

THE UNIVERSITY OF HULL

COGNITIVE FLEXIBILITY TRAINING WITH
SEVERELY AND MODERATELY MENTALLY HANDICAPPED PERSONS

being a Thesis submitted for the Degree of
Doctor of Philosophy
in the University of Hull

by

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May 1982

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ACKNOWLEDGEMENTS

This thesis is dedicated to my husband for creating an environment at home enabling me to undertake this research.

The sheer poverty of words impedes me from acknowledging fully, not only the personal supervision of this research by Professor Alan Clarke, but, much more than that, the kindness and affection shown to me by Dr. Ann Clarke and Professor Alan Clarke, in advising and helping me to start the Psychology Services, and then establishing the Department of Psychology in St. Ebba's, and now in the uphill task of putting research into practice.

I am also very grateful to Mr. Peter Oysten for the statistical help in analysing the results of the experiments reported in this thesis.

SUMMARY

An attempt is made in this thesis to measure the effects of Cognitive Flexibility Training with moderately and severely handicapped individuals.

The first chapter starts by introducing various criteria adopted to classify mentally retarded people. This leads to discussion on the objectives, strategies and trends of research in mental handicap, which were the subject of critical reviews in the recent papers published in the American Journal of Mental Deficiency. Since the theoretical frameworks play an important part in determining research, these positions are summarised along with the methodological problems involved in carrying out research. The general theme in this thesis is to study the processes underlying the learning of subnormal persons, and it is therefore considered appropriate to introduce the concept of amelioration in this chapter.

The second chapter attempts to amplify and report the experimental studies relating to psychological methods used in modifying the existing handicaps of severely and moderately retarded subjects. These studies pertain to sensori-motor and perceptual processes, vocational skills, social skills, mediation and conceptual behaviour, academic skills, language and predictive assessments. This provides a broader context for investigations reported in the later chapters.

In the third chapter, there is a move from general to specific discussions regarding the concept of rigidity in mental subnormality, an area of investigation detailed in chapters six, seven, eight and nine. Various theoretical frameworks to study rigidity/flexibility put forward by Lewin and Kounin, Goldstein, Werner and Strauss, Zigler, Heal and Johnson and Clarke and Clarke are summarised.

Subjects employed in the experiments described in the later chapters lived in large institutions. Therefore, it seemed appropriate to discuss briefly in the fourth chapter the experimental literature related to the effects of institutional experience on the behaviour of mentally handicapped persons. These studies cover the characteristics of the person, nature of the institution, and measures of the behavioural growth of retarded persons.

The fifth chapter starts with statements pertaining to the study of cognitive processes in retarded, as compared to non-retarded, persons, reflecting developmental and deficit or difference theories. It is noted from the reviews undertaken in the previous chapters that there is a gap between the cognitive capacity and cognitive competence of the severely and moderately handicapped persons. Hence, the transfer of training paradigm is used to study rigidity/flexibility to evaluate retarded individuals' on-going behaviour, which is illustrated in the overall plan of the research. This is followed by general design, type of subjects chosen, materials used, procedure adopted and the type of analysis employed on the data obtained, to evaluate the effectiveness of training.

In the sixth chapter, studies related to Cognitive Flexibility Training carried out by Corter and McKinney with bright normal and mildly handicapped children and productive thinking by Rouse with educable retarded subjects are outlined in the earlier part of this chapter. The first experiment is aimed at evaluating the Cognitive Flexibility Training with severer grades of handicap, by using a modified version of Corter and McKinney's training programme. The training covers Conceptual, Perceptual and Spontaneous areas of flexibility. The results are highly significant in the areas of

Conceptual and Spontaneous flexibility, and less effect was apparent in Perceptual flexibility tasks.

Since perceptual tasks are frequently reported in the literature to study rigidity, it seemed appropriate to investigate this concept in depth. Therefore, an experiment was devised to investigate Perceptual Flexibility by using Embedded Figure Tasks. In the seventh chapter, the programme devised by the author of this thesis, aimed at teaching part-whole perception and thereby increasing the subjects' ability to notice changes in the internal parts of a stimulus, is described. The results indicate that the training programme devised by the experimenter was very effective, as compared to Corter and McKinney's programme in this particular area of flexibility.

In the eighth chapter, another area of Perceptual Flexibility is investigated, namely Figure-Ground Reversals. It is noted that severely retarded adults, like young children, find difficulty in discriminating visual orientation and rotated mirror-images. In the third experiment the effects of perceptual training are evaluated in geometrical figures and their reversals. The results are significant to indicate, once again, that overt responses of severely and moderately retarded people do not ordinarily reflect their ability and that they respond to intensive training.

In the ninth chapter, the concept of rigidity is re-examined in the light of Chown's definition. This concept is investigated in the context of variety of training. The results are significant, and differ from the findings of Lewin and Kounin's theory of rigidity in mental handicap.

The results of the research reported in this thesis are discussed in the tenth chapter in the context of all approaches put forward to

explain the apparent rigid behaviour of the mentally retarded persons, with implications for social policies. It concludes by summarising the important issues raised by this research.

The details of the materials used in the Transfer and Training tasks in all four experiments are described in the Appendices, A₁ to D₂.

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CHAPTER 1

INTRODUCTION

CHAPTER 1

Introduction

Mental handicap is first and foremost a social phenomenon. An attempt to classify the mentally handicapped, therefore, possesses a long history of development and change. At present, the major criteria of subnormality are: an IQ below 70, social incompetence and educational retardation. Each criterion has shown to be over-inclusive of other conditions. It has been argued that:-

- (1) the IQ criterion includes many socially competent members at the above IQ 50 level;
- (2) that social incompetence is to be found in many other conditions than subnormality and is thus not specifically pathognomonic;

and

- (3) that, educationally, as Burt once put it, "the dull are usually backward, but the backward are not necessarily dull."

Clarke and Clarke (1974b) have compared the British and International terminology relating to IQ and to aetiology and this is shown in Fig. 1.

Recent centennial papers in the American Journal of Mental Deficiency by Haywood (1976); Brooks and Baumeister (1977a, 1977b); Clarke and Clarke (1977); House (1977); Zigler and Balla (1977); and Scott (1978) have examined critically the directions, goals and strategies of research in mental handicap and reflect the knowledge gained by research and experience during the last one hundred years.

In the first section of this chapter, an attempt will be made to outline the directions and goals of research in mental handicap. The second section contains various theoretical frameworks which

have been advanced by psychologists to explain the behaviour of the mentally handicapped. The third section outlines methodological problems in carrying out research in the field of mental handicap. The last section leads to the concept of amelioration in mental handicap.

In this thesis, various national and international terms have been used synonymously to describe mental handicap such as 'mental deficiency', 'subnormality', 'mental retardation', etc.

Goals and Directions of Research

Brooks and Baumeister (1977a) point out that in spite of considerable experimental effort and laboratory research in learning, memory, and cognition, this has not led to a remarkable increase in our understanding of retarded behaviour. They contend that the experimental psychology of mental retardation, which basically seeks causal relations between theoretical constructs and retarded behaviour, is suffering from some metatheoretical and methodological short-comings. These include, fundamentally, a prevalent failure to consider the ecological aspects of the phenomenon of mental retardation. Implications of ecological validity are important with respect to the basis upon which subjects are selected for investigation, the rationale underlying manipulation of independent variables, the choice of dependent variables, and the definition of the boundaries that limit generalizations.

Brooks and Baumeister (1977a) point out that there are two ways of viewing experimental research in mental retardation - one as the goal of refining cognitive theories, the other as the aim of learning more about the phenomenon of mental retardation. These goals differ particularly with respect to the theoretical and methodological constraints entailed. They look at only those limitations that

concerned research conducted for the purpose of explaining mental retardation. They state that one of the implicit purposes of such research is to identify cognitive factors that account for mental retardation. This implies that some causality is to be attributed to the concepts involved. In order to ascribe causality to some theoretical constructs, an elaborated specification of the nature of the causal relationship is necessary. In many cases, researchers are content with correlational relationships that denote consistency with the theory but not causality.

