groups in the number of correct answers over the twenty four trials.
3. Internals rated themselves as being more confident than externals (initial confidence). No significant differences in either middle or post confidence

ratings between the two groups were obtained (both manifested low confidence).

4. Internals, relative to externals, perceived the task and their performance to be significantly more controlled by skill, and were significantly more interested in the task. There were no significant differences between the two groups regarding:
   a. task difficulty (both groups perceived the task to be difficult); and
   b. number of subjects who wrote comments about the experiment (although more internals than externals wrote comments).

As in the previous discussion sections, task performance indices are discussed first, followed by those for the confidence ratings, perceptions of, and reactions to, the task. The discussion focuses on the performance of subjects on the first nine trials as a comparison of the different approaches to finding the principle. It will be remembered that most of the externals had found the principle by the ninth trial. The overall performance of internals and externals for the twenty four trials will also be considered.

a. Task Performance

Before discussing the deciphering of the principle by externals it is important to present the consistency of cognitive responses displayed by internals and externals across the three studies.

Internals and externals approached the third task differently, and in a manner very similar to their approaches to the task in the first study. The externals produced relatively more solution hypotheses, did not persist with a solution hypothesis for long, and changed their hypotheses frequently. The internals, on the other hand, generated fewer solution hypotheses, persisted longer with a solution hypothesis and were less mobile among hypotheses[8]. The externals were adopting a "butterfly" approach (i.e. flitting from one solution hypothesis to another), while internals follow a more systematic and persistent approach. These cognitive responses were also evident in the second study; the less thorough and systematic processing of information by externals required them to use more switchbacks than internals. Moreover, the externals in the third study reacted in a less thorough fashion than internals

---

8 It is very important to note that in both studies reinforcement (i.e. number of correct trials) did not affect internals and externals differently as no significant differences in the number of correct trials was found. Thus the differences in the number of solution hypotheses and the way in which they were used were a result of the different approaches to problem solving by internals and externals.

by guessing on more trials, and in the second study their less thorough and less systematic response was also shown by low correlations between their preparation time and switchbacks. Thus over three different tasks, three different groups of internals and externals exhibited similar cognitive responses. Therefore, following Warr's (1970) definition of a cognitive style as a generalisable cognitive response, internals and externals seem to be characterised by different cognitive styles.

The second significant finding is that the externals were more successful in deciphering the principle than internals. The externals adopted a "carefree" approach (guessed on more trials and engaged in 'gambler's fallacy'[9] behaviour) and used less complex solution hypotheses. The internals were less carefree and utilised more complex solution hypotheses, yet they were less successful than externals in identifying the principle. Possible reasons for these results are discussed below.

It had been demonstrated that externals, relative to internals, require more explicit cues as a prerequisite to efficient problem solving (Lefcourt, 1967; Lefcourt and Wine, 1969; second study; Wolk and DuCette, 1974). The externals employed the same cognitive style in both the first and the third studies. Such a style was not efficient in deciphering the principle of the first study as the task employed in that

---

9 This difference between internals and externals approached significance.

study was too difficult, or, in other words, the nature of that task was such that it was less susceptible to the externals' cognitive style. The principle used in the present study was not as difficult to discover. Indeed independent judges classified solution hypotheses that concentrated on a letter or a number (i.e. ones typically used by externals) as "simple". It is argued that the principle in the present study was a relatively "salient" one; and since externals' problem solving ability is enhanced the more salient information becomes, then their performance on this task is understandable. Many of the externals who found the principle said that they suddenly "saw" the recurrence of 'A' and '3' in positive sets. It is not as if they were searching thoroughly and systematically for the principle but just engaging in the production of many solution hypotheses, changing them frequently and then hitting on the principle. This activity of the externals may indicate creativity or divergent thinking (see Guilford, 1956), as compared to the more deliberate and structured style of internals which may reflect convergent thinking (see Guilford, 1956). Although such an argument seems reasonable based on the above data, a study by Lotsof and Steinke (1973) failed to establish any relationship between locus of control and divergent thinking (as measured by Guilford's unusual uses tests).

What is not so readily understandable is why

internals were less successful at deciphering the principle if the principle was more "salient" than in the first study. The cognitive style of internals, which has been described as more thorough and systematic, is not always more efficient because internals were not successful in finding the principle in both the first and third studies. It seems that when faced with a relatively simple principle they masked its simplicity by looking for complex hypotheses. As explained earlier, complex hypotheses pertain to more complicated mathematical combinations between the numbers and letters within a set. Wason (1960 ; 1968), who used a seemingly trivial rule in a task, found that the subjects who used complicated hypotheses failed to find the rule.

The internals' persistence with a solution hypothesis and the tendency not to return to solution hypotheses may be indicative of cautious and calculated behaviour. Internals, relative to externals, have been shown to display less risk taking behaviour (DuCette and Wolk, 1972), and more persistence and endurance on a vigilance task (Sanders et al 1976). Persistence and endurance may not always result in efficient problem solving. Gavurin and Murgatroyd (1974) regarded endurance as synonymous with perseveration which, they argued, hindered problem solving. They found a significant negative correlation between solving anagrams and endurance. It is interesting to present what Gavurin and Murgatroyd meant by

endurance:

> "... to keep at a job until it is finished, to work hard at a task, to keep at a puzzle or problem until it is solved, to work at a single job before taking on others, to stay up late in order to get a job done, to put in long hours at work without distraction, to stick at a problem even though it may seem as if no progress is being made, to avoid being interrupted while at work."
>
> (page 100 (extracted from Edwards, 1959)).

The above attributes seem to fit the internals who, in another study, described themselves as being "... enthusiastic ... assertive ... deliberate, persevering, hard headed ... (and) ... stubborn" (Hersch and Scheibe, 1967, p.612).

The task performance of subjects also needs to be discussed with reference to <u>task difficulty</u>. By any standards the first task was difficult, whereas the second proved relatively easy for subjects. It was expected that the third task would be of intermediate difficulty. But the internals rated it as very difficult and skill determined: was this because they were unable to find the principle, or were they unable to find the principle because they assumed the task to be difficult and therefore proposed complicated solution hypotheses to solve it? The data available do not answer the question, however, the fact that <u>initially</u> they were more confident regarding task performance than externals suggests that at the outset, internals did not perceive it to be a very

difficult task. It may be that the nature of the task used in the first and third studies provides particular difficulties for internals as they appear to have set about solving the third task, if not the first, using more complicated hypotheses than were necessary.

To summarise: what these data indicate is that when the task was easy and perceived as such, internals outperformed externals; but when the task became difficult, or was perceived to be difficult, differences in task performance between internals and externals were removed, and even reversed.

One final point regarding the performance of internals on the third task merits attention, namely, that over the twenty four trials the number of correct answers they obtained was not significantly different from the number obtained by externals, even thought the latter discovered the principle while most of the internals did not. Furthermore, the mean number of correct answers for internals (mean = 15.89) was much higher than would have been expected on the basis of chance (i.e. a mean of 12). This suggests that the internals were able to identify positive sets, but were not able to identify the principle which underlinedthe construction of these sets. It is not surprising that many of them spent at least an hour on the task while the externals typically finished within fifteen or twenty minutes.

The fact that externals were better able to discover the principle than internals may seem to contradict the findings of previous studies which have reported 'superior' problem solving by internals (e.g. DuCette and Wolk, 1973; Hickey, 1976; Lefcourt et al, 1973). A discussion of these studies is in order.

DuCette and Wolk (1973) employed a task which depended, for solution, on subjects' identifying cues emitted by the experimenter holding a card. It can be argued that the presence of the experimenter motivated the internals to search for the emitted cues. After all,Lefcourt and Wine (1969) have shown how more inquisitive the internals, relative to externals, became when a person's behaviour was rendered less predictable. Moreover, the nature of the task employed by DuCette and Wolk may have suited the internals' cognitive style. The task was composed of two cards containing either 'A' or 'B' and the subject, looking at the blank side of the card, had to detect which letter was on the other side of the card by observing non-verbal cues emitted by the experimenter.

Using the same argument it is maintained that the more structured and systematic cognitive styles of internals facilitated their problem solving in Hickey's (1976) study. Hickey employed anagrams which required efficient structuring of stimuli that had to be preceded by higher degrees of concentration. In these situations the externals' cognitive

style is relatively less effective than the internals' style. Hickey also found, however, that externals, relative to internals, performed better on nonsense anagrams which demanded less concentration and a less systematic approach than word anagrams. Problems that require minimum structuring (like the one in the third study) may be more suitable for the externals' cognitive style.

As regards Lefcourt et al's (1973) study, the task used was a ribald one. The subjects were presented with stimulus words in a double entendre word association list. The rule was to discover words bearing sexual connotations (e.g. rubber, prick, blow, screw etc..). The response measures were delay of response time and frequency of smiles and laughs. Lefcourt et al found that internals were faster than externals in noticing the sexual connotations. Do internals pick up cues better than externals, as Lefcourt et al suggest, or are internals simply less inhibited and/or more experienced sexually than externals? A clear answer is not possible because of the ambiguity of the task employed. Such a task may not be suitable for the measurement of "cognitive activity" as the problem solving skills involved are not clear.

b. Confidence Ratings, and Perception of, and Reactions to the Experiment Indices

The results of the initial confidence measure upheld the prediction; internals' initial confidence was higher than that of the externals' indicating the internals' belief in their problem solving abilities. Scores for middle and post task confidence were relatively low for both groups. As far as the internals are concerned such typical shifts are expected (i.e. lowering of confidence following failure). However, it is surprising that the externals did not increase their confidence sharply after their success (middle confidence). In fact it was only the external females who exhibited a significant increase in confidence. It may be that externals thought that what they discovered was not the principle since it appeared trivial once it had been identified; or it may be that they believed that the task was difficult and that they had only discovered the principle by chance.

It should be mentioned that some sex differences were found for initial confidence, males being more confident than females. This is to be expected in a culture where 'masculinity' is typically associated with strength, independence and confidence, while 'femininity' is typically characterised by passivity and dependence.

The internals, besides feeling more confident of finding the principle, rated the task and their performance as being more controlled by skill than externals. The internals seem to believe more in mastering their environment by viewing events as a challenge to their own capabilities. Indeed the concept of personality locus of control was derived from studies using tasks which induced skill or chance control (e.g. Phares, 1957; Rotter et al, 1961). The internals preference to construe events as self determined reflects their sensitivity to intrinsic motivation as opposed to the externals' susceptibility to extrinsic motivation (Baron and Ganz, 1972; Baron et al, 1974; Kumchy and Rankin, 1975). Perhaps it is this degree of motivation and the sense of challenge which triggered the internals into adopting complex solution hypotheses which in turn masked the otherwise simple principle.

The externals' perceptions of the task and especially their performance as chance oriented, even though they were more successful than internals in discovering the principle, is interesting and consistent with the cognitive style attributed to them and with their perceptions of the nature of behaviour-reinforcement contingencies. According to Rotter (1966) one of the main agents of externality is the failure of the individual to perceive behaviour-reinforcement contingencies. In the present study, externals did not attribute success to their own ability. It appears that externals not only view

external variables as responsible for their failure (Phares et al, 1971), but also for their success.

As regards task difficulty, both internals and externals construed the task as being very difficult. This behaviour is expected of the internals since they were unable to decipher the principle. As has already been suggested, the externals' responses can also be viewed as 'expected' as they felt that they only discovered the principle by chance.

The internals, especially those who did not find the principle, were perplexed after being told of the nature of the task during the debriefing session. It seemed as if they never thought the concept could be so straightforward. Such reactions lend more support to the contention put forward earlier that internals approached the task with a high sense of challenge. Such an approach instead of facilitating problem solving inhibits it on this kind of task. Yet the internals rated the task as being more interesting than externals. These reactions were similar to those displayed by Wason's (1960) subjects. Those who found a seemingly simple rule viewed the task as being meaningless and trivial, while those who failed to pick the rule were bemused by their shortsightedness.