Brooks and Baumeister (1977a) point out another aspect of the problem of causality which arises from the definition of mental retardation. They state that the basic criteria adopted by the American Association on Mental Deficiency (Grossman, 1973) include a low score on an adaptive behaviour scale, and a low IQ obtained from a 'general' measure of intelligence. However, in practice, the IQ is the one more often used as a criterion (Adams, 1973). The use of IQ scores to test cognitive accounts of mental retardation and to select subjects for research, amounts to using one theory of mental retardation (psychometric) to validate another theory (cognitive). For example, a researcher who conducts studies with mentally handicapped, normal and bright normal people, on the processes that underly cognition is probably more interested in the ways in which individual differences i.e. gross individual differences in either IQ and/or MA are related to a particular cognitive model than to explain mental retardation. According to Brooks and Baumeister, this is a practice that does not seem likely to lead to a better understanding of the adaptive, social problems of mental retardation, only to endless correlates with the IQ score.

Brooks and Baumeister (1977a) make some suggestions for remedying these theoretical and methodological problems, namely:-

- (a) elaborating causal relationships in the theory;
- (b) selecting subjects on more meaningful valid grounds than the I Q score;
- (c) employing tasks with demonstrated validity with respect to the theoretical concept;and
- (d) defining constructs according to ecologically real factors in the lives of retarded people.

However, House (1977) disagreeing with Brooks and Baumeister (1977a) states that there are two different goals a researcher might have in mind in studying the behaviour of retarded persons. One is to gain a scientific understanding of low intelligence as a sub-category of human intellectual functioning and the other is to develop practical techniques for prediction, control and improvement of retardation in daily life. House (1977) states that Brooks and Baumeister (1977a) have confused the two and have advocated methods suitable for practical application in order to try to answer questions about the nature of retardation.

Scott (1978) states that, over a period of two decades, our knowledge of the complexity of the relationship among learning, intelligence and mental development has increased. Referring to the methodological errors in mental retardation research, he points out that the understanding of this overall relationship at present is, however, incomplete. This lack of knowledge leaves us essentially without the formal means to develop a technology of intervention. Thus, programmes based on the idea of enrichment (see ability-enrichment model below) can possess high ecological validity, but from the perspective of science, are unacceptable. Without a scientific understanding of the learning and development process, the choice of independent variables

for the intervention, i.e. the curriculum content, and how this relates to the dependent measure, i.e. the measure of outcome, can only be arbitrary and hence the scientific technology of intervention is not satisfactory.

Assessing the progress of the past and attempting to predict the future, Clarke and Clarke (1977) state that it became increasingly clear in the 1950's that proper programming of learning, and proper incentives and knowledge of results, could transform the skills of moderately and sometimes severely retarded persons. Then, in the following decade, behaviour modification as a formalised system developed rapidly, again, with the same general implications as the earlier work, but this time more often applied to the more profoundly handicapped. As a technology of learning its implications are, of course, far wider than for retardation alone. Its very considerable efficacy for those whose learning deficits are their main problem accounts for the rapid spread of these techniques. It has also become clear that early and prolonged intervention, in the home, using parents as educators, can have significant effects upon the early development of the moderately or severely retarded child. So, twenty-five years of research has totally transformed our expectancies of what can be done.

Clarke and Clarke (1977) regard these as great achievements but doubt whether they have been translated into practice. In the main, the more severely retarded persons, except in a few centres, very rarely get the sort of help from which they can benefit. What is needed, is lengthy, skilled and consequently costly help, not unskilled caretaking. The findings to which they refer are often either unknown to practitioners, totally misunderstood or thought to be inappropriate. Hence, even among professionals, there tends to be a widespread underestimation of what can be done. This is serious, for low expectancies are clearly

associated with poor provision and, therefore, poor outcome. A vicious circle is then perpetuated. Moreover, Grant, Moores and Whelan (1973) have shown that those staff in day-training centres who are most closely in touch with these handicapped adults consistently underestimate their clients' potential work performance.

Theoretical Frameworks in Mental Retardation

Scott (1978) has described some of the psychological models proposed to date, namely:-

- (a) Deficit - difference model
- (b) Diagnosis - treatment model
- (c) Ability - enrichment model
- (d) Assessment - intervention model

These frameworks are yet embryonic and are perhaps less important in their own right as psychological theories. However, these positions play an important role in determining research projects and therefore are outlined briefly.

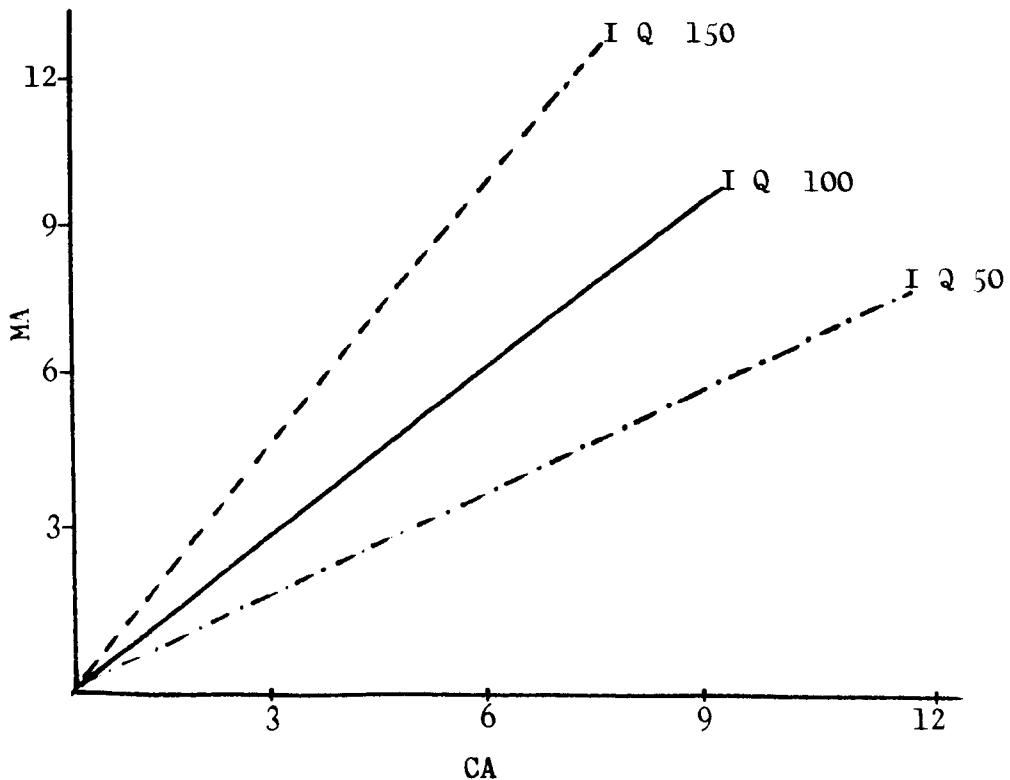
- (a) Deficit - difference model A two-group approach to retardation was first proposed by Lewis (1933) and then expanded by Zigler (1966a). This model draws attention to known facts about the distribution of intelligence in the population and to the aetiology of retardation (Mercer, 1973). Zigler's approach distinguishes between retarded persons who are an integral part of the population genetic pool and another group where there is a physiological defect. He puts forward two distributions of intelligence, the first representing the polygenetic distribution of intelligence, and the second being for those retarded persons having a known physiological defect. According to Zigler, the former are best characterised by describing their mental development using a developmental approach,

whereas the latter are seen as best described by a defect approach. In his review, Zigler classifies most behavioural theories of mental development in retarded persons as defect theories in contrast to his own general developmental approach.

- (b) Diagnosis - treatment model This is a medically-based concept and is closest to Zigler's (1966a) defect approach. This model applies to the description of that sub-sample of the retarded population with a known aetiology or physiological defect. The point made here is that advances in medical knowledge will render behavioural intervention unnecessary. Where medical treatment is not available, the task for the learning theorist is to explain the particular defects or delays in learning and cognitive processes that characterise a given aetiology and then to propose appropriate intervention strategies. Belmont (1971) describing the behaviour of Down's Syndrome children, provided an excellent example of this model. Since the aetiology of many physiologically damaged children is unknown, this approach is limited by diagnostic understanding at any point in time.
- (c) Ability - enrichment model This conception is based on the normal distribution of intelligence and is most concerned with those individuals who come from the lower parts of that distribution. These are seen by Zigler as appropriately described by a developmental approach. The more general concern for the learning theorist has been to attempt to explain the nature of intelligence by finding which learning processes are implicated in lowered performance on an intelligence

test score. The idea advanced here is that an intelligence test covers the material universally taught in a culture and that the task of the behavioural theorist in retardation is to determine how it is that some individuals do not advance as rapidly as others. Figure 2. presents a linear version of the theoretical relations among MA (Mental Age), CA (Chronological Age) and I Q in childhood. MA is treated as a level variable, I Q is treated as a rate variable and is indexed by the slope of the line.

Fig. 2. The theoretical relations among MA, CA and I Q



For applied research on intervention, the ability-enrichment model has led to the idea that retardation can be ameliorated by an enriched environment.

- (d) Assessment - intervention model This model is based on the idea that an individual achieves particular skills

or behaviour that can be assessed, trained and re-assessed. The need and appropriateness of educational measures is clear. Following the assessment of developmental delay or the absence of skill, the learning theorist must explain the processes that prevent learning from occurring and then engineer a successful training procedure. The content of the instruction is defined by re-assessment and the appropriateness of a post-test is largely self-evident. This process could be referenced by a sound description of 'normal' development or by an analysis of the learning processes found in retarded populations. The model has obvious appeal to the developmental psychologist or the learning theorist. It also clearly relates assessment and intervention that should lead to much more sensitive comparison between alternative training procedure and intervention.

There appears to be an overlap between Ability-enrichment and Assessment-intervention models. However, the main difference between the two seems to be in the emphasis on finding learning processes based on the concept of 'intelligence' in the case of the former and on particular skills in the latter. The Ability-enrichment model (based on the normal distribution of intelligence) possesses some methodological and theoretical problems. Firstly, I Q is an ability measure based on tests that have been designed to maximise individual differences rather than rate of development. Secondly, it is not clear that intelligence is a single entity, in the sense of something that can be manipulated. Intervention in this case may mask differences that might occur between different intervention strategies.

Mental Retardation: A New Look' concludes that the similar performances of the retarded and non-retarded children support the developmental theory of retardation, i.e. that children matched for MA will demonstrate similar cognitive abilities.

Indeed, in a review on the changing concept of intelligence, Clarke and Clarke (1974b) have stated that intelligence, however defined, is multi-faceted. In their view, the most useful approach is to study the conditions facilitating the development of intellectual attainments, as well as those which retard them. The study of research upon human skills is likely to prove far more rewarding than a search for an entity called intelligence.

Problems in Designing Research

Most of the experimental studies in mental subnormality compare the performance of a group or groups of mentally retarded subjects with those of normal subjects matched on MA or CA. When the MA match is considered, then I Q differences of up to fifty points have been found. When the CA match is considered then I Q differences of thirty points are found to be usual. Differences of seventy points have been reported when retarded subjects have been compared with intellectually superior subjects. Psychologists studying the retarded and normal populations matched on their mental ages have stated that they were looking for qualitative differences between the two populations. Scientists are now looking critically at research designs in common use and at the questions that can be answered legitimately in any particular case.

Zeaman (1965) suggested that mental subnormality can be approached in two ways either by finding the laws about the subnormal behaviour or by finding the unique laws of their behaviour. If the unique laws are to

be attempted then the comparisons with normal children are essential but here one faces enormous difficulties in designing research projects. As Zeaman stated, if you match for CA then MA is out of control. If you assume CA is not a relevant variable and match for MA then other differences appear to be out of control, i.e. length of institutionalisation home environment, previous schooling, tender loving care and socio-economic status are factors likely to be different for retardates and normals.

Baumeister (1967) discusses the difficulties in comparing normal and subnormal populations. He points to the fundamental problem of finding a task for the two groups that is an equivalent measure of the same psychological process. When studying any cognitive process and if differences emerge, it is necessary to be able to exclude differences such as sensory, motor, or motivational. Obviously, this principle is violated when studies are carried out on institutionalised sub-normals and non-institutionalised normals. There is a general agreement that the essential problem of mentally retarded individuals is their intellectual or cognitive inadequacy. Zigler (1969) points out that research workers have concentrated on cognitive functioning, thereby totally ignoring the possibility that other factors such as temperament, educational opportunities, motivation, social class and environmental background could contribute to the current status and task performance of the retardates.

Some investigators have argued that experimental matching on MA and CA may not be valid assumption because, as indicated, it leads to the introduction of systematic differences between groups on variables other than MA and CA. Furthermore, experimental matching can lead to biased selection of the subjects as it is often found that it is necessary to discard those who cannot be matched with others. Baumeister (1967)

suggests a multiple factor design in which subject characteristics are co-manipulated with experimental factors. Here one is not concerned with the fact that the subnormals are inferior but whether experimental manipulation will produce the same behavioural adjustments when studying normals and subnormals. This procedure does not assume that the task is exactly the same for normals and subnormals, but the task and subject characteristics are constant for all values of the experimental variables. The research work by Clarke and Blakemore (1961) and Clarke and Cooper (1966) has shown that 'floor' and 'ceiling' effects are a further source of difficulty in group comparisons and this is particularly so in learning studies. In their first study they reported that there was a greater transfer in children than in adolescents and adults. In their second study, transfer differences were not found when the task difficulty was adjusted to achieve equal starting points for the older and younger sub-normals. 'Floor' and 'ceiling' effects are also noted by Ellis and Anderson (1968), and Chapman and Chapman (1975).

Ellis (1969) points out that the obvious rationale of an equal MA match is that it equalises development for normals and sub-normals. However, equal MA scores are not always based on equal sub-test performances. In addition, MA may reflect past and present motivational status as well as cognitive factors.

Baumeister (1968) further points to the problem of greater performance variability of sub-normals than normal subjects. After reviewing the literature he concludes that it is certain that the two intelligence groups differ on this characteristic to a significant extent.

Scott (1978) raises the question of reliability of measures and states that intelligence test scores are themselves imperfectly reliable, and

this has often been coupled with measures of learning of unknown reliability. Furthermore, the smaller the range of intelligence or ability considered, the less it is likely that a relation to learning will be found.

Amelioration

The psychological study of mental subnormality provides a great challenge to our understanding of the processes underlying the learning of subnormal persons and can have bearing upon the wider study of normal mankind. Therefore, environment can be used as a therapeutic agent to promote specific behaviour in the retarded as well as general long-term behavioural recovery from disorders disrupting the function of the brain.

The presenting feature of severe mental retardation is primarily a severe lag in behavioural development, commonly indicated by failure to pass the milestones for motor and language development at normal ages.

Clarke and Hermelin (1955) summarised contemporary views held by clinicians of the potential of such persons as follows:-

- (1) At best they find it very difficult to concentrate and, more typically, seem capable only of involuntary and momentary attention;
- (2) They are incapable of comparing and discriminating even on the simplest plane, and of appreciating the relationship between cause and effects;
- (3) They are quite incapable of adapting themselves to anything out of the ordinary;
- (4) They are only able to perform the simplest routine tasks under constant supervision;
- (5) All this makes them unable to contribute appreciably towards their own support.

Such descriptions are seen as accurate statements concerning the initial disabilities of severely subnormal institutionalised persons, but inaccurate if appropriate training were provided. In spite of reported studies, these clinical impressions, even in the 1980's, remain the

views of many care staff employed in institutions where the majority of the severely and moderately handicapped persons are cared for.