More internals wrote comments about their performance and/or about the task, but such difference only approached significance. Thus although this finding failed to replicate that of the second study, it was, nonetheless, in the same

direction. Such a finding is interesting since, besides employing different tasks, the two studies produced different performances for internals and externals. In the second study both internals and externals were equally successful in naming the correct objects, while in the third study the internals were less successful than externals in finding the principle. Moreover, the sample size of the third study was smaller than that of the second study. DuCette and Wolk (1973) suggested that internals are more motivated to do well under congruent as well as under incongruent conditions (i.e. with respect to their generalised beliefs about control) because of their desire to do well. In the light of the findings from the first study regarding the nature of 'chance' situations it might be more accurate to say that internals, relative to externals, seem to be more involved in situations they are in, despite the irregularity of rewards they receive from such situations, so long as they perceive the situation to be skill determined.

c. Conclusions

Internals and externals appear to be 'characterised' by different cognitive styles. The way in which they handle solution hypotheses is not the same. The internals' style is not always more efficient in problem solving than that of the externals. The relatively 'carefree' approach of the externals can certainly

be fruitful depending on the problem at hand. These different cognitive styles beg the question of the nature of locus of control as a personality variable. This issue is discussed in the next, and final, chapter.

CHAPTER 7

SUMMARY, IMPLICATIONS AND CONCLUSIONS

The aim of this final chapter is two-fold: to summarise and discuss the results of the three studies; and to examine their broader implications. The chapter is accordingly divided into two sections.

The first section attempts: to clarify the nature of the "cognitive activity" of internals and externals; to relate their cognitive styles to other social-cognitive research; and to examine the interpersonal behaviour of internals and externals. It has been noted that the three studies were more cognitively than socially oriented, since the molecular approach to the study of the behaviour of internals and externals had produced more consistent data than the molar one. Since this thesis is more 'cognitive' than 'social', discussion of the social implications will be mainly of a speculative nature, but it may nevertheless provide suggestions for future research.

In the second section, a discussion of the relevance of the results of this research to Rotter's (1954) social learning theory is presented in an attempt to establish a cognitive-social framework for understanding the behaviour of internals and externals.

The developing focus of this research was to identify the distinctive cognitive styles that characterise internals from externals rather than the cognitive responses of limited generalisability found in previous studies. The research showed that internals and externals approached the problem of the three studies using different strategies of handling solution hypotheses, and processing information. The first study was also successful in differentiating the 'chance' condition of previous research into 'quasi' versus 'pure' chance conditions. Before going any further it will be useful to summarise the results of the three studies.

In the first study the subjects perceived the skill, chance 1 (quasi chance) and chance 2 (pure chance) differently. However, it was only the internals who evidenced different reactions to chance 2 as compared to their reactions to skill or chance 1. Both the internals and the externals were unable to decipher the principle. Externals, relative to internals, used and generated more solution hypotheses; changed them more frequently; returned more times to already utilised solution hypotheses; and employed more 'gambler's fallacy' behaviour (left-right sequences of the response cards). Moreover, under skill, internals found the task more interesting and exerted more effort than externals who displayed the same trend in chance 2. No significant differences between the two groups under chance 1 were found. Further, the externals rated the chance 2 situation as being more comfortable than internals.

In the second study the subjects construed the task to be completely unfamiliar. Both the internals and externals were successful in naming most of the correct objects. Externals, as compared to internals, had longer initial preparation time , total preparation and solution times,and switchbacked more frequently. Internals made more half switchbacks than externals who employed more standard, double and double plus switchbacks. The correlations between total preparation and solution time and switchbacks were not significant for externals, but were highly significant for internals. Both groups found the task to be interesting and worked hard on it, however, internals perceived the task as being more skill controlled than externals. Further, more internals wrote comments about their performance and/or the task.

The externals, in the third study, were more successful than internals in finding the principle. Moreover, relative to internals, they, produced more solution hypotheses; persisted less with a solution hypothesis (in terms of number of trials); guessed on more trials and adopted'gambler's fallacy' behaviour (the difference though only approaches significance). Both internals and externals construed the task as being skill oriented, although the internals' ratings were more extreme. Further, the internals viewed their performance on the task to be determined by skill whereas the externals regarded it as being influenced by chance. Externals, relative to internals, were

less interested in the task, and initial confidence was higher for the internals than externals. There were no significant differences between the two groups in middle and post confidence (both had low scores); in rating task difficulty (both found the task very difficult); and in writing comments about their performance and/or the task (although more internals wrote comments). The task was perceived as being completely unfamiliar to internals and externals.

1. Reactions to Chance 1 and Chance 2 Conditions

An important finding of the thesis was that 'chance' conditions of different natures produced different responses from subjects. The first study demonstrated that when the chance elements of the task were defined by the high level of task difficulty, the subjects did not perceive the task as being totally controlled by chance. On the other hand, when the nature of the task was intrinsically chance controlled, subjects perceived it as such. Thus some of the inconsistencies of the research on personality-situation locus of control were the result of confounding quasi chance conditions (i.e. the element of chance is extrinsic to the task) and pure chance conditions (i.e. the element of chance is intrinsic). Moreover, the first study also showed that externals were motivated under the pure chance condition, while internals were more motivated

under the skill condition. It appears that in terms of motivation, the personality-situation locus of control congruency model is plausible, but in terms of performance of successful solutions (i.e. the idea that externals solve problems better under pure chance conditions) is still far from being clear. Although research indicates that internals tend to produce better results than externals under skill (e.g. Lefcourt et al, 1968; DuCette and Wolk, 1973) the reverse was true in the third study. Furthermore, almost all the studies dealing with personality-locus of control congruency do not report better solution of the problem by externals over internals in chance conditions (.e.g DuCette and Wolk, 1973; Lefcourt et al, 1968; McDonald et al, 1968)[1]. Since internals and externals do not differ from each other on intelligence tests (Rotter, 1966) or academic performance (Eisenman and Platt, 1968; Hjelle, 1970; Warehime, 1972), then externals' ability to solve problems is not necessarily greater or less than internals under skill or chance respectively. It would seem that a model to predict the performance of internals and externals should not only take account of the skill-chance dimension but should also allow for such variables as task difficulty and the nature of the task.

---

1 An exception is Bronzaft (1972) who showed that externals were able to find their own pictures in an extra sensory perception task. Bronzaft, however, did not employ the standard I-E scale but a shorter one instead.

The present research has indicated that with certain kinds of tasks externals can outperform internals even under skill conditions.

2. The Nature of the Cognitive Activity as a Function of Locus of Control

In the three studies differences due to locus of control were highly significant. Sex differences were minimal and did not seriously complicate the data. An important finding was the extent in which internals' and externals' cognitive responses in each study were generalisable to the other studies. What renders these findings significant is the fact that in the three studies different samples of subjects and different tasks were used. The subjects of the first study were Open University students who represented a highly heterogeneous group. Although the subjects of the second and third studies were first year psychology students, they, nonetheless, belonged to different academic sessions. The tasks employed in the three studies were of various natures. The first study included a purely verbal concept task where the subjects had to determine the principle relating a word on one of two response cards, to a word on the stimulus cards, each of which contained five words. The task of the second study involved lists of characteristics describing objects and the subject had to pick the object best

described by the characteristics from a list of objects. In the third study a concept formation task made up of a series of sets containing two numbers and two letters per set was used. Thus despite the varying nature of subjects and tasks, distinctive cognitive styles characterising internals and externals emerged.

These cognitive styles of handling solution hypotheses add valuable information to the mode by which internals and externals approached problems. Internals appeared to be more cautious in formulating and testing their solution hypotheses and processed information more thoroughly. The externals, on the other hand, were more casual in the generation and testing of solution hypotheses, and processed information less thoroughly. An important finding of this thesis is that the cognitive styles of internals and externals each seem particularly suited to dealing with certain kinds of tasks. The effectiveness of each group becomes evident when they are confronted with the tasks most suited to them. The great difficulty of the task employed in the first study rendered both styles ineffective. The task of the second study provided the internals with an opportunity to display their efficiency at processing simultaneously different aspects of the task; whereas the externals seemed unable to do this without relying heavily on the use of switchbacks. The principle of the task of the third study was deciphered more successfully by externals apparently because their simple "butterfly" approach enabled them to discover the key letters

and/or numbers, whereas the internals' more systematic and complicated approach tended to obscure the principle.

Lefcourt (1976) and Phares (1976), after reviewing the molecular research on locus of control, conceptualised the internals as being more cognitively 'active' than externals. However, in the context of these laboratory tasks it is clear that both internals and externals were cognitively active, the difference lying in the way this activity was executed. Furthermore, internals and externals were not consistently distinguished by their ability to solve the problems successfully.

3. Cognitive Structures and other Cognitive Styles

The present research was concerned with the cognitive styles of internals and externals, the emphasis being on the characteristic ways information was processed by these two groups, on different tasks. However, the way persons assimilate and process information also reflects the way they organise their cognitions, that is, it reflects what have been called their cognitive structures (cf. Bieri, 1955, 1961; Scott, 1969) or cognitive or belief systems (cf. Harvey, Hunt and Schroder, 1961; Rokeach, 1960, 1968). The research of these and other social psychologists has been concerned with the influence of the structure of individuals' cognitive systems on the way they

construe and act upon their social environment. These investigators distinguished between those individuals whose cognitive systems are more "open", "abstract" or "complex" and those whose cognitive systems are more "closed", "concrete" or "simple". Superficially, the internals' more thorough and systematic cognitive style may seem related to cognitive complexity and abstractness; while that of the externals' to be more related to cognitive simplicity and concreteness. However, while this may seem an elegant way of relating these two areas of research it is an empirical issue as to what the exact relationship is, and the limited evidence at present available is not encouraging. Firstly, these different measures of cognitive structures do not correlate well with each other (cf. Ostell, 1974), thus internality could be associated with abstractness but not complexity. Secondly, poor correlations have been found between internality and the "openness" of a belief system (Clouster and Hjelle, 1970; Pawlicki, 1972) and internality and field independence (Chance and Goldstein, 1971; Deever, 1968; Lefcourt and Telegdi, 1971; McIntyre and Dreyer, 1973).

However, one dimension has been identified which bears some resemblance to the cognitive styles of internals and externals. Kagan (1965) has described a dimension ranging from <u>impulsivity</u> (inclination toward quick and often simplistic processing of information), to <u>reflectivity</u> (tendency toward slower, more cautious and filtered processing of information).

Although no study, as far as the present author is aware, has investigated the relationship between the I-E scale and Kagan's dimension, the cognitive styles of internals and externals may well correlate with reflectivity and impulsivity, respectively. This may be an avenue for future research.

It is interesting to note that Greene (1975) in reviewing the research on concept formation, identified a selection of cognitive styles commonly manifested by subjects working on concept formation tasks. Two of these styles are of particular interest to us: a) conservative focusing which requires the persistent testing of few solution hypotheses; and b) successive scanning where the subject changes hypothese every time they are disconfirmed. These styles are similar to those displayed by internals and externals in this research. Thus, the internals' style comes closer to a "conservative focusing" one, while the externals' style resembles a "successive scanning" one.

4. Interpersonal Behaviour and Cognitive Styles of Internals and Externals

So far, the whole emphasis in this thesis has been on the cognitive processing of internals and externals, by examining their cognitive styles in solving problems. In this section a brief outline of the way internals and externals react

in social situations is presented in an attempt to relate these "social" styles to their cognitive counterparts.

Internals, as compared to externals, have been shown to be less conforming to group pressures (Crowne and Liverant, 1963; Tolor, 1971); less susceptible to influence (Biondo and MacDonald, 1971; Jones and Shrauger, 1968; Ritchie and Phares, 1969; Ryckman, Rodda, and Sherman, 1972; Sherman, 1973); and to respond more to the informational demands of the task rather than to its social demand aspects (Pines, 1973; Pines and Julian, 1972). These differences between internals and externals were considered by the authors involved as reflecting a greater desire to control social outcomes on the part of internals,and lack of confidence in achieving success alone,on the part of externals. Moreover, a great deal of research supports the contention that externals manifest greater anxiety than internals (e.g. Hountras and Scharf, 1970; Levenson, 1973b; Nelson and Phares, 1971; Platt and Eisenman, 1968). The internals were also shown to react in a more constructive manner to frustration (Brissett and Nowicki, 1973) and to stress (Wolk and Bloom, 1978) than externals. Thus internality seems to be related to more adjusted and psychologically 'healthy' behaviour than externality. Moreover, as mentioned in the introduction to the first study internals, relative to externals, attribute success and failure to themselves. How, if at all, do the above differences relate to the cognitive styles of

internals and externals?

Recently, a number of investigators have advocated a direct relationship between cognitive processing and social behaviour in an attempt to explain the way such processing affects interpersonal interaction (Berkowitz, 1975; Greene, 1976; Simon, 1976; Shaver, 1975; Spivack, Platt, and Shure, 1976; Stotland and Canon, 1972). In fact Lefcourt (1976) argues that the differences in cognitive responses between internals and externals determine their different responses to social pressure and attempts to influence their behaviour.