Research by a number of British workers confirms that those with I Q s in the 30's and 40's appear, in the main, to learn well, to retain their learned skills over long periods of non-practice and sometimes to show powerful specific and non-specific transfer to other tasks. Recognition of the differences between experimental and more ordinary situations enables one to describe this gap as a relative deficiency in learning spontaneously in ordinary unstructured life situations. This deficiency can, to a worthwhile extent, be modified in an appropriate experimental situation with consequences that, to a varying amount, extend in time well beyond the limits of a single series of experiments and often 'transfer' to other skills (Clarke and Cookson,1962). It is pointed out firstly that there is often a wide range of individual differences in performance on the first trial of a new task. With increasing experience, not only does a very great improvement occur, but the differences between individuals usually diminish markedly. In other words, appropriate training not only improves performance on simple tasks but brings the subjects to similar criteria of success, very often not much inferior to those of normal persons. Secondly, individual performance on the first trial is a poor predictor of responsiveness to training. Both these points describe what has been termed as the 'funnel effect' - wide initial differences narrowing down to small ones. Clarke and Clarke (1974b) remark that:-

"...it is the variables of task or programme demand and their duration and nature, which differentiate effective from ineffective programmes of amelioration."

Clarke and Clarke (1974a) reporting in 'Mental Retardation and

Behavioural Change' examine four common views of normal human development which may be pertinent to mildly and severely handicapped persons:-

- (i) The concept of 'an innate mental capacity' is widespread, with the assumption that intellectual (or other) development is fully pre-programmed at conception. However, a carefully documented monograph by Callaway (1970) challenges some of these classic notions. His work indicated that the concept of an innate structure necessarily unfolding in a particular way, virtually unmodified by experience, cannot be supported. Rather, the phenotype, arising from a given genotype, can vary according to circumstances.
- (ii) If the foregoing is correct, then one would expect to find a considerable responsiveness in development to significant and prolonged changes in environment. It is clear from studies that environmental change which is prolonged is always accompanied by behavioural change, and that those who function initially at a high level, vis-à-vis their age peers, show less marked alterations in such circumstances.
- (iii) Another area of behavioural change that requires close scrutiny, is the view that individual development is usually a rather stable process in which children retain, more or less, their status with respect to age peers. It has recently been argued that this view reflects a common misunderstanding of the meaning of correlation coefficients in longitudinal studies, and that individual variability during growth (whether intellectual, physical, personality or scholastic) is much more common than is usually realized. Both gross and subtle environmental factors appear to be involved as well as an intrinsic irregularity in the

unfolding of the phenotype.

- (iv) Finally, it is widely accepted that early experience is likely to exercise a crucial effect upon later characteristics. In the absence of adverse biological factors, relevant evidence suggests that, for man, critical periods of psychological development are far less crucial than in the animal kingdom. Unless this is so, one cannot account for subsequent fairly normal development of very severely deprived children restored to a normal environment after years of gross adversity. For example, Koluchová (1972 and 1976) has reported on twin boys, isolated, neglected, and cruelly treated from eighteen months to seven years. These were severely subnormal, rachitic, and virtually without speech upon discovery. Shortly after birth they were taken into care for a year, following the mother's death. Transferred to a maternal aunt for a period of twelve to eighteen months, they were then handed over to the sadistic stepmother who banished them to a cellar for the next five-and-a-half years. Now, in a most unusual adoptive home, they are cognitively and emotionally normal and have caught up scholastically. This, and other findings, indicate that responsiveness to environmental change is not merely confined to the very early years and, as noted, it is clear that such notions as critical periods of development for intellect and language need substantial modification.

C O N C L U S I O N

This chapter was devoted to outlining:-

- (a) the directions and goals of research in mental handicap;
- (b) various theoretical frameworks which have been put forward by the psychologists to explain the behaviours of mentally handicapped people;
- (c) the methodological problems in carrying out research in this field;

and

- (d) the concepts of amelioration in this population.

It was pointed out that intervention of some kind aimed at modifying an existing or developing defect in subnormals may take place through social improvements, educational or training methods, through administrative changes, and, above all, through the careful step-by-step investigation of what broadly may be termed 'the learning processes'. The implications of intervention studies are that if certain mental processes are easily modifiable in a short period, then creating the proper environmental conditions should promote long-term behavioural improvements. The next chapter contains details of the studies aimed at amelioration of the existing handicaps of moderately and severely retarded people, an area that is under investigation in this thesis.

C H A P T E R 2

REVIEW OF AMELIORATION STUDIES IN
THE MODERATELY AND SEVERELY HANDICAPPED

Introduction

Until the early 1950's there had been little interest in the psychology of moderately and severely handicapped persons. However, our concepts of moderately and severely handicapped persons have changed dramatically in the past thirty years. These individuals are no longer considered hopeless and untrainable. The importance of environment and of adequate stimulation is confirmed repeatedly, and basic principles of learning are used to ameliorate the handicaps of these people.

Bortner and Birch (1970) have reviewed the literature on cognitive capacity and cognitive competence in mentally subnormal children and in other subjects. They conclude:-

"It is clear from all these data that performance levels under particular conditions are but fragmentary indicators of capacity. Possessed concepts and skills, and particular conceptual abilities, as well as levels of learning when manifested in performance, all reflect the interaction between possessed potentialities and the particular conditions of training and task demand. Glaring differences occur in the estimates of potential when meaningful alterations are made in the conditions for performance. It is clear that we have but begun to explore the universe of conditions for learning and performance which will facilitate most effectively the expression of the potentialities for adaptation which exist in mentally subnormal children."

The studies prior to 1955 on severely and profoundly handicapped are covered in reviews by Sarason and Gladwin (1958), Dokecki (1964) and Bialac (1970). Papers by Spradlin and Girardeau (1966), and Hollis and Gorton (1967) represent the important developments in behavioural thinking in the 1960's that still constitute the most

vigorous aspects of the literature. A recent bibliography of behavioural research on severe and profound mental retardation is presented by Berkson and Landesman-Dwyer (1977).

This chapter contains experimental studies relating to the amelioration of various areas of functioning in the moderately and severely handicapped. These studies relate to the area of transfer of learning and the purpose of this chapter is to provide a general and rather wide context for the particular studies reported later in chapters 6-10.

Advocates of perceptual-motor training for children with various disabilities claim that practice of precisely defined exercises aids the development of cognitive processes. These movements promote sensory and perceptual integration through motor acts, and this integration is theoretically necessary for thinking processes to emerge (Kephart, 1960 and Frostig, 1970).

Webb and Koller (1979) have investigated the effects of sensorimotor training on intellectual and adaptive skills of profoundly handicapped young adults. These adults were eighteen to forty-five years of age, with mental ages of three to thirty months. The subjects were matched on CA, MA, sex and behavioural age and randomly assigned to the training and control groups. These subjects had been institutionalised for seven to fifteen years.

Comparison of pre- and post-training test scores showed that the training group made significant gains in awareness and gross motor skills as well as in intellectual and adaptive skills. No significant gains in fine motor and initiative skills were found nor were significant changes observed in the control group.

Webb and Koller state that their findings support theories that cognitive functions emerge when sensorimotor patterns are sufficiently integrated. The results also confirm the few existing experimental studies showing that improvement in adaptive skills and measured intelligence occurs with sensorimotor training. More importantly, this study shows that such gains from intensive sensorimotor training can be made by profoundly handicapped adults who have been institutionalised for a long time.

Similar results have been reported by Edgar, Ball, McIntyre and

Shotwell (1969); Maloney, Ball and Edgar (1970) and Morrison and Pothoer (1972).

Reviewing perceptual studies in the mentally handicapped, Spivack (1963) has concluded that the paucity of research data on perceptual processes is striking and the results are too fragmentary to permit meaningful integration.

"Too often the 'single shot' study raises more questions than are answered and is rarely followed up by others."

The important question of the inter-dependence of perceptual and intellectual development is considered by Doyle (1967) who advanced the hypothesis that perceptual development might proceed independently of intellectual development.