Externals have been shown to be more attuned to the social demands of a situation than internals (Pines, 1973). This may be due to the fact that externals feel that success in that situation will not be contingent on their efforts alone. Why? Internals seem to pay more attention to task relevant information than externals (Lefcourt et al, 1968; Phares, 1968; second study) while externals are more sensitive to salient cues of information (third study; Wolk and DuCette, 1974). Thus externals seem unable to distinguish relevant from irrelevant information but react to salient cues, even though they may not be appropriate ones. To some extent this explains why externals seem less able to identify significant causal relationships among variables, and it is precisely this ambiguity in establishing the causal relationships of behaviour-reinforcement contingencies,which makes generalised

expectancies more external and makes externals more susceptible to influence from others.

Joe (1971) raised the question whether externals were more anxious than internals due to their generalised expectancies regarding control, or whether such expectancies were external because of their high levels of anxiety. It is argued here that the more thorough and organised cognitive functioning of internals renders the causal relationships among variables in their environment more comprehensible, and hence they avoid high levels of anxiety, and are better able to reduce anxiety when it is aroused. Externals, on the other hand, due to their less thorough and organised cognitive styles may fail to grasp the true relationships among events around them, so that they do not know how to respond to some situations, or their responses prove inappropriate. This may lead, to use Seligman's (1975) terminology, to feelings of helplessness, and increase anxiety.

It is interesting to note that internals, relative to externals, tend to repress failure (Efran, 1963); tend to deny a disability when having one (Lipp, Kilstoe, James, and Randall, 1968); and repress negative information concerning personal problems (Phares, Ritchie, and Davis, 1968). It could be speculated that although internals are more confident about their abilities (Johnson and Kilmann, 1975; third study), and are more achievement oriented (Wolk and DuCette, 1973) than

externals, they nonetheless seem to be more prone to engage in 'face saving' behaviour than externals. The internals' more thorough and systematic cognitive styles may function most smoothly when the information in the environment is congruent with their basic personal and social beliefs. If so, it is not very surprising that they resist attempts to influence their beliefs more than externals.

5. Broader Implications of the Cognitive Styles of Internals and Externals

The high degree of specifity with which the cognitive styles of internals and externals have been treated in this thesis should not mask their relevance to Rotter's social learning theory. According to that theory the role of locus of control is mediated by other variables such as the nature of the situation and reinforcement value. This research has shown that the effectiveness of the cognitive styles, in terms of finding the correct solution, depends on the nature of the task at hand (and on task difficulty). The value of reinforcement was held more or less constant over the three studies in that subjects found the three tasks interesting and internals and externals had approximately the same number of correct answers in each study.

The findings of this research raise an interesting question: What exactly constitutes a "genuine" internal or

"external"? Is it his generalised beliefs about behaviour-reinforcement contingencies, or his cognitive style? People are typically classified as an "internal" or an "external" depending on their scores on the I-E scale. The present research suggests that cognitive styles can also be used as stable measures of "internality" and "externality".

As indicated in Chapter 2, the I-E scale measures the contemporary beliefs of an individual. There is some evidence suggesting a positive relationship between internality and chronological age (Penk, 1969). Moreover, group therapy can induce shifts toward internality as measured by the I-E scale (Diamond and Shapiro, 1973; Dua, 1970; Foulds, 1971; Foulds, Guihan, and Warhime, 1974; Nowicki and Barnes, 1973). However, these changes in beliefs may not have been associated with actual and significant behavioural changes. Further, people endorse internal or external items on the I-E scale for different reasons. Individuals may believe in internal control because they value hard work (Clark, 1976), or they may select the external items because they cannot cope with the competition around them (Hersch and Scheibe, 1967). Thus beliefs <u>per se</u> do not delineate the nature of internality and externality as well as cognitive styles do, and they are probably less stable than these styles.

Although it is difficult to specify unambiguously which comes first, beliefs or cognitive styles, it is argued here that

the way persons process information seems to engender the kind of beliefs they have about the world. Moreover, this relationship is mediated by experiences of success and failure. For example, when a person after appraising some situation takes action which subsequently proves successful, then this experience will strengthen certain responses associated with that situation and could also engender a belief in his autonomy. These beliefs are only properly assimilated, however, if the person perceives the causal relationship between the success experience and his behaviour. The external may fail to perceive such a relationship (cf. third study). The author is arguing that the internal perceives this relationship which engenders beliefs in his personal autonomy, thus reinforcing his tendency to appraise and react to situations in the manner he does. Thus the way people process information about situations influences their reactions to, and consequently, their beliefs about these conditions.

Internals relative to externals, assimilate, organise and process information more quickly, thoroughly and systematically. Thus, producing a shift towards internality on the I-E scale is not a sufficient condition for developing internality. Individuals need to be able to identify the important variables operating in their environment; they need to become aware of, or able to discover, the causal relations among variables and learn how to respond to situations to achieve their purposes; if they are

to develop internality in its fullest sense.

Our ability to negotiate our environment effectively is determined to a large extent by our ability to process relevant information in our environment. As we do this successfully our beliefs regarding internal control begin to take shape. Experience, beliefs and cognitive styles are closely interwoven: we are, in a sense, the way we process.

APPENDICES

APPENDIX 1

First Study

Materials and Additional Data

A) The materials used in the first study are presented in the following order:

1.1 Rotter's Internal-External Scale (Rotter, 1966) which is made up of 29 forced choice items of which 6 are filler items.[1]

1.2 The concept formation task which consists of 50 trials each made up of 5 stimulus words and 2 response words.

1.3 The post task questionnaire.

Additional data pertaining to the number of quasi solution hypotheses and the number of trials on which the subjects guessed, are presented in Section B.

---

1 Since the I-E Scale had been used in the three studies, it will not be mentioned in subsequent appendices.

APPENDIX 1

1.1 Rotter's Internal-External Scale

NAME: ..... DATE: .....
(Block Capitals)

AGE: ..... (years) ..... (months) SEX: .....

This is a questionnaire to find out the way in which certain important events in our society affect different people. Each item consists of a pair of alternatives lettered a or b. Please select the one statement of each pair (and only one) which you more strongly believe to be the case as far as you are concerned.

Be sure to select the one you believe to be more true rather than the one you think you should choose or the one you would like to be true. This is a measure of personal belief: obviously there are no right or wrong answers.

Indicate your answer for each item by drawing a circle around the letter (a or b) next to the statement you select. Please answer these items carefully but do not spend too much time on any one item, and please give an answer for every item.

In some instances you may discover that you believe both statements, or neither one. In such cases select the one statement which is the most acceptable, or least unacceptable, belief as far as you are concerned. Try to respond to each item independently when making your choice; do not be influenced by your previous choices.[2]

1. a Children get into trouble because their parents punish them too much.

   F[3]

   b The trouble with most children nowadays is that their parents are too easy with them.

---

2 These instructions were slightly modified from the original to render the Scale more comprehensible to the subjects of this research.

3 Indicates the filler item and is added by the author of this thesis.

Appendix 1

2. a Many of the unhappy things in people's lives are partly due to bad luck.

   b People's misfortunes result from the mistakes they make.

3. a One of the major reasons why we have wars is because people don't take enough interest in politics.

   b There will always be wars, no matter how hard people try to prevent them.

4. a In the long run people get the respect they deserve in this world.

   b Unfortunately, an individual's worth often passes unrecognised no matter how hard he tries.

5. a The idea that teachers are unfair to students is nonsense.

   b Most students don't realise the extent to which their grades are influenced by accidental happenings.

6. a Without the right breaks one cannot be an effective leader.

   b Capable people who fail to become leaders have not taken advantage of their opportunities.

7. a No matter how hard you try some people just don't like you.

   b People who can't get others to like them don't understand how to get along with others.

8. a Heredity plays the major role in determining one's personality.

   F

   b It is one's experiences in life which determine what they're like.

9. a I have often found that what is going to happen will happen.

   b Trusting to fate has never turned out as well for me as making a decision to take a definite course of action.

Appendix 1

10. a In the case of the well prepared student there is rarely if ever such a thing as an unfair test.

    b Many times exam questions tend to be so unrelated to course work that studying is really useless.

11. a Becoming a success is a matter of hard work, luck has little or nothing to do with it.

    b Getting a good job depends mainly on being in the right place at the right time.

12. a The average citizen can have an influence in government decisions.

    b This world is run by the few people in power, and there is not much the little guy can do about it.

13. a When I make plans I am almost certain that I can make them work.

    b It is not always wise to plan too far ahead because many things turn out to be a matter of good or bad fortune anyhow.

14. a There are certain people who are just no good.

    b There is some good in everybody.

15. a In my case getting what I want has little or nothing to do with luck.

    b Many times we might just as well decide what to do by flipping a coin.

16. a Who gets to be the boss often depends on who was lucky enough to be in the right place first.

    b Getting people to do the right thing depends upon ability, luck has little or nothing to do with it.

17. a As far as world affairs are concerned, most of us are the victims of forces we can neither understand, or control.

    b By taking an active part in political and social affairs the people can control world events.

F

Appendix 1

18. a Most people don't realise the extent to which their lives are controlled by accidental happenings.

    b There really is no such thing as "luck".

19. a One should always be willing to admit mistakes. F

    b It is usually best to cover up one's mistakes.

20. a It is hard to know whether or not a person really likes you.

    b How many friends you have depends upon how nice a person you are.

21. a In the long run the bad things that happen to us are balanced by the good ones.

    b Most misfortunes are the result of lack of ability, ignorance, laziness, or all three.

22. a With enough effort we can wipe out political corruption.

    b It is difficult for people to have much control over the things politicians do in office.

23. a Sometimes I can't understand how teachers arrive at the grades they give.

    b There is a direct connection between how hard I study and the grades I get.

24. a A good leader expects people to decide for themselves what they should do. F

    b A good leader makes it clear to everybody what their jobs are.

25. a Many times I feel that I have little influence over the things that happen to me.

    b It is impossible for me to believe that chance or luck plays an important role in my life.

Appendix 1

26. a People are lonely because they don't try to be friendly.

b There's not much use in trying too hard to please people, if they like you, they like you.

27. a There is too much emphasis on athletics in school.

F

b Team sports are an excellent way to build character.

28. a What happens to me is my own doing.

b Sometimes I feel that I don't have enough control over the directions my life is taking.

29. a Most of the time I can't understand why politicians behave the way they do.

b In the long run the people are responsible for bad government on a national as well as on a local level.

Note - The underlined items are the external items.
The score is the number of these items.

Appendix 1

1.2 Task Employed in the First Study

Below is a list of all the items comprising the task. Numbers adjacent to response cards denote the number of letters of the correct response words which correspond to the number of letters of the second word on the stimulus card. The location of the numbers varies from left to right of a response word indicating the correct one.

Trials	Stimulus Card		Response Card 1	Response Card 2	
1	capital time street ape paper		knife	face	4
2	uncle society half studio fat	7	embassy	marriage	
3	nun flat object property station	4	wine	cinema	
4	pencil bed postage glass book	3	leg	tree	
5	east lecture gun skill danger	7	luggage	tooth	
6	leaf theory hydro act company	6	church	balance	
7	war colleague pint umbrella truth		king	journal	7
8	food key building straw window		stone	ice	3
9	machine red ladder shop radio	3	cat	lorry	
10	week hospital box nerve boiler	8	feedback	soldier	
11	romantic screen defence saint blue		base	degree	6
12	mountain net line shadow journey	3	hat	market	

Appendix 1

Trials	Stimulus Card		Response Card 1	Response Card 2	
13	mirror sand boy gesture river		record	word	
14	aim birthday test rocket theme	8	pharmacy	spirit	
15	computer bell candle toy cover		bicycle	body	4
16	juice nose actress random tin	4	rest	science	
17	game instinct fellow gas brain		shirt	chairman	8
18	age earth neutron flower norm	5	novel	doll	
19	blouse delegate may group plug		exit	pleasure	8
20	pump fever crystal illusion orange	5	eagle	fog	
21	chair jam method theatre coat	3	sky	silver	
22	sister bread industry wax film	5	house	eye	
23	out school harvest music festival	6	father	lady	
24	iron national power service aid		fair	cylinder	8
25	green pyramid wood napkin crockery		oil	library	7
26	campaign cycle natural cold jacket	5	table	terminal	
27	set metal matrix economy bone		exchange	black	5
28	lake art jewel airport statue		bridge	cup	
29	south needle fork approach tug		odd	centre	6
30	pad life attitude brown memory		product	knob	4
31	sound rod calendar tape stable		letter	pen	3
32	beer globe ear lounge stadium	5	small	question	
33	picture spring wall model man		arm	person	6

Appendix 1

Trials	Stimulus Card		Response Card 1	Response Card 2	
34	funeral prospect guide door axe	8	commerce	race	
35	ordinary court rent law border	5	honey	business	
36	bee compact seed press modern		end	mixture	7
37	job measure board editor ball	7	channel	sun	
38	old cotton town style pattern	6	golden	map	
39	spoon play fragment gallon far		culture	bird	4
40	hair future clear railway tropical		jet	campus	6
41	emotion text hermit hen value	4	duck	raw	
42	scale pig blue island problem	3	jaw	husband	
43	student hut trait dice action	3	ray	medicine	
44	result fight goal finance pub		one	water	5
45	number complex need rum blind	7	graphic	office	
46	price discount tar team belief		bed	accident	8
47	million family back motor rat		concert	budget	6
48	bath social fan money director	6	amount	seat	
49	gum hope judgement decade rally		occasion	idea	4
50	land clerk physics ant league		preface	judge	5

The distribution of the number of letters of the correct word is as follows:

Appendix 1

9 instances of a three letter word
9 " " " four " "
9 " " " five " "
9 " " " six " "
7 " " " seven " "
7 " " an eight " "

When the correct response word was a three letter word, the distribution of the wrong response words was as follows:

1 four letter word
2 five " words
4 six " "
1 seven " word
1 eight " "

and this would add up to the 9 instances associated with the correct three letter words.

When the correct response word was a four letter word, the wrong response words were distributed as follows:

1 three letter word
1 five " "
2 six " words
4 seven " "
1 eight " word

Appendix 1

When the correct response word was a five letter word the following was the distribution of the wrong response words:

4 three letter words
0 four " "
0 six " "
1 seven " word
4 eight " words

If the correct response word was a six letter word, the distribution of the wrong response words was as follows:

4 three letter words
3 four " "
0 five " "
2 seven " "
0 eight " "

If the correct response word was a seven letter word, the wrong response words were distributed as follows:

3 three letter words
1 four " word
1 five " "
1 six " "
1 eight " "

Appendix 1

When the correct response word was an eight letter word, the following was the distribution of the wrong response words:

1 three letter word
3 four " words
1 five " word
1 six " "
1 seven " "

Appendix 1

1.3 The Post Task Questionnaire

Please print

Name: . . . . . .

Sex: . . . . . .

Age: . . . . . (years) . . . . . (months)

Occupation: . . . . . .

Educational qualifications already obtained:

Intended degree: . . . . . .

Appendix 1

A(1) How many different strategies[4] did you use in trying to discover the underlying principle which related the correct word on the response card to the stimulus card? If you only used one strategy write the number 1 in the space provided; if you used more than one strategy, put down the number of strategies you used; if you simply guessed leave the space blank:

A(2) Below, there is a list of different strategies which people possibly might have used in trying to discover the underlying principle. Examine the list carefully. I want you to do two things:

(a) If, and only if, you have used one or more strategies not mentioned in the list below, write them down in the space provided. Do not write down strategies you have not used. If you did not use any specific strategy, or the strategy(ies) is (are) included in those mentioned below, do not add anything to the list.

(b) Now look at the list again, and try to think which strategy you used first and then put the number 1 against that strategy in the space provided in the left hand column. If the first strategy did not work and you tried a different one then put the number 2 next to that strategy and so on. However, if, and only if, you returned to a strategy after having already rejected it, put down another number against that strategy. The numbers should be separated by a hyphen. For example, the numbers 2-4 next to a strategy indicate that that particular strategy was tried second and then fourth respectively; similarly the numbers 1-3-5 (for example) would indicate that

---

4 The term "strategy" instead of "solution hypothesis" was used in the questionnaire in order not to confuse the subjects. Therefore, the term strategy here will always denote solution hypothesis.

Appendix 1

the strategy was tried first, and then third and then fifth respectively. If you did not use any specific strategy, put down the number 1 against the strategy "simply guessed the correct word". If you used (say) two different strategies and then simply guessed for the remaining trials, put 3 next to the strategy "simply guessed the correct word".

Please do not put a number against a strategy unless you have used that strategy. You are not being compared with others, so please respond in a manner which truly reflects your actual performance on the task.

STRATEGIES YOU MAY HAVE USED TO DISCOVER THE PRINCIPLE RELATING THE RESPONSE WORD TO THE STIMULUS CARD.

_____ Simply guessed the correct word.

_____ Looked for a relationship in terms of similar meaning between the word on the response card and the stimulus card.

_____ Looked for a relationship in terms of opposite meaning between the word on the response card and the stimulus card.

_____ Looked for a relationship in terms of the same number of letters of the word on the response card and a word on the stimulus card.

_____ Looked for a relationship in terms of a common category (e.g. the word on the response card and the words on the stimulus card belonged to the same category such as "fruits", "wooden objects", "animals" etc.).

_____ Looked for a relationship in terms of letter sequence (e.g. the word on the response card contained the same letter(s) as the one(s) prominent in the words on the stimulus card).

Appendix 1

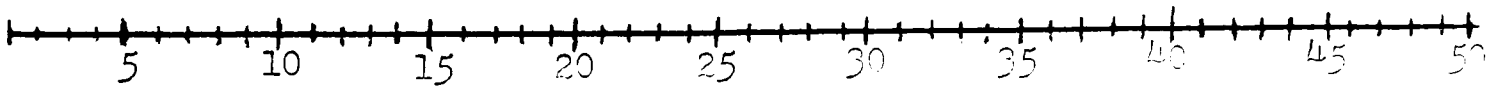
_____

_____

_____

_____

B Some subjects, when they cannot find the correct principle, resort to guessing. Some resort quickly, others take more time, and others do not resort to guessing at all. Indicate on the line below, by circling the appropriate trial, the approximate point at which you adopted the guessing strategy (do this only if you actually started guessing). If you resorted to guessing more than once, then circle the appropriate trials at which guessing started (e.g. if you started guessing on (say) trial 20, and then on trial 30 you rejected guessing, but resorted to it again on (say) trial 40, then circle trials 20 and 40 respectively and so on). If you persisted to find the correct principle over the 50 trials and did not resort to guessing at all then tick (✓) the box below trial 50:



Appendix 1

C Below you find a number of questions about your reaction to the experiment. Please answer each question by drawing a circle around the number on each scale which truly reflects your opinion or performance:

How much did you <u>like</u> the task? 1 2 3 4 5 6 7 8 9

disliked the task very much — liked the task very much

When trying to discover the underlying principle, <u>how hard did you try</u>? 1 2 3 4 5 6 7 8 9

did not try at all — tried as hard as I could

How <u>interested</u> were you in the task? 1 2 3 4 5 6 7 8 9

not interested at all — very much interested

How much do you think this was a task which depended on <u>skill</u> or <u>chance</u>? 1 2 3 4 5 6 7 8 9

purely a matter of chance — purely a matter of skill

D(1) Did you find the underlying principle? Yes ☐ / No ☐ (tick one box)

(2) For how many trials did you find the correct word? (Please give an answer out of 50) _____

Appendix 1

(3) Think back over your performance and then indicate on the scales below how much you think each of the factors listed influenced your performance on the task:

1 2 3 4 5 6 7 8 9

The task was too easy for me — The task was too difficult for me

1 2 3 4 5 6 7 8 9

I am not competent at such a task — I am highly competent at such a task

1 2 3 4 5 6 7 8 9

I wasn't feeling comfortable at all during the experiment — I was feeling very comfortable during the experiment

1 2 3 4 5 6 7 8 9

testing situation distracted me very much — I wasn't distracted at all by testing situation

Finally, please add any other comments you wish about your performance or any aspects of the task:

p.t.o./

Appendix 1

THANK YOU VERY MUCH FOR YOUR CO-OPERATION. AS OTHER PEOPLE ARE STILL GOING TO BE TESTED, PLEASE DO NOT DISCUSS THIS EXPERIMENT WITH THE OTHERS. THANK YOU.

Appendix 1

B Additional Data:

1.4 Number of Quasi Solution Hypotheses

Subjects were asked to write down the number of the solution hypotheses they used over the 50 trials. The mean scores for the number of quasi solution hypotheses are presented in table 1.1.

Table 1.1

Mean scores for the number of quasi solution hypotheses as a function of locus of control, sex, and conditions

	Conditions			
Subjects	Skill	Chance 1	Chance 2	Combined Conditions
Internals	3.67	4.47	2.16	3.43
Externals	7.08	4.50	3.37	4.98
Males	3.25	5.07	2.87	3.73
Females	7.50	3.90	2.66	4.69
Combined sample	5.38	4.49	2.77	4.21

The data were then analysed using A 2 x 2 x 3 (locus of control x sex x conditions) factorial design with unequal number

Appendix 1

in cells (least square analysis). This design is also used for the subsequent analysis. Summary of the analysis of variance of the number of quasi solution hypotheses is reported in table 1.2.

Table 1.2

Summary of analysis of variance of the number of quasi solution hypotheses as a function of locus of control, sex, and conditions

Variation	SS	DF	MS	F	P
A (Locus of control)	40.500	1	40.500	3.143	
B (Sex)	14.222	1	14.222	1.104	
C (Conditions)	88.694	2	44.347	3.441	$<.038$
AB	19.199	1	19.199	1.490	
AC	42.031	2	21.016	1.631	
BC	99.477	2	49.739	3.860	$<.026$
ABC	13.978	2	6.989	.542	
Within cells (error)	773.176	60	12.886		

Locus of control main effect almost reached significance, and table 1.1 shows that externals wrote down more quasi solution hypotheses. The highly significant conditions main effect indicates that skill, chance 1 and chance 2 produced different

Appendix 1

responses among subjects. Table 1.1 shows that subjects in skill and chance 1 wrote down more quasi solution hypotheses as compared with subjects under chance 2.

The significant sex x conditions interaction was investigated using Tukey's HSD test (q) for a posteriori pairwise comparisons between the means, as the interaction had not been predicted. The q values show that under skill females wrote down more quasi solution hypotheses than did the males ($q = 3.896$, df 2/60, $P<.01$); no significant differences for the other conditions were found.

1.5 Number of Trials on which Subjects Guessed

The subjects were required to circle the number of trials on which they guessed on a 50 point line (each point standing for a trial). Table 1.3 presents the means of the number of trials on which subjects guessed.

Summary of analysis of variance (shown in table 1.4), resulted in significant locus of control and conditions main effects and locus of control x conditions interaction. As table 1.3 shows the internals guessed more than externals, and subjects reactions were greatly dependent on the conditions (the highest number was in the chance 2 condition).

Appendix 1

Table 1.3

Mean scores for the number of trials on which subjects guessed as a function of locus of control and conditions

Locus of Control	Conditions			
	Skill	Chance 1	Chance 2	Combined
Internals	1.33	2.47	19.33	7.71
Externals	3.58	3.47	6.33	4.46
Combined	2.46	2.97	12.83	6.09

As the locus of control x conditions had not been predicted, Tukey's q test for a posteriori pairwise comparisons between the means was employed. The q values revealed that under chance 2 internals guessed on more trials than did externals ($q = 8.287$, df 2/60, $P < .01$); no significant differences existed for the other conditions.

Appendix 1

Table 1.4

Summary of the analysis of variance of the number of trials on which subjects guessed as a function of locus of control, sex, and conditions

Variation	SS	DF	MS	F	P
A (Locus of control)	378.125	1	378.125	6.487	$<.013$
B (Sex)	86.681	1	86.681	1.487	
C (Conditions)	2266.694	2	1133.347	19.444	$<.001$
AB	2.907	1	2.907	.050	
AC	1331.735	2	665.867	11.424	$<.001$
BC	56.848	2	28.424	.488	
ABC	3.992	2	1.996	.034	
Within cells (error)	3497.338	60	58.289		

APPENDIX 2

Second Study

Materials

The materials employed in the second study consisted of the following: the concept formation task (made up of 24 trials each comprised of a certain number of characteristics - ranging from 3 to 9 inclusive - and 5 objects); and the post task questionnaire.

2.1 Task employed in the Second Study

Below is a list of all the items comprising the task. The number on the right hand side of the characteristics denotes the number of characteristics of a given trial. The two zero trials preceding the first trial are the preparatory trials. The asterisk adjacent to an object in any trial indicates the correct object.