Sidman and Stoddard (1966) have demonstrated perceptual discrimination learning in subjects devoid of language including the severely and profoundly handicapped (IQ less than 20), by means of careful programming and specially devised apparatus. In their study, a group was provided with a series of steps designed to transfer stimulus control from an easy discrimination to the more difficult circle-ellipse discrimination. The programme first required the subjects to make a simple brightness discrimination. This brightness dimension was then faded out, requiring a 'form-no form' discrimination. Finally, ellipses were slowly faded in and the subject had to base his responses on the forms themselves in order to obtain reinforcement. A control group was not provided with this pre-training but was given the criterion form discrimination task to be learned by trial and error at the outset. Under these conditions the control group did not perform as well as the programmed group.

Haywood and Heal (1968) reported a study in which experimentally naive

institutionalised retardates at four different IQ levels were trained in a group over fifteen presentations on a visual coding task. Each IQ level was divided into the top, middle, and bottom thirds according to the number of codes correctly recalled during the fifteen acquisition trials. Retention tests were given to all the participants in the experiment at post-training intervals of one hour, twenty-four hours, one week, two weeks, and four weeks. No differences were observed in either training or retention performance among the four IQ groups. Subjects in any IQ group who made more correct responses during acquisition retained the learned associations best and appeared to forget them at a slower rate.

Bijou (1968) has explored the ingredients of an experimental history enabling a normal or handicapped child to perform a left-right concept formation task. Experimental history consisted of training in form discrimination, mirror-image discrimination, and rotated mirror-image discrimination. The programme used matching-to-sample technique, first to teach subjects to select a correct form irrespective of its orientation, and then to distinguish rotated matches from rotated mirror-images. This programme was successful for both young children and handicapped. Experience in this task facilitated mirror-image discrimination to new nonsense forms as well as to alphabet letters. For the handicapped subjects, there was also a positive relationship between progress in the programme and mental age scores.

Guralnick (1975) has investigated techniques for facilitating alphabet letter discrimination within the framework of distinctive feature and attention theory (Zeaman and House, 1963). She compared the effectiveness of different instructional procedures for emphasising distinctive features. Separate groups of retarded children (mean IQ approximately 41) received distinctive-feature training, highlighting of the features

or distinctive-feature training plus fading-in of the letter forms, along with a control for each of these dimensions. The horizontal-slant, open-close, and straight-curve dimensions were chosen for this study. Training effects were assessed by presenting corresponding alphabet letter pairs (H-N, C-O, U-V) and two sets of generalization forms. Results indicated that the three experimental groups performed better than the control, but did not differ from each other. All groups except fade-in readily generalized to other forms. These findings were discussed in terms of the educational value of distinctive feature analyses and the use of instructional methods.

Vocational-Skills Training

Acquisition and performance of vocational tasks by severely and moderately handicapped persons have been reported with increasing frequency during the last three decades. It now seems clear that to label a person 'handicapped', even 'severely handicapped' implies no inevitable restriction on the individual's potential to learn a variety of work behaviours.

Post-war research in vocational training on severe subnormality began with the work of Tizard and his colleagues. Gordon, O'Connor and Tizard (1955) observed forty male severely and moderately handicapped adults, aged from seventeen to thirty-five, and with a Stanford-Binet IQ from twenty-five to forty-eight (mean thirty-five), in studying "some effects of incentives on the behaviour of imbeciles". They found that on a somewhat unpleasant persistence task "imbeciles clearly respond to incentives in an orderly and predictable way and in a direction not unlike that found amongst normals!" It was also clear that the subjects were capable of intense and sustained effort, at least over short periods of time.

A second experiment used a simple manual dexterity task - namely, the insertion of small nails into the perforations of zinc sheeting; this called for precision, speed, and accuracy. Gordon states that:-

"Examination of the learning curves for the first thirty trials did not suggest any striking difference from the shape of learning curves, reported in several studies employing a simple motor task with normal subjects."

Tizard and Loos (1954) investigated the learning of a fairly complex spatial relations test by six severely and moderately retarded adults. All showed rapid improvement and considerable 'transfer of training' to a similar task. When the subjects were retested a month after the final practice period their scores remained much higher than initially. It was concluded that a subject's initial score is likely to give a poor idea of his ability to do the test after practice.

Clarke and Hermelin (1955) using the same subjects as Tizard and Loos, undertook experiments on industrial work. They employed three tasks:-

- (1) the use of guillotine to cut insulated wire to exact lengths;
 - (2) the soldering of four different coloured wires to the correct terminals of an 8-pin television plug;
- and
- (3) the assembly of a bicycle pump, involving nine operations which had to be performed in the correct order.

The table below summarizes some of the findings.

Clarke and Hermelin state that the guillotine data, based on only two hours of training, separated by a week of non-practice, show very considerable improvement which no doubt would have continued had the minimal training been prolonged. The television plug results show widely different starting points and great improvement leading to very similar endpoints ('the funnel effect'). The bicycle pump assembly

data indicates precisely similar results to the above. In all cases, Trial One performance (the typical assessment device) is very poor, nor is it any guide to ultimate level of improvement, nor is it correlated with ultimate level. The authors concluded that the main difference on simple tasks between the ability of these subjects and normals was not so much the end point as the time taken to achieve it.

Table 1
Some Basic Data

	Initial Range	Final Range	Duration of Training
Guillotine	15-40 wires cut per 5 min	33-57 wires cut per 5 min	2 x 1 hour periods
Television Plug	4 min-19 min per plug	1 min 42 sec- 3 min 30 sec per plug	34 trials
Bicycle Pump	4 min 20 sec- 10 min 45 sec per assembly	54 sec-1 min 50 sec per assembly	30 trials

The above work was confirmed and amplified by Clarke (1962), Clarke and Cooper (1966) and Radon and Clarke (1971).

On retention of learning sets Clarke(1962) reported that a group of adult imbeciles, retested on the learning of the four Minnesota formboards seven years after initial learning (thirty- two trials) showed greatly enhanced performance, particularly on the first board. This could not be attributed to maturation but may, however, have resulted from the reinforcement provided by perceptual-motor experience

in industrial workshops. However, Clarke and Cookson (1962) showed impressive retention of perceptual-motor learning by child and adult imbeciles over six months and one year, respectively, of non-reinforcement. In both these studies learning had been taken to asymptote, and motivation was apparently very high indeed.

The studies related to vocational skills training reported in early 1950's by the British researchers has been further validated in America by Gold (1972, 1974) and Gold and Barclay (1973).

Irvin and Bellamy (1977) examine the relative efficacy of various stimulus related variables for vocational-skill training of severely retarded individuals. Fifty-one severely retarded adults were taught a difficult visual discrimination in an assembly task by one of three training techniques:-

- (a) adding and reducing large cue differences on the relevant shape dimension;
 - (b) adding and fading a redundant colour dimension;
- or
- (c) a combination of the two techniques.

There were significant differences between training conditions in both trials and errors-to-criterion performance. These were attributed to differential establishment of stimulus control in the first phase of training, with the combined procedure being the most effective, the colour coding/fading next, and the relevant-dimension cue-disparity method the least powerful. These results demonstrated that substantial differences may exist in the efficacy of various vocational-skill training procedures involving manipulation of stimulus features.

The general purpose of Gold's (1972) study was to develop a structure and methodology for studying the application of stimulus control

procedures to the acquisition of complex work task skills. The specific aim of his research was to examine the effects of cue redundancy and overlearning on the acquisition and transfer of a complex assembly task skill, and to evaluate their effect on long-term retention. Gold (ibid) used sixty-four moderately and severely retarded individuals who learned to assemble a fifteen-piece bicycle brake and were then tested for transfer to a twenty-four-piece bicycle brake. Fifty-three of the subjects were retested on both tasks after one year. Training procedures utilised information obtained from the basic psychological research on discrimination learning. One-half of the subjects worked with the parts of the training task brake as they came from the factory (form only). The others worked with parts that were colour coded (colour-form). Coding consisted of painting that surface of each part that is facing the subject when it is placed in the proper position, for assembly. All groups worked with the parts of the transfer task brake as they came from the factory (form-only). Half of the subjects learned the tasks to a criterion of six correct out of eight consecutive trials, the other half performed twenty trials beyond criterion on the training task brake (over-learning). The colour-form groups learned the training task brake significantly faster than the form-only groups. Over-learning did not affect transfer. The one-year retention study yielded significant retention effects.

Friedenberg and Martin (1977) trained two severely retarded adults (IQ 30 and 36) on a task requiring multiple, multidimensional discrimination. Two procedures for accomplishing the task were subjected to task analysis, and training procedures for each devised. Each student was trained on both a hand and machine procedure for stapling labels on plastic bags. Subsequent production tests suggested that tangible reinforcement may be a necessary ingredient in maintaining low-error

performance with an inherently non-reinforcing task. Recommendations are made for in-depth analysis of tasks prior to setting up training programmes.

Several demonstrations are available that severely retarded persons can learn difficult vocational tasks (Clarke and Hermelin, 1955; Karen, Eisner and Endres, 1974; Bellamy, Peterson and Close, 1975; and Gold, 1976). Little effort has been made to determine whether this learning occurs as a result of the reported training procedures. O'Neill and Bellamy (1978) trained a severely retarded woman to assemble a saw chain when teaching procedures involving differential reinforcement, modelling, and physical priming. The use of a multiple baseline design across task segments allowed for the interpretation that the procedures were functionally related to the trainee's gains.

Crosson (1969) has demonstrated the use of behavioural techniques to sheltered workshop settings through his use of task analysis and intensification of cues by the trainer. In this training procedure:

"the trainer demonstrates each of the component behaviours in the proper sequence and prompts the trainee to immediately model the behaviour. This can be accomplished by verbal or gestural command, although it is occasionally necessary to mould the response by physically guiding the trainee through an appropriate topography."

He trained seven severely retarded males (mean IQ 27) to perform two tasks, including the operation of a drill press and the use of a hammer in the assembly of flower boxes. Two-month and twelve-month follow-up studies were conducted with highly significant retention effects obtained.

Karen, Eisner and Endres (1974) carried out a study to measure the effects of a token system and a screening of a sheltered workshop area on the work behaviour of ten severely retarded adolescent students (MA 3.5 to 5.9 yrs).

Task-specific performance measures of average error and production in each of five nursery-can type production tasks (box delivery, stripping, washing, punching, boxing) and the generalised work performance measure of average visual inattention-verbal prompt were observed during baseline training and follow-up. Group data revealed differences in task difficulty, a reduction in average error, and an increase in average production with the tokens. Average inattention-verbal prompt decreased irrespective of the tokens and there were individual differences in average error; production and visual inattention-verbal prompt.

Much research has focused on factors that influence vocational-skill acquisition by severely retarded persons because of the apparent reduced ability of these individuals to select and attend to the relevant dimensions in learning tasks (Fisher and Zeaman, 1973). Because retarded persons appear to form avoidance tendencies more slowly than approach responses in the initial stages of discrimination learning, it is clear that correction of errors is an important facet of discrimination training with these individuals.

Training procedures that employ systematic feedback following errors have been and continue to be developed for use with severely retarded individuals. Such methods involve the use of verbal correction (Gold, 1972; Gold and Barclay, 1973; Bellamy, Peterson and Close, 1975; and Irvin and Bellamy, 1977), and repeated practice or 'overcorrection' (Azrin, Kaplan and Fox, 1973; Rusch, Close, Hops and Agosta, 1976) for discrimination and manipulation errors in skill training with severely retarded persons.

Close, Irvin, Prehm and Taylor (1978) studied the effects of different types of verbal correction and of different types of systematic physical

correction on severely retarded individuals' performance of a difficult discrimination task. Seventy severely retarded adults were taught a vocational assembly-skill task involving a difficult visual-motor discrimination. Comparisons of relative effects on trials-to-criterion were made among two types of verbal correction, (general: 'try another way' and specific: 'flat side in') and three types of systematic physical-correction procedures (gesture, physical prompt and repeated practice). Reliable differences in effects occurred only between the three systematic physical-correction procedures, with repeated practice the most effective physical prompts next, and gestures the least effective. The results were interpreted as demonstrating the efficacy of trainer-related training procedures in relation to stimulus-related strategies, as well as relative efficacy among trainer-related correction procedures.

Low levels of productivity is another area for researchers to explore in sheltered workshops. Well-engineered training (Gold, 1972) and incentive (Hunt and Zimmerman, 1969) programmes can increase productivity. Nevertheless large individual differences in productivity persist in workshops even among groups homogeneous with respect to IQ. Of major interest is whether such differences can be attributed to differences in unmeasured aspects of cognitive ability, to differences in motivational levels, or to both.

Cohen and Close (1975) studied twelve retarded adults (mean IQ 52) and production time in a sheltered workshop was analysed in terms of actual time working as opposed to actual time not working and under conditions of standard and high motivation. Under standard conditions, low productivity was primarily the result of more time spent not working. High motivation accentuated this effect. The results were discussed in terms of cognitive versus motivational interpretation of individual differences in work performance.

Numerous attempts have been made to relate behavioural measures to the work potential of retarded adults, but no single measure of intellectual or motoric functioning has been found sufficiently predictive of individual case outcomes. Gold (1973) reported a nonsignificant correlation of .29 between IQ and a mean production-rate measure. Certain tests of manual dexterity have correlated significantly with specific measures of sheltered workshop productivity (Elkin, 1967). However, dexterity test have been criticised as predictors of work potential in retarded persons since they are:-

- (a) job specific;
- (b) limited in that most jobs likely to be secured by retarded workers have limited dexterity demands (Cohen, 1960);

and

- (c) often used as 'one shot' measures of retarded persons' performance that fail to assess the positive effects of extended practice (Tizard and Loos, 1954; Wolfensberger, 1967).

Few personality measures or scales of adaptive social functioning have been studied as predictors of vocational success. Guarnaccia (1976) indirectly examined the relationship between the Adaptive Behaviour Scale and workshop productivity. He found that physical development, occupation-domestic and earnings each loaded significantly on a factor labelled Productivity.

Cunningham and Presnall (1978) examine the relationship of the Adaptive Behaviour Scale factors to workshop productivity, as measured by earnings of workshop members. A factor analysis was performed on the twenty-four domains of the AAMD. Adaptive Behaviour Scale using a sample of two hundred and seventeen adult retarded workshop clients (mean IQ 35). Of the seven dimensions found to describe adaptive behaviour, Personal Independence, Social Maladaptation, and Personal Maladaptation accounted

for the majority of variance in the factor matrix. They concluded that adaptive behaviour is a multidimensional variable, significantly affecting productivity in sheltered workshop settings.

While recommendations concerning reinforcement strategies in vocational training of retarded persons range from the use of minimal social reinforcement to the use of extra social and edible reinforcement, empirical comparisons of such strategies are seldom found in the literature. Koop, Martin, Yu and Suthons (1980) conducted four experiments to compare minimal social reinforcement to social plus edible reinforcement while severely retarded adults were taught assembly tasks of varying complexities. In all experiments, the extra reinforcement generally facilitated the learning of a task to criterion in terms of training time, number of trials, total number of errors, and the proportion of errors on learned steps. Moreover, a preference test showed that the majority of clients preferred the extra reinforcement condition.

Social Skills and Social Behaviour

Researchers who study severely and profoundly handicapped populations have begun to realise the importance of ongoing social interaction among these individuals. As a result, efforts have been made to increase the rate of social behaviour of severely and profoundly handicapped individuals who do not engage in such activity or do so infrequently (Milby, 1970).

Peterson, Austin and Lang (1979) studied the effects of increasing:-

- (a) the frequency of social behaviour of three severely and profoundly handicapped adolescents through teacher prompts and reinforcement

and

- (b) in determining whether generalization would

occur when these adolescents were in a free-play setting with the teacher absent.