Trial	Characteristics		Objects
0	Reeled	1	Film
	Playable	4	*2 Tape
	Magnetic	3	Disc
	Recording	4	Ribbon
		5	Cord

Appendix 2

Trial	Characteristics			Objects
0	Wearable		1	Socks
	Paired	3	2	Gloves
	Laced		3	Ear muffs
			*4	Shoes
			5	Slippers
1	Sharp		1	Sickle
	Straight		2	Saw
	Cutter		3	Claw
	Dangerous	8	4	Javelin
	Solid		*5	Knife
	Pointed			
	Metallic			
	Sheathed			

Appendix 2

Trial	Characteristics		Objects	
2	Amorphous		1	Iceberg
	Hard		*2	Stone
	Solid		3	Monument
	Unpolished	7	4	Concrete
	Natural		5	Mountain
	Moveable			
	Opaque			
3	Open		1	Globe
	Flat		2	Signpost
	Descriptive		*3	Map
	Readable		4	Dictionary
	Scaled	8	5	Notice
	Directional			
	Representative			
	Geographical			

Appendix 2

Trial	Characteristics			Objects
4	Hard		1	Teeth
	White		*2	Bone
	Supportive	5	3	Skull
	Living		4	Tusk
	Calcified		5	Chalk
5	Breakable		1	Ice
	Insulator	3	2	Bottle
	Transparent		3	Wind-screen
			*4	Glass
			5	Goggles
6	Traversable		1	Dome
	Joining		2	Tunnel
	Suspended		*3	Bridge
	Solid		4	Road
	Pillared	9	5	Vault
	Crossing			
	Arched			
	Constructed			
	Communicating			

Appendix 2

Trial	Characteristics		Objects
7	Coloured	*1	Carpet
	Soft	2	Curtain
	Covering	3	Blanket
	Flat	8 4	Coat
	Woven	5	Towel
	Fitted		
	Patterned		
	Insulator		
8	Horizontal	1	Cabinet
	Fixed	4 2	Hanger
	Flat	3	Wall
	Supportive	4	Bench
		*5	Shelf

Appendix 2

Trial	Characteristics		Objects
9	Water-proof	1	Parachute
	Protective	2	Tent
	Spoked	3	Raincoat
	Portable 7	*4	Umbrella
	Compact	5	Wheel
	Light		
	Collapsible		
10	Inflatable	*1	Balloon
	Thin	2	Bubble-gum
	Expansible 5	3	Dinghy
	Rubbery	4	Bag
	Coloured	5	Tube
11	Tailored	1	Apron
	Light	2	Jacket
	Collared	*3	Shirt
	Textured 7	4	Jeans
	Buttoned	5	Skirt
	Wearable		
	Tailed		

Appendix 2

Trial	Characteristics		Objects	
12	Opener		1	Lever
	Releaser		2	Tin-opener
	Light		3	Release mechanism
	Flat		4	Instrument
	Metallic	9	*5	Key
	Portable			
	Small			
	Handled			
	Serrated			
13	Woven		1	Cotton
	Textured		2	Wool
	Fibrous	6	3	Silk
	Tailorable		4	Rubber
	Wearable		*5	Cloth
	Coloured			

Appendix 2

Trial	Characteristics			Objects
14	Spherical		1	Bubble
	Inflatable	3	2	Tyre
	Bouncy		3	Rubber
			4	Racket
			*5	Ball
15	Twistable		1	Button
	Metallic		*2	Knob
	Rounded	6	3	Handle
	Projecting		4	Steering wheel
	Solid		5	Hook
	Lumpish			
16	Woven		1	Hood
	Crowning	4	2	Bonnet
	Brimmed		3	Scarf
	Concave		*4	Hat
			5	Crown

Appendix 2

Trial	Characteristics			Objects
17	Necked		1	Jar
	Brittle		*2	Bottle
	Hollow		3	Mug
	Stoppered	7	4	Pan
	Pourer		5	Cylinder
	Upright			
	Flat-bottomed			
18	Nibbed		1	Pencil
	Refillable	3	2	Brush
	Writer		*3	Pen
			4	Quill
			5	Ink
19	Metallic		1	Chain
	Flexible		2	Arial
	Coated	6	*3	Wire
	Insulated		4	Iron
	Manufactured		5	Cord
	Conductive			

Appendix 2

Trial	Characteristics			Objects
20	Smooth		1	Hook
	Pointed	4	*2	Nail
	Metallic		3	Screw
	Headed		4	Spear
			5	Rivet
21	Flat		*1	Tray
	Handled	4	2	Basket
	Portable		3	Trolly
	Shallow		4	Coffin
			5	Box
22	Container		1	Carrybag
	Transportable		*2	Suitcase
	Personal		3	Satchel
	Capacious	8	4	Cupboard
	Handled		5	Drawer
	Hollow			
	Lockable			
	Hinged			

Appendix 2

Trial	Characteristics		Objects	
23	Synthetic		1	Nylon
	Pliable	3	2	Leather
	Oil-based		3	Aluminium
			*4	Plastic
			5	Tarpaulin
24	Magnifying		*1	Lens
	Convex		2	Binoculars
	Polished		3	Camera
	Zooming		4	Magnifying glass
	Small	9	5	Telescope
	Precision-made			
	Detachable			
	Glass			
	Photographic			
25	Coloured		1	Fossil
	Breakable		2	Lead
	Dusty	5	3	Crayon
	Light		4	Clay
	Alkaline		*5	Chalk

Appendix 2

Trial	Characteristics			Objects
26	Covering		1	Label
	Transportable		2	Folder
	Light	5	*3	Envelope
	Flapped		4	Pad
	Gummed		5	Wrapper
27	Container		1	Purse
	Folding		2	Hand-bag
	Compartmented		3	Case
	Personal		*4	Wallet
	Light	9	5	Money-bag
	Flat			
	Stitched			
	Valuable			
	Masculine			

Appendix 2

Trial	Characteristics			Objects
28	Metallic		1	Pliers
	Portable		2	Spanner
	Strong	6	3	Scissors
	Cutter		4	Sword
	Pivoted		5	Knife
	Adjustable			

Appendix 2

2.2 The Post Task Questionnaire

Please print

Name: . . . . . .

Sex: . . . . . .

Age: . . . . . .

Appendix 2

Below, there is a list of different strategies[1] which people possibly might have used in trying to solve the task. Examine the list carefully. If you have used any strategies listed, put a cross against that strategy in the space provided in the left hand column; otherwise leave the space blank.

_____ Tended to conceptualize the appropriate object while examining the characteristics' list, and before looking at the objects' list.

_____ Used the above strategy for all the objects (i.e. in all the trials).

_____ Used the above strategy for the obvious objects only.

_____ In addition to matching the appropriate object with the characteristics, I tried to compare all the five objects with each other.

Below, you find a number of questions about your reaction to the experiment. Please answer each question by drawing a circle around the number on each scale which truly reflects your opinion or performance:

How interested were you in the task? 1 2 3 4 5 6 7 8 9

not interested at all — very much interested

---

1 The term "approach" as used in the text was considered to be more appropriate than "strategy" in order to alleviate any confusions with the way a strategy was defined in the first study.

Appendix 2

When trying to name the correct object, how hard did you try?

1 2 3 4 5 6 7 8 9

did not try at all — tried as hard as I could

How much did you like the task?

1 2 3 4 5 6 7 8 9

disliked the task very much — liked the task very much

How much do you think this was a task which depended on skill or chance?

1 2 3 4 5 6 7 8 9

purely a matter of chance — purely a matter of skill

Think back over your performance and indicate on the scales below how much you think each of the factors listed influenced your performance on the task:

1 2 3 4 5 6 7 8 9

the task was too easy for me — the task was too difficult for me

Appendix 2

1 2 3 4 5 6 7 8 9

I lack the ability to perform such a task

I am very able to perform such a task

Finally, please add any other comments you wish about your performance or any other aspect of the task:

APPENDIX 3

Third Study

Materials and Additional Data

A - the materials of the third study are presented in the following order:

3.1 The concept formation task (a booklet presenting 24 trials of sets of the two numbers and two letters).

3.2 Post task questionnaire.

Section B contains data of the comparisons in task performance between paid versus volunteer subjects; paid versus volunteer internals; and successful externals versus unsuccessful externals.

Appendix 3

3.1 The Task

The task was presented in a booklet form (each page of the booklet measured 21 x 15 cm). After the title page, the following confidence rating scale was presented:

> Please circle the number on the scale below which truly reflects your opinion:
>
> How confident are you of finding the underlying principle?
>
> 1 2 3 4 5 6 7 8 9
>
> Not confident at all — very much confident

A sample of a trial page is presented below:

BA43

_____ This set contains the principle

_____ This set does not contain the principle

Please write down the strategy(ies) that you used:

Below is a list of all the sets (24) used in the task. Each set is presented in a trial page.

A postive (+) sign next to a set indicates that that

Appendix 3

particular set contains the principle. A negative (-) sign indicates that the set does not contain the principle.

Trials	Sets	
1	BA43	+
2	BC24	-
3	DA23	+
4	BA36	+
5	AC13	+
6	DB21	-
7 -	DA32	+
8	CD42	-
9	DB54	-
10	AC23	+
11	AB13	+
12	AD43	+
13	BA39	+
14	CD26	-
15	CA36	+
16	BC12	-
17	DB16	-
18	DA53	+

Appendix 3

Trials	Sets	
19	CA32	+
20	AD35	+
21	DB45	-
22	AC31	+
23	DC18	-
24	BA34	+

Four letters (A to D inclusive) and 8 numbers (1, 2, 3, 4, 5, 6, 8 and 9) were used in constructing the 24 sets. In all there were 48 letters and 48 numbers distributed as follows: 15 As; 11 Bs; 10 Cs; 12 Ds; 7 ones; 9 twos; 15 threes; 7 fours; 4 fives; 4 sixes; 1 eight; and 1 nine.

After each set a feed back sheet stating "THE SET CONTAINED THE PRINCIPLE" or "THE SET DID NOT CONTAIN THE PRINCIPLE" was presented. Following trial number 12 another confidence scale (similar to the one shown above) was presented. The last two pages of the booklet (following trial number 24) are shown below respectively:

Appendix 3

THE SET CONTAINED THE PRINCIPLE

Did you find the principle?

_____ Yes

_____ No

If you ticked yes, please state the nature of the principle:

If you ticked no, please turn over the page.

and

If you did not find the principle, how confident are you of finding it if the number of the trials was doubled? Please circle the appropriate number on the scale below:

1 2 3 4 5 6 7 8 9

not confident at all — very much confident

Appendix 3

3.2 Post Task Questionnaire

Name: .....

Below, you find a number of questions about your reaction to the experiment. Please answer each question by drawing a circle around the number on each scale which truly reflects your opinion or performance:

How much do you think this was a task which depended on skill or chance?

1 2 3 4 5 6 7 8 9

purely a matter of chance — purely a matter of skill

How much do you think your performance on this task depended on skill or chance?

1 2 3 4 5 6 7 8 9

purely a matter of chance — purely a matter of skill

How familiar was this task to you?

1 2 3 4 5 6 7 8 9

too familiar — not familiar at all

How difficult was this task for you?

1 2 3 4 5 6 7 8 9

too difficult — too easy

Appendix 3

How interesting was the task? 1 2 3 4 5 6 7 8 9

not interesting at all — very much interesting

Finally, please add any other comments you wish about your performance or any other aspects of the task:

Appendix 3

B. Additional Data

As indicated in the results section of the third study, comparisons between paid versus volunteer subjects, paid internals and volunteer internals, and successful externals versus unsuccessful externals were carried out to determine the degree of discrepancy between them. All the data were analysed by 2 x 2 factorial design with unequal number in cells (least square analyses). The first factor refers to either paid versus volunteer subjects or successful versus unsuccessful externals, and the other factor is sex. A sample of the breakdown of the sums of squares is presented in table 3:1. The remaining tables contain the means for each index of comparison. There were no significant differences due to the first factor in all the analyses[1]. Sex main effects were found only for initial confidence with males being significantly more confident than females (the same differences were obtained in the main results).

---

1 Except for successful versus unsuccessful externals in their ratings of middle confidence. As indicated in the results section, the unsuccessful externals were less confident than successful externals following the 12th trial.

Appendix 3

Table 3.1

Summary of analysis of variance of the number of correct trials as a function of paid versus volunteer subjects and sex based on 24 trials

Variation	SS	DF	MS	F	P
A (Subjects)	9.655	1	9.655	.612	
B (Sex)	49.728	1	49.728	3.154	
AB	8.943	1	8.943	.567	
Within cells (error)	567.649	36	15.768		

Table 3.2

Mean scores for the number of correct trials as a function of paid versus volunteer subjects and sex

	Sex		
Subjects	Males	Females	Combined
Paid subjects	16.44	21.00	18.72
Volunteer subjects	14.90	16.84	15.87
Combined	15.67	18.92	17.30

e: The scores are out of 24

Appendix 3

Table 3.3

Mean scores for the number of solution hypotheses as a function of paid versus volunteer subjects and sex

	Sex		
Subjects	Males	Females	Combined
Paid subjects	4.44	4.00	4.22
Volunteer subjects	3.40	4.21	3.81
Combined	3.92	4.11	4.02

Table 3.4

Mean ratings of initial confidence as a function of paid versus volunteer subjects and sex

	Sex		
Subjects	Males	Females	Combined
Paid subjects	4.78	3.00	3.89
Volunteer subjects	5.10	3.42	4.29
Combined	4.94	3.21	4.09

e: Low score indicates low confidence, high score the reverse

Appendix 3

Table 3.5

Mean scores for the number of correct trials as a function of paid versus volunteer internals and sex

	Sex		
Internals	Males	Females	Combined
Paid internals	15.67	21.00	18.34
Volunteer internals	14.20	15.57	14.89
Combined	14.94	18.29	16.62

e: The scores are out of 24

Table 3.6

Mean scores for the number of solution hypotheses as a function of paid versus volunteer internals and sex based on 24 trials

	Sex		
Internals	Males	Females	Combined
Paid internals	4.33	4.00	4.17
Volunteer internals	4.20	4.43	4.32
Combined	4.27	4.22	4.25

Appendix 3

Table 3.7

Mean ratings of initial confidence as a function of paid versus volunteer internals and sex

	Sex		
Internals	Males	Females	Combined
Paid internals	5.67	3.00	4.34
Volunteer internals	5.80	4.29	5.05
Combined	5.74	3.65	4.70

e: Low score denotes low confidence, high score the reverse

Table 3.8

Mean ratings of initial confidence as a function of successful versus unsuccessful externals and sex

	Sex		
Externals	Males	Females	Combined
Successful externals	4.00	2.75	3.38
Unsuccessful externals	3.67	3.25	3.49
Combined	3.84	3.00	3.42

e: Low score indicates low confidence, high score the reverse

Appendix 3

Table 3.9

Mean ratings of middle confidence as a function of successful versus unsuccessful externals and sex

	Sex		
Externals	Males	Females	Combined
Successful externals	4.00	5.38	4.69
Unsuccessful externals	3.00	1.75	2.38
Combined	3.50	3.57	3.54

Table 3.10

Mean scores for the average number of trials per solution hypothesis as a function of successful versus unsuccessful externals and sex based on the first 6 and 9 trials

		Sex		
Trials	Externals	Males	Females	Combined
First 6 Trials	Successful externals	1.26	1.29	1.28
	Unsuccessful externals	1.00	1.38	1.19
	Combined	1.13	1.38	1.24
First 9 Trials	Successful externals	1.92	1.61	1.77
	Unsuccessful externals	1.13	1.93	1.53
	Combined	1.53	1.77	1.65

Appendix 3

Table 3.11

Mean scores for the maximum number of trials per solution hypothesis as a function of successful versus unsuccessful externals and sex based on the first 6 and 9 trials

		Sex		
Trials	Externals	Males	Females	Combined
First 6 Trials	Successful externals	1.40	1.38	1.39
	Unsuccessful externals	1.33	2.25	1.79
	Combined	1.37	1.82	1.59
First 9 Trials	Successful externals	3.00	2.50	2.75
	Unsuccessful externals	1.67	2.75	2.21
	Combined	2.34	2.63	2.48

Appendix 3

Table 3.12

Mean scores for the number of solution hypotheses as a function of successful versus unsuccessful externals and sex based on the first 6 and 9 trials

		Sex		
Trials	Externals	Males	Females	Combined
First 6 Trials	Successful externals	2.40	2.25	2.33
	Unsuccessful externals	1.33	2.25	1.79
	Combined	1.87	2.25	2.06
First 9 Trials	Successful externals	3.20	3.63	3.42
	Unsuccessful externals	2.00	3.00	2.50
	Combined	2.60	3.32	2.96

Appendix 3

Table 3.13

Mean scores for the number of correct trials as a function of successful versus unsuccessful externals and sex based on the first 6 and 9 trials

		Sex		
Trials	Externals	Males	Females	Combined
First 6 Trials	Successful externals	2.60	3.38	2.99
	Unsuccessful externals	2.33	3.25	2.79
	Combined	2.47	3.32	2.89
First 9 Trials	Successful externals	5.00	5.13	5.07
	Unsuccessful externals	3.67	4.75	4.21
	Combined	4.34	4.94	4.64

REFERENCES

REFERENCES

Altrocchi, J., Palmer,J., Heliman, R. and Davis, H. (1968) The Marlow-Crowne, Repressor-Sensitizer, and Internal-External Scales and Attribution of Unconscious Hostile Intent. Psychological Reports, 23, 1229-1230.

Abramowitz, S.I. (1973) Internal-External Control and Social-Political Activism: A Test of the Dimensionality of Rotter's I-E Scale. Journal of Consulting and Clinical Psychology, 40, 196-201.

Abramowitz, S.I. (1974) Research on Internal-External Control and Social-Political Activism. A Note and Bibliography. Psychological Reports, 34, 619-621.

Atkinson, J.W. (1964) An Introduction to Motivation. Princeton, N.J.: Van Nostrand.

Baron, R.A. (1967) Motivation and Performance in Skill and Chance Defined Situations. Psychonomic Science, 9, 631-632.

Baron, R.A. (1968) Authoritarianism, Locus of Control, and Risk Taking. Journal of Psychology, 68, 141-143.

Baron, R.M., Cowan, G., Ganz, R.L. and McDonald, M. (1974) Interaction of Locus of Control and Type of Reinforcement Feedback: Considerations of External Validity. Journal of Personality and Social Psychology, 30, 285-292.

Baron, R.M. and Ganz, R.L. (1972) Effects of Locus of Control and Type of Feedback on the Task Performance of Lower-Class Black Children. Journal of Personality and Social Psychology, 21, 124-130.

REFERENCES

Bartel, H., DuCette, J. and Wolk, S. (1972) Category Clustering in Free Recall and Locus of Control. The Journal of General Psychology, 87, 251-257.

Berkowitz, L. (1975) A Survey of Social Psychology. Hinsdale, Illinois: The Dryden Press.

Berzins, J., Ross, W.F. and Cohen, D.I. (1970) Skill Versus Chance Acitivty Preferences as Alternative Measures of Locus of Control: An attempted Cross-Validation. Journal of Consulting and Clinical Psychology, 35, 18-20.

Bialer, I. (1961) Conceptualization of Success and Failure in Mentally Retarded and Normal Children. Journal of Personality, 29, 303-320.

Bieri, J. (1955) Cognitive Complexity-Simplicity and Predictive Behavior. Journal of Abnormal and Social Psychology, 51 263-268.

Bieri, J. (1961) Complexity-Simplicity as a Personality Variable in Cognitive and Preferential Behavior. In D.W. Fiske and S.R. Maddi (Eds.). Functions of Varied Experience. Humewood, Ill.: Dorsey.

Biondo, J. and MacDonald, A.P., Jr. (1971) Internal-External Locus of Control and Response to Influence Attempts. Journal of Personality, 39, 407-419.

Blackman, S. (1962) Some Factors Affecting the Perception of Events as Chance Determined. Journal of Psychology, 54, 197-202.

REFERENCES

Brecher, M. and Denmark, F.L. (1969) Internal-External Locus of Control and Verbal Fluency. Psychological Reports, 25, 707-710.

Brissett, M. and Nowicki, S. (1973) Internals Versus Externals Control of Reinforcement and Reaction to Frustration. Journal of Personality and Social Psychology, 25, 35-44.

Bronzaft, A.I. (1972) Internal-External Scores and Success on an ESP Task. Psychological Reports, 31, 41-42.

Calder, B.J. and Staw, B.M. (1975a) The interaction of Intrinsic and Extrinsic Motivation: Some Methodological Notes. Journal of Personality and Social Psychology, 31, 76-80.

Calder, B.J. and Staw, B.M. (1975b) Self-Perception of Intrinsic and Extrinsic Motivation. Journal of Personality and Social Psychology, 31, 509-605.

Chance, J.E. and Goldstein, A.G. (1971) Locus of Control and Performance on Embedded Figures. Perception and Psychophysics, 9, 33-34.

Clark, R.A. (1976) The I-E Scale: Control of What? Journal of Consulting and Clinical Psychology, 44, 154.

Clouster, R.A. and Hjelle, L.A. (1970) Relationship between Locus of Control and Dogmatism. Psychological Reports, 26, 1006.

Collins, B.E. (1974) Four Separate Components of the Rotter I-E Scale: Belief in a Difficult World, a Just World, a Predictable World and a Politically Responsive World. Journal of Personality and Social Psychology, 29, 381-391

Collins, B.E., Martin, J.C., Ashmore, R.D. and Ross, L. (1973) Some Dimensions of the Internal-External Metaphor in Theories of Personality. Journal of Personality, 41, 471-492.

Crandall, V.C., Katkovsky, W. and Crandall, V.J. (1965) Children's Beliefs in their Own Control of Reinforcement in Intellectual-Academic Situations. Child Development, 36, 91-109.

Crówne, D.P. and Liverant, S. (1963) Conformity Under Varying Conditions of Personal Commitment. Journal of Abnormal and Social Psychology, 66, 547-555.

Davis, W.L. and Davis, D.E. (1972) Internal-External Control and Attribution of Responsibility for Success and Failure. Journal of Personality, 40, 123-136.

Davis, W.L. and Phares, E.J. (1967) Internal-External Control as A Determinant of Information Seeking in a Social Influence Situation. Journal of Personality, 35, 547-561.

Deaux, K., White, L. and Farris, E. (1975) Skill Versus Luck: Field and Laboratory Studies of Male and Female Preferences. Journal of Personality and Social Psychology, 32, 629-636.

De Charms, R. (1968) Personal Causation. New York: Academic Press.

REFERENCES

Deci, E.L. (1975) Intrinsic Motivation. New York: Plenum Press.

Deever, S.G. (1968) Ratings of Task Oriented Expectancy for Success as a Function of Internal Control and Field Independence. Dissertation Abstracts, Section B, 29(1), 365.

Diamond, M.J. and Shapiro, J.L. (1973) Changes in Locus of Control as a Function of Encounter Group Experience. Journal of Abnormal Psychology, 82, 514-518.

Dixit, R.C. and Singh, R.P. (1975) External vs. Internal Control of Reinforcement as Related to Decision Time. Indian Journal of Psychology, 50, 142-149.

Dua, P.S. (1970) Comparison of the Effects of Behaviorally Oriented Action and Psychotherapy Recution on Intraversion-Extraversion, Emotionality, and Internal-External Control. Journal of Counselling Psychology, 17, 567-572.

DuCette, J. and Wolk, S. (1972) Locus of Control and Extreme Behavior. Journal of Consulting and Clinical Psychology, 39, 253-258.

DuCette, J. and Wolk, S. (1973) Cignitive and Motivational Correlates of Generalized Expectancies for Control. Journal of Personality and Social Psychology, 26, 420-426.

Edwards, A.L. (1972) Experimental Design in Psychological Research - 4th Ed. New York: Holt, Rinehart and Winston Inc.

Efran, J. (1963) Some Personality Determinants of Memory for Success and Failure. Unpublished Doctoral Dissertation, Ohio State University.

Eisenman, R. and Platt, J.J. (1968) Birth Order and Sex Differences in Academic Achievement and Internal-External Control. Journal of General Psychology, 78, 270-285.

Feather, N.T. (1968) Change in Confidence Following Success or Failure as a Predictor of Subsequent Performance. Journal of Personality and Social Psychology, 9, 38-46.

Foulds, M.L. (1971) Changes in Locus of Internal-External Control. Comparative Group Studies, 2, 293-300.

Foulds, M.L., Guinan, J.F. and Warehime, R.G. (1974) Marathon Group: Changes in Perceived Locus of Control. Journal of College Student Personnel, 15, 8-11.