Training took place in the classroom on successive school days with the teacher prompting each subject to engage in positive social interaction with each peer. Observations for generalization effects immediately followed each training session. The remaining class members were brought into the room, and social interactions were observed in a free-play setting while the teacher was absent. During both phases observers recorded the behaviour of the three subjects for five minutes and recorded all units of social exchange that each subject initiated or responded to. Increased rates of social behaviour were obtained for all three subjects during both training and generalization. Successful results have also been reported by Whitman, Mercurio and Caponigii(1970); Paloutzian, Hasazi, Streifel and Edgar (1971) and Burney, Russell and Shores (1977).

Some investigators have attempted to explore the development of social and assertive skills of retarded persons. Stacy, Doleys and Malcolm (1979) have examined the effects of social-skills training upon the behaviour of eight previously institutionalized mentally retarded adults, residing in community group homes. The subjects' IQs ranged from 43 to 60 and length of institutionalization varied from thirteen to forty-seven years. Each had been released from an institutional setting within the last two years. They tended to display over-compliant, helpless and socially incompetent behaviours. A broad range of social skill behaviours was examined. Generality of behaviour change from familiar to unfamiliar situations was also assessed. In comparison to a control group those who received training showed substantial changes in the desirable direction for each behaviour. Generalization to unfamiliar situations was also noted. The problems in placing retarded clients in the community without social-skills

training, and the potential disadvantages of inadequate training were discussed. Further support in the development of social and assertive skills has been reported by McClure (1968).

A considerable disparity has been found in motivational level and self-concept of retarded versus non-retarded children. Retarded children typically experience more failures than do non-retarded children and consequently, meet new situations with a low, often unrealistic expectancy of success which in turn precipitates less than optimum performance (Cromwell, 1959).

Simpson and Meaney (1979) have studied changes in the self-concept of trainable mentally retarded children as a function of experience in a physical activity programme. The IQ of subjects ranged from 40 to 60 and the experimenters used the Lipsitt self-concept scale for children (Lipsitt, 1958) as a transfer measure. The self-concept of a group of students was measured before and after participation in a five-week ski programme. A control group received similar pre- and post-measures of self-concept but did not participate in the ski programme. Significant changes in the self-concept occurred among students in the experimental group but not the control group. Furthermore, the magnitude of success in learning to ski was shown to be positively and significantly correlated with magnitude of change in self-concept.

Researchers have consistently reported that retarded individuals fail in job situations partly due to social behaviour, rather than an inability to perform tasks (Gold, 1975). Social skills represented largely by verbal behaviour, are rarely stressed in vocational-training centres. In addition, few researchers have reported long-term maintenance data regarding social behaviour in vocational-training programmes.

Dwinell and Connis (1979) have investigated social feedback as a

treatment strategy for reducing inappropriate verbalizations by a retarded adult (IQ of 42) in a vocational training programme. Treatment procedures were introduced as a combination of three components: praise for not verbalizing inappropriately, reprimands and instruction. Additional investigations were made into procedures for withdrawing treatment, while maintaining the corrected verbal behaviour. Results of this study indicated that the social feedback procedures were effective in reducing inappropriate verbalization. Effects of withdrawing all social feedback components at once suggested that the treatment gains would not be maintained. However, fading social feedback components sequentially was effective in maintaining low levels of inappropriate verbalizations. Various other treatment strategies have been used to reduce or control inappropriate verbal behaviours by Barton (1970) and Gibson, Lawrence and Nelson (1977).

One of the goals of socialization is the development of self-regulatory skills that allow an individual to function independently (Mahoney and Mahoney, 1976). Intellectually handicapped individuals are typically characterized as being unable to control their own behaviour (Kurtz and Beisworth, 1976) dependent (Mahoney and Mahoney, 1976) and outer-directed in their problem-solving orientation (Zigler, 1966b).

Litrownik, Freitas and Franzini (1978) have attempted to develop self-regulatory skills in the moderately handicapped children (IQ 30 to 50; MA 3 to 5 years). They claim that self-regulatory skills are acquired via the same processes as are any overt response. In addition, to serving as a self-regulatory technique (i.e. stimulus control or environmental planning), self-monitoring is also one of the component skills, along with standard setting, self-evaluation and self-reward that involved in behavioural programming or self-reinforcement. Thoresen and Mahoney (1974) identified self-monitoring as the crucial first step

in the acquisition of self-reinforcement skills. That is, individuals must be able to monitor their behaviour if they are going to set standards based on past performances, compare current performances to this standard (i.e. self-evaluation), and then self-administer rewards contingent on a positive evaluation.

Litrownik et al (ibid) first assessed self-monitoring skills of the moderately handicapped children and then developed and evaluated a demonstration-training programme aimed at teaching these skills. The subjects were divided into three groups, each group matched on IQ, MA and CA. One group was randomly assigned to each of the three treatment conditions:-

- (a) training;
- (b) attention control;
- and (c) no-contact control.

Initially, they assessed children's ability to observe and monitor differentially the consequences of their performance as well as the type of task they worked on. Self-monitoring skills were similarly assessed after one-hour demonstration-training programmes. Following a one-week retention interval, and on a transfer task they found that none of the children could appropriately self-monitor at the preassessment, but these skills were acquired, retained, and transferred as a function of the demonstration-training programme. The results suggest that moderately handicapped persons can be given more responsibility for monitoring their own behaviour(including consequences).

Matson, Marchetti and Adkins (1980) carried out a study in which seventy-five moderately to profoundly retarded adults living in a large institution were randomly assigned to one of three groups: standard treatment; independence treatment; and no-treatment control. Standard treatment consisted of teaching self-help behaviours by training

methods such as verbal prompts, modelling, manual guidance, social reinforcement, shaping, fading, etc. The aim of independence training was to increase input and responsibility of subjects in their treatment and to heighten both self-awareness and peer reinforcement for appropriate behaviour. All procedures described in the standard training method were used in independence training, with the addition of self-evaluation and monitoring as part of the treatment. A significant increase in correctly completed steps of the targeted behaviour from pre- to post-treatment as well as from pre-treatment to follow-up assessment (eight weeks after the completion of the post-treatment evaluations) was noted for the independence training group. Independence training proved to be significantly more effective over both standard treatment and no treatment control as the post-assessment.

Mediation and Conceptual Behaviour

Psychologists have long been concerned with the cognitive functioning of mentally retarded children and adults (Haywood, 1970; Allen, 1973; Robinson and Robinson, 1976) and conceptual problems incurred by this population have been interpreted in many ways. One of the most basic and recurring problems concerns the ability of retarded children and adults to perceive, represent, and deal symbolically with various aspects of their environment i.e. through the use of symbolic mediation processes.

Clarke and Cooper (1966) tested the notion that task complexity might, within limits, facilitate transfer. Holding age constant they have matched groups of imbeciles training on conceptual sorting tasks of different complexity. It was found that:-

- (1) transfer was related to training task complexity;
- (2) it occurred across tasks that possessed no identical elements other than that

they were conceptual problems;

- (3) differential effects of differing degrees of complex training were subsequently persistent over ten trials of the transfer task;

and

- (4) the amount of overlearning of the complex training task was also relevant.

Greenson and Jens (1977) have studied instructional modelling and the development of visual-and-verbal mediation skills by trainable mentally retarded children (IQ range 34 to 61). A paired-associate (PA) learning task was administered to forty children under one of four instructional-modelling conditions; imagery, verbal mediation, imagery and verbal mediation, and a control condition. On one half of the PA-learning study trials, the children were provided modelled mediating responses (connective pictures and/or sentences) and on the other trials no model was provided. The children's use of mediating responses on study trials was evaluated as was their recall performance. Each instructional modelling condition resulted in more effective mediator use and better recall than the control condition, verbal-mediation training was more effective than instruction in the use of visual imagery. Generation of mediators was most apparent when youngsters were first provided with models and then required to generate their own mediating responses. Gains in mediator use and recall were retained over a period of several days.