Gavurin, E.I. and Murgatroyd, D. (1973) Anagram Solving and Locus of Control. Psychological Reports, 33, 402.

Gavurin, E.I. and Murgatroyd, D. (1974) Personality Correlates of Anagram Problem Solving. The Journal of Psychology, 88, 97-101.

Gilmor, T.M. and Minton, H.L. (1974) Internal versus External Attribution of Task Performance as a Function of Locus of Control, Initial Confidence and Success-Failure Outcome. Journal of Personality, 42, 159-174.

REFERENCES

Gilmor, T.M. and Reid, D.W. (1978) Locus of Control, Prediction, and Performance on University Examinations. Journal of Consulting and Clinical Psychology, 46 (No. 3), 365-366.

Goh, D.S. and Farley, F.H. (1977) Personality Effects on Cognitive Test Performance. The Journal of Psychology, 96, 111-122.

Gold, D. (1966) Preference for Skill or Chance Tasks and I-E Scores. Psychological Reports, 19, 1279-1281.

Gold, D. (1967) Preference for Skill or Chance Tasks in Ambiguous Situations. Psychological Reports, 20, 877-878.

Greene, D. (1976) Social Perception as Problem Solving. In J.S. Caroll and J.W. Payne (Eds.) Cognition and Social Behavior. Hillsdale, New Jersey: Lawrence Erlbaum.

Greene, J. (1975) Thinking and Language. London: Methuen and Co. Ltd.

Guilford, J.P. (1956) The Structure of Intellect. Psychological Bulletin, 53, 267-293.

Gurin, P., Gurin, G., Lao, R.C. and Beattie, M. (1969) Internal-External Control in the Motivational Dynamics of Negro Youth. Journal of Social Issues, 25, 29-53.

Harvey, O.J., Hunt, D.E. and Schroder, H.M. (1961) Conceptual Systems and Personality Organisation. New York: Wiley.

Heider, F. (1958) The Psychology of Interpersonal Relations. New York: Wiley.

Hersch, P.D. and Scheibe, K.E. (1967) Reliability and Validity of Internal-External Control as a Personality Dimension. Journal of Consulting Psychology, 31, 609-613.

Hickey, K.S. (1976) Internal-External Locus of Control and Environmental Cohesiveness. Personality and Social Psychology Bulletin, 2 (3), 282-285.

Hiroto, D.S. (1974) Locus of Control and Learned Helplessness. Journal of Experimental Psychology, 102, 187-193.

Hjelle, L.A. (1970) Internal-External Control as a Determinant of Academic Achievement. Psychological Reports, 26, 326.

Hjelle, L.A. (1971) Social Desirability as a Variable in the Locus of Control Scale. Psychological Reports, 28, 807-816.

Hochreich, D.J. (1974) Defensive Externality and Attribution of Responsibility. Journal of Personality, 42, 543-557.

Hochreich, D.J. (1975) Defensive Externality and Blame Projection Following Failure. Journal of Personality and Social Psychology, 10, 279-292.

Holden, K.B. and Rotter, J.B. (1962) A nonverbal Measure of Extinction in Skill and Chance Situations. Journal of Experimental Psychology, 63, 519-520.

REFERENCES

Hountras, P.T. and Scharf, M.C. (1970) Manifest Anxiety and Locus of Control of Low-Achieving College Males. Journal of Psychology, 74, 95-100.

House, W.C. (1976) Effect of Locus of Control, Expectancy Confirmation-Disconfirmation, and Type of Goal on Causal Attributions of Failure. Journal of Research in Personality, 10, 279-292.

Hunt, J. McV. (1965) Intrinsic Motivation and its Role in Psychological Development. In D. Levine (Ed.) Nebraska Symposium on Motivation (Vol. 13). Lincoln: University of Nebraska Press.

James, W.H. (1957) Internal Versus External Control of Reinforcement as a Basic Variable in Learning Theory. Unpublished Ph.D. Dissertation, Ohio State University.

James W.H. and Rotter, J.B. (1958) Partial and 100% Reinforcement Under Chance and Skill Conditions. Journal of Experimental Psychology, 55, 397-403.

Joe, V.C. (1971) A Review of the Internal-External Control Construct as a Personality Variable. Psychological Reports, 28, 619-640.

Joe, V.C. (1974) Perceived Personal Control and Attribution of Causality. Perceptual and Motor Skills, 38, 323-329.

Johnson, B.L. and Kilmann, P.R. (1975) Locus of Control and Perceived Confidence in Problem-Solving Abilities. Journal of Clinical Psychology, 31, 54-55.

Johnson, D.M., Lincoln, R.E. and Hall, E.R. (1961) Amount of Material and Time of Preparation for Solving Problems. Journal of Psychology, 51, 457-471.

Jones, E.E. and Davis, K.E. (1966) From Acts to Dispositions: The Attribution Process in Person Perception. In L. Berkowitz (Ed.) Advances in Experimental Social Psychology, Vol. 6. New York: Academic Press.

Jones, E.E., Kanouse, D.E., Kelley, H.H., Nisbett, R.E., Valins, S. and Weiner, B. (1972) Attribution: Perceiving the Causes of Behavior. Morristown, J.J.: General Learning Press.

Jones, S.C. and Shrauger, J.S. (1968) Locus of Control and Interpersonal Evaluations. Journal of Consulting and Clinical Psychology, 32, 664-668.

Julian, J.W. and Katz, S.B. (1968) Internal Versus External Control and the Value of Reinforcement. Journal of Personality and Social Psychology, 8, 89-94.

Julian, J.W., Lichtman, C.M. and Ryckman, R. (1968) Internal-External Control and the Need to Control. The Journal of Social Psychology, 76, 43-48.

Kagan, J. (1965) Individual Differences in the Resolution of Response Uncertainty. Journal of Personality and Social Psychology, 2, 154-160.

Karabenick, S.A. (1972) Valence of Success and Failure as a Function of Achievement Motives and Locus of Control. Journal of Personality and Social Psychology, 21, 101-110.

Kelley, H.H. (1967) Attribution Theory in Social Psychology. In D. Levine (Ed.) Nebraska Symposium on Motivation, Lincoln: University of Nebraska Press.

Kelley, H.H. (1971) Attribution in Social Interaction. New York: General Learning Press.

Kilmann, P.R. and Howell, R.J. (1974) Effects of Structure of Marathon Group Therapy and Locus of Control on Therapeutic Outcome. Journal of Consulting and Clinical Psychology, 42, 912.

Kirk, R.E. (1968) Experimental Design: Procedures for the Behavioral Sciences. California: Brooks/Cole.

Koch, S. (1956) Behavior as "Intrinsically" Regulated: Work Notes Towards a Pretheory of Phenomena Called Motivational. In M.R. Jones (Ed.) Nebraska Symposium on Motivation (Vol. 4). Lincoln: University of Nebraska Press.

Krovetz, M.L. (1974) Explaining Success or Failure as a Function of One's Locus of Control. Journal of Personality, 42, 175-189.

Kumchy, G.C. and Rankin , R.E. (1975) Locus of Control and Mode of Reinforcement. Perceptual and Motor Skills, 40, 375-378.

Lao, R.C. (1970) Internal-External Control and Competent and Innovative Behavior Among Negro College Students. Journal of Personality and Social Psychology, 14, 263-270.

REFERENCES

Lefcourt, H.M. (1966) Internal-External Control of Reinforcement: A Review. Psychological Bulletin, 65, 206-220.

Lefcourt, H.M. (1967) The Effects of Cue Explication Upon Persons Maintaining External Control Expectancies. Journal of Personality and Social Psychology, 5, 372-378.

Lefcourt, H.M. (1976) Locus of Control. New York: John Wiley and Sons.

Lefcourt, H.M., Gronnerud, P. and McDonald, P. (1973) Cognitive Activity and Hypothesis Formation During a Double Entendre Word Association Test as a Function of Locus of Control and Field Dependence. Canadian Journal of Behavioral Science, 5, 161-173.

Lefcourt, H.M., Hogg, E., Struthers, S. and Holms, C. (1975) Causal Attributions as a Function of Locus of Control, Initial Confidence, and Performance Outcomes. Journal of Personality and Social Psychology, 32, 391-397.

Lefcourt, H.M., Lewis, L. and Silverman, I.W. (1968) Internal Versus External Control of Reinforcement and Attention in Decision-Making Tasks. Journal of Personality, 36, 663-682.

Lefcourt, H.M. and Telegdi, M. (1971) Perceived Locus of Control and Field Dependence as Predictors of Cognitive Activity. Journal of Consulting and Clinical Psychology, 37, 53-56.

Lefcourt, H.M. and Wine, J. (1969) Internal Versus External Control of Reinforcement and the Deployment of Attention in Experimental Situations. Canadian Journal of Behavioral Science, 1, 167-181.

Levenson, H. (1973a) Perceived Parental Antecedents of Internal, Powerful Others, and Chance Locus of Control Orientations. Developmental Psychology, 9, 268-274.

Levenson, H. (1973b) Multidimensional Locus of Control in Psychiatric Patients. Journal of Consulting and Clinical Psychology, 41, 397-404.

Lipp, L., Kolstoe, R., James, W. and Randall, H. (1968) Denial of Disability and Internal Control of Reinforcement: A Study Using a Perceptual Defence Paradigm. Journal of Consulting and Clinical Psychology, 32, 72-75.

Liverant, S. (1958) The use of Rotter's Social Learning Theory in Developing a Personality Inventory. Psychological Monographs, 72 (Whole No. 455).

Liverant, S. and Scodel, A. (1960) Internal and External Control as Deteminants of Decision Making Under Conditions of Risk. Psychological Reports, 7, 59-67.

Lotsof, E.J. and Steinke, J. (1973) Internal-External Control, Divergent Thinking and Levels of Abstractness. Psychological Reports, 32, 1035-1041.

McDonald, R., Tempone, V.J. and Simmons, W.L. (1968) Locus of Control as a Personality and Situation Variable. Perceptual and Motor Skills, 27, 135-141.

McIntire, W.G. and Dreyer, A.S. (1973) Relationship of Cognitive Style to Locus of Control. Perceptual and Motor Skills, 37, 553-554.

REFERENCES

Mandler, G., Cowan, P.A. (1962) Learning of Simple Structures. Journal of Experimental Psychology, 64, 177-183.

Mandler, G., Cowan, P.A. and Gold, C. (1964) Concept Learning and Probability Matching. Journal of Experimental Psychology, 67, 514-522.

Milgram, S. (1963) Behavioral Study of Obedience. Journal of Abnormal Psychology, 67, 371-378.

Milgram, S. (1974) Obedience to Authority. New York: Harper and Row.

Mirels, H.L. (1970) Dimensions of Internal Versus External Control. Journal of Consulting and Clinical Psychology, 34, 226-228.

Nelson, P.C. and Phares, E.J. (1971) Anxiety, Discrepancy Between Need Value and Expectancy, and Internal- External Control. Psychological Reports, 28, 663-668.

Nowicki, S. and Barnes, J. (1973) Effects of a Structured Camp Experience on Locus of Control Orientation. Journal of Genetic Psychology, 122, 247-252.

Nowicki, S. and Strickland, B.R. (1973) A Locus of Control Scale for Children. Journal of Consulting and Clinical Psychology, 40, 148-154.

Ostell, A.E. (1974) The Role of Belief Systems and Negative Information in the Resolution of Conflicting Information. Unpublished Ph.D. Thesis, University of Sussex.

Pawlicki, R.E. (1972) Relationship Between Locus of Control and Tolerance of Ambiguity. Psychological Reports, 31, 102.

Payne, R.W. (1973) Cognitive Abnormalities. IN H.J. Eysenck (Ed.) Handbook of Abnormal Psychology (2nd Ed.). San Diego, California: Knapp.

Penk, W. (1969) Age Changes and Correlates of Internal-External Locus of Control Scales. Psychological Reports, 25, 856.

Petzel, T.P. and Gynther, M.D. (1970) Effects of Internal-External Locus of Control and Skill or Chance Instructional Sets of Task Performance. The Journal of General Psychology, 82, 87-93.

Phares, E.J. (1955) Changes in Expectancy in Skill and Chance Situations. Unpublished Ph.D. Dissertation, Ohio State University.

Phares E.J. (1957) Expectancy Changes in Skill and Chance Situations. Journal of Abnormal and Social Psychology, 54, 339-342.

Phares, E.J. (1962) Perceptual Threshold Decrements as a Function of Skill and Chance Expectancies. Journal of Psychology, 53, 399-407.

Phares, E.J. (1968) Differential Utilization of Information as a Function of Internal-External Control. Journal of Personality, 36, 649-662.

Phares, E.J. (1971) Internal-External Control and the Reduction of Reinforcement Value After Failure. Journal of Consulting and Clinical Psychology, 37, 386-390.

Phares, E.J. (1976) Locus of Control in Personality. New Jersey: General Learning Press.

Phares, E.J. and Lamiell, J.T. (1974) Relationship of Internal-External Control to Defensive Preferences. Journal of Consulting and Clinical Psychology, 42, 872-878.

Phares, E.J. and Lamiell, J.T. (1975) Internal-External Control, Interpersonal Judgements of Others in Need, and Attribution of Responsibility. Journal of Personality, 43, 23-38.

Phares, E.J, Ritchie, D.E. and Davis, W.L. (1968) Internal-External Control and Reaction to Threat. Journal of Personality and Social Psychology, 10, 402-405.

Phares, E.J., Wilson, K.G. and Klyver, N.W. (1971) Internal-External Control and the Attribution of Blame Under Neutral and Distractive Conditions. Journal of Personality and Social Psychology, 18, 285-288.

Pines, H.A. (1973) An Attributional Analysis of Locus of Control Orientation and Source of Informational Dependence. Journal of Personality and Social Psychology, 26, 262-272.

Pines, H.A. and Julian, J.W. (1972) Effects of Task and Social Demands on Locus of Control Differences in Information Processing. Journal of Personality, 40, 407-416.

Platt, J.J. and Eisenman, R. (1968) Internal-External Control of Reinforcement, Time Perspective, Adjustment, and Anxiety. Journal of General Psychology, 79, 121-128.

Reid, D. and Ware, E.E. (1973) Multidimensionality of Internal-External Control: Implications for Past and Future Research. Canadian Journal of Behavioral Sciences, 5, 264-271.

Ritchie, E. and Phares, E.J. (1969) Attitude Chance as a Function of Internal-External Control and Communicator Status. Journal of Personality, 37, 429-443.

Rokeach, M. (1960) The Open and Closed Mind. New York: Basic Books.

Rokeach, M. (1968) Beliefs, Attitudes and Values. San Francisco, California: Josey-Bass.

Rotter, J.B. (1954) Social Learning and Clinical Psychology. Englewood Cliffs, N.J.: Prentice-Hall.

Rotter, J.B. (1960) Some Implications of a Social Learning Theory for the Prediction of Goal Directed Behavior from Testing Procedures. Psychological Review, 67, 301-316.

Rotter, J.B. (1964) Clinical Psychology. Englewood Cliffs, New Jersey: Prentice-Hall.

Rotter, J.B. (1966) Generalized Expectancies for Internal Versus External Control of Reinforcement. Psychological Monographs, 80 (Whole No. 609).

Rotter, J.B. (1975) Some Problems and Misconceptions Related to the Construct of Internal Versus External Control of Reinforcement. Journal of Consulting and Clinical Psychology, 43, 56-67.

Rotter, J.B., Chance, J. and Phares, E.J. - Eds. - (1972) Applications of a Social Learning Theory of Personality. New York: Holt, Rinehart and Winston.

Rotter, J.B., Liverant, S. and Crowne, D.P. (1961) The Growth and Extinction of Expectancies in Chance Controlled and Skilled Tasks. Journal of Psychology, 52, 161-177.

Rotter, J.B. and Mulry, R.C. (1965) Internal Versus External Control of Reinforcement and Decision Time. Journal of Personality and Social Psychology, 2, 598-604.

Rotter, J.B. and Phares, E.J. (1956) Effect of the Situation on Psychological Testing. Journal of Consulting Psychology, 20, 291-293.

Rotter, J.B., Seeman, M. and Liverant, S. (1962) Internal Versus External Control of Reinforcement: A Major Variable in Behaviour Theory. In N.F. Washburne (Ed.) Decisions, Values and Groups, Vol. 2 London: Pergamon Press.

Ryckman, R.M., Gold, J.A. and Rodda, W.C. (1971) Confidence Rating Shifts and Performance as a Function of Locus of Control, Self-Esteem, and Initial Task Experience. Journal of Personality and Social Psychology, 18, 305-310.

Ryckman, R.M. and Rodda, W.C. (1971) Locus of Control and Initial Task Experience as Determinants of Confidence Changes in a Chance Situation. Journal of Personality and Social Psychology, 18, 116-119.

Ryckman, R.M., Rodda, W.C. and Sherman, M.F. (1972) Locus of Control and Expertise Relevance as Determinants of Changes in Opinion About Student Activism. Journal of Social Psychology, 88, 107-114.

Ryckman, R.M., Rodda, W.C. and Stone, W.F. (1971) Performance Time as a Function of Sex, Locus of Control, and Task Requirements. Journal of Social Psychology, 85, 299-305.

Ryckman, R.M., Stone, W.F. and Elam, R.R. (1971) Emotional Arousal as a Function of Perceived Locus of Control and Task Requirements. Journal of Social Psychology, 83, 185-191.

Sanders, M.G., Halcomb, C.G., Fray, J.M. and Owens, J.M. (1976) Internal-External Locus of Control and Performance on a Vigilanc Task. Perceptual and Motor Skills, 42, 939-943.

Schneider, J.M. (1968) Skill Versus Chance Activity Preferences and Locus of Control. Journal of Consulting and Clinical Psychology, 32, 333-337.

Schneider, J.M. (1972) Relationship Between Locus of Control and Activity Preferences: Effects of Masculinity, Activity and Skill. Journal of Clinical and Consulting Psychology, 38, 225-230.

Schneider, J.M. and Parsons, O.A. (1970) Categories on the Locus of Control Scale and Cross-Cultural Comparisons in Denmark and the United States. Journal of Cross-Cultural Psychology, 1, 131-138.

Scott, W.A. (1969) The Structure of Natural Cognitions. Journal of Personality and Social Psychology, 12, 261-278.

Seeman, M. (1963) Alienation and Social Learning in a Reformatory. American Journal of Sociology, 69, 270-284.

Seeman, M. and Evans, J.W. (1962) Alienation and Learning in a Hospital Setting. American Sociological Review, 27, 772-783.

Seligman, M.E.P. (1975) Helplessness: On Depression, Development, and Death. San Francisco: Freeman.

Seligman, M.E.P. and Maier, S.F. (1967) Failure to Escape Traumatic Shock. Journal of Experimental Psychology, 74 1-9.

Seligman, M.E.P., Maier, S.F. and Solomon, R.L. (1971) Unpredictable and Uncontrollable Aversive Events. In F.R. Brush (Ed.) Aversive Conditioning and Learning. New York: Academic Press.

Shaver, K.G. (1975) An Introduction to Attribution Processes. Cambridge, Massachusetts: Winthrop.

Shaw, M.E., Floyd, F.A., and Gwin, N.E. (1971) Perceived Locus of Motivation as a Determinant of Attribution of Responsibility. Representative Research in Social Psychology, 2, 43-51.

Sherman, S.J. (1973) Internal-External Control and its Relationship to Attitude Chance Under Different Social Influence Techniques. Journal of Personality and Social Psychology, 23, 23-29.

Siegel, S. (1956) Nonparametric Statistics for the Behavioral Sciences. New York: McGraw-Hill Book Company.

Simon, H.A. (1976) Discussion: Cognition and Social Behavior. In J.S. Caroll and J.W. Payne (Eds.) Cognition and Social Behavior. Hillsdale, New Jersey: Lawrence Erlbaum.

Sky, A.W. (1950) An Apparatus for a Frustration Task. Australian Journal of Psychology, 2, 116-120.

Sobel, R.S. (1974) The Effects of Success, Failure, and Locus of Control on Postperformance Attribution of Causality. The Journal of General Psychology, 91, 29-34.

Sosis, R.H. (1974) Internal-External Control and the Perception of Responsibility of Another for an Accident. Journal of Personality and Social Psychology, 30, 393-399.

Spivack, G., Platt, J.L. and Shure, M.B. (1976) The Problem-Solving Approach to Adjustment. San Francisco: Josey-Bass.

Srull, T.K. and Karabenick, S.A. (1975) Effects of Personality-Situation Locus of Control Congruence. Journal of Personality and Social Psychology, 32, 617-628.

Stabler, J. and Johnson, E.E. (1970) Instrumental Performance as a Function of Reinforcement Schedule, Luck Versus Skill Instructions and Sex of Child. Journal of Experimental Child Psychology, 9, 330-335.

Steger, J.A., Simmons, W.L. and Lavelle, S. (1973) Accuracy of Prediction of Own Performance as a Function of Locus of Control. Psychological Reports, 33, 59-62.

Stotland, E. and Canon, L.K. (1972) Social Psychology: A Cognitive Approach. Philadelphia: W.B. Saunders.

Strickland, L.H., Lewicki, R.J. and Katz, A.M. (1966) Temporal Orientation and Perceived Control as Determinants of Risk Taking. Journal of Experimental Social Psychology, 2, 143-151.

Tolor, A. (1971) Are the Alienated More Suggestible? Journal of Clinical Psychology, 27, 441-442.

Tseng, M.S. (1970) Locus of Control as a Determinant of Job Proficiency, Employability, and Training Satisfaction of Vocational Rehabilitation Clients. Journal of Counselling, 17, 487-491.

Walls, R.T. and Cox, J. (1971) Expectancy of Reinforcement in Chance and Skill Tasks Under Motor Handicap. Journal of Clinical Psychology, 27, 436-438.

Warehime, R.G. (1972) Generalized Expectancy for Locus of Control and Academic Performance. Psychological Reports, 30, 314.

Warr, P.B. - Ed. - (1970) Thought and Personality. Harmondsworth, Middlesex: Penguin Books.

Wason, P.C. (1960) On the Failure to Eliminate Hypotheses in a Conceptual Task. Quarterly Journal of Experimental Psychology, 12, 129-140.

Wason, P.C. (1968) On the Failure to Eliminate Hypotheses...- A Second Look. In P.C. Wason and P.N. Johnson-Laird (Eds.) Thinking and Reasoning, Harmondsworth, Middlesex: Penguin Books.

Watson, D. and Baumal, E. (1967) Effects of Locus of Control and Expectation of Future Control Upon Present Performance. Journal of Personality and Social Psychology, 6, 212-215.

Weiner, B., Frieze, I., Kukla, A., Reed, L., Rest, S., and Rosenbaum, R.M. (1971) Perceiving the Causes of Success and Failure. New York: General Learning Press.

Weiner, B., Heckausen, H., Meyer, W.U. and Cook, R.E. (1972) Causal Ascriptions and Achievement Behavior: A Conceptual Analysis of Effort and Reanalysis of Locus of Control. Journal of Personality and Social Psychology, 21, 239-248.

Weiner, M.J. and Daughtry, T. (1975) Locus of Control as a Determinant of Information Seeking. Personality and Social Psychology Bulletin, 1, 505-508.

Weizmann, F. and Protter, B.S. (1976) Generalizability of Locus of Control: A Rep Grid Investigation of Personality Consistency. Journal of Consulting and Clinical Psychology, 44 (No. 55), 863.

Witkin, H.A., Dyk, R.B., Faterson, H.F., Goodenough, D.R. and Karp, S.A. (1962) Psychological Differentiation. New York: Wiley.

Wolfe, R.N. (1972) Perceived Locus of Control and Prediction of Own Academic Performance. Journal of Consulting and Clinical Psychology, 38, 80-83.

Wolk, S. and Bloom, D. (1978) The Interactive Effects of Locus of Control and Situational Stress Upon Performance Accuracy and Time. Journal of Personality, 46 (No. 2), 279-298.

Wolk, S. and DuCette, J. (1973) The Moderating Effect of Locus of Control in Relation to Achievement-Motivation Variables. Journal of Personality, 41, 59-70.

Wolk, S. and DuCette, J. (1974) Intentional Performance and Incidental Learning as a Function of Personality and Task Directions. Journal of Personality and Social Psychology, 29, 90-101.

Woodworth, R.S. (1918) Dynamic Psychology. New York: Columbia University Press.

Woodworth, R.S. and Schlosberg, H. (1954) Experimental Psychology. New York: Holt, Rinehart and Winston.

Young, P.T. (1961) Motivation and Emotion. New York: Wiley.

Zerega, W.D., Tseng (JR.), M.S. and Greever, K.B. (1976) Stability and Concurrent Validity of the Rotter Internal-External Locus of Control Scale. Educational and Psychological Measurement, 36, 473-475.