Clarke, Clarke and Cooper (1970) found significant effects of a learned set on the free recall of moderately retarded adults, all members of an Adult Training Centre. It was concluded that if categorical relations among words are repeatedly demonstrated by clustered presentation, a set to perceive inter-item associations develops. This is available for use with new categorizable material so that the categorical relations

are perceived at the input-coding stage with consequent augmentation of total output (recall score). Clustering at any significant level is a reflection of organisation of input material in store, and in an activity that occurs after at least two repetitions of a list, predominantly among subjects of higher intelligence. The results point to the importance of total recall score as a measure of categorization, in addition to clustering, which later may well depend on different psychological processes.

The area of modelling or observational learning is one that has received considerable attention in the literature. Acquisition of various kinds of behaviour via modelling requires observers first to attend to the demonstration and then to store information so that it can be retrieved at some later time. Because of proposed attentional and/or mediational deficits in the more severely retarded child there is some question as to whether or not the low mental age (MA) school-aged trainable mentally retarded child can benefit from modelling exposures when more complex conceptual behaviour is demonstrated.

Litrownik, Franzin and Turner (1976) established a four-factor repeated measures design in order to determine:-

- (a) whether or not trainable mentally retarded (TMR) children could acquire a novel rule-governed concept via modelling;

and

- (b) the effects of type of modelling demonstration, verbal rule provision and observer gender on concept matching and transfer by TMR children.

Twenty-four male and twenty-four female TMR children (mean IQ 44 and mean MA 5.67 years) were divided into four groups each equated by stratified assignment on IQ and MA. One male and one female group were randomly selected to observe a live female model present:

- (a) massed-demonstration trials which verbalized the concept;
- (b) massed trials without the concept being verbalised;
- (c) distributed demonstration trials with the conceptual verbalization;

and

- (d) distributed trials without conceptual verbalization.

Subjects were then presented with three transfer tasks each subsequently requiring a greater degree of generalization from the demonstration task. It was found that TMR children could acquire and transfer the complex concept via modelling. Distributed demonstrations yielded better initial response matching, while massed demonstrations led to better transfer. Rule provision facilitated transfer for massed demonstration groups and facilitated matching for the male distributed-trials groups.

Mansdorf (1977) hypothesized that imagery may be a preferred representation device in retarded adults as it is believed to be by some in younger children (Bruner, Oliver and Greenfield, 1966). A group of severely retarded institutionalized adults (mean IQ 29) was exposed to three different types of instructional procedures (imaginal instruction, verbal instruction, no instruction) and three types of reinforcement procedures (no reinforcement, reinforcing correct responses, reinforcing all responses) in learning concepts through modelling. Concept acquisition was tested, using Leiter-type items, in direct imitation as well as in a generalization task. On both imitation and generalization conditions, imaginal instructions were more effective than verbal instructions which in turn were more effective than no instructions. The study of modelling procedures, especially with regard to the use of imagery, is called for in order to investigate the processes involved

in their effectiveness with a severely retarded population.

Reflection-impulsivity has been proposed as a dimension of individual difference in cognitive style that is concerned with the way in which persons approach tasks containing high response uncertainty. Those who respond quickly and make frequent errors are described as cognitively impulsive and those who delay their responses and make few errors are described as cognitively reflective.

The cognitive style dimension of reflection-impulsivity was assessed by Peters and Davies (1981) with twenty-seven retarded adolescents (mean MA 7.5 years) using the Matching Familiar Figures Test.

The most impulsive adolescents subsequently received training in self-instruction while observing a reflective model, or observed the model without specific training in self-instruction. Post-training measures indicated that the self-instruction procedure produced significantly more reflective responding than did the model-alone procedure. The results also suggested the presence of a developmental lag in cognitive style among the retarded children compared to recent norms, for non-retarded children. The finding that the retarded youths were responsive to self-instructional training appears to be inconsistent with Luria's (1961) contention that retarded individuals are incapable of using the language-based second signalling system to influence and control their own behaviour.

Academic Skills

A variety of methods have been recommended for teaching sight words to trainable mentally retarded (TMR) learners (Brown and Perlmutter 1971; and Brown, Huppler, Pierce, York and Sontag, 1974).

Wolfe and Cuvo (1978), compared two different prompting procedures for teaching letter-discrimination to mentally retarded subjects. Each

of twenty-four severely retarded persons (mean IQ 28) received training on six alphabet letters, three letters by extra stimulus prompting (adding a topographically different cue, a pointing finger) and three by within-stimulus prompting (accentuating critical features of the stimuli themselves). Letter discrimination was tested prior to, immediately following, and two weeks after training. A significantly greater proportion of letters trained by within-stimulus prompting was learned ($P < .001$). The authors conclude that, since mentally retarded persons are overselective and attend to few cues in a stimulus array, within-stimulus prompting may be more effective than between-stimulus prompting.

Walsh and Lamberts (1979) compared the effectiveness of two approaches for teaching beginning sight words to thirty TMR (mean IQ 43) students. In picture fading technique, words are taught through association with pictures that are faded out over a series of trials, while in programme error-less-discrimination technique words are taught through shaped sequences of visual and auditory-visual matching-to-sample, with the target word first appearing alone and eventually appearing with orthographically similar words. Students were instructed in two lists of ten words each, one list in the picture-fading and one in the discrimination method, in a double counter-balanced repeated-measures design. Co-variance analysis on three measures (word identification, word recognition, and picture-word matching) showed highly significant differences between the two methods. Students' performances were better after instruction with the error-less-discrimination method than after instruction with the picture fading technique. The findings on picture fading were interpreted as indicating a possible failure of the shifting of control from picture to printed word that earlier researchers have hypothesized as occurring.

Vandever and Stubbs (1977) designed a study to investigate the acquisition, retention and transfer of reading skills for TMR children. Twenty-one TMR students (mean IQ 46) completed two years of reading instruction, using a whole-word approach; students were pre-tested and post-tested, both years, on two word lists; one list was made up of words included in the reading programme, the other of words not included. The former list was used to assess work acquisition and retention, the latter to assess transfer. A one-way repeated measure analysis of variance indicated a statistically significant increase in words recognised. By the close of the second year, the average student had completed one hundred lessons and had learned forty-one words. Students retained most of the words they had learned over the three-month summer vacation. A separate one-way repeated measure analysis indicated statistically significant transfer to untaught words. The authors concluded that TMR students could profit from reading instruction.

Smith and Meyers (1979) examined telephone-skills training delivered to institutionalized retarded adults in group and individual demonstrations both with and without verbal instructions. Persons in all conditions including the practice control condition, significantly improved skill performance. These findings indicate that, for skill development tasks with retarded adults, demonstration and verbal summaries may add little to the practice experience and that group delivery of training procedures appears to be cost-effective.

Smeets (1978) designed a study to teach severely and moderately retarded subjects (IQ's 39 to 48) all functional component skills of coin usage without using complex numerical skills. The purpose of the study was to evaluate the use of a slide rule procedure to teach coin-summation and purchasing power of Dutch coin combinations. The programme consisted of eight sequential training steps. All three subjects learned monetary

skills in seventeen to twenty-five hours.

Language

A major behavioural deficit of severely and profoundly handicapped students is in the area of language development (Bricker, Ruder and Vincent, 1976). Typical areas of language intervention usually involve attendant skills, such as verbal and motor imitation, receptive vocabulary, function of object use, noun comprehension, and noun production, etc. The inability to proceed through these phases of normal language development seriously interferes with all aspects of habilitation for severely and profoundly handicapped persons.

Wehman and Garrett (1978) describe the implementation and results of a developmentally-sequenced language programme with children (IQ range from untestable to 35). The results indicate that while the students were still receiving training in motor imitation skills, approximately fifty per cent of these students have advanced two or more levels, with several more advancing only one level.

In a review on the use of operant techniques in the establishment and generalization of language with the mentally retarded, Garcia and DeHaven (1974) conclude that the operant training techniques have been successfully used to establish and remediate speech and language behaviour. Review of experimental reports suggests that an operant technology presently exists for establishing verbal imitation and can be used as a basis for training different forms of receptive and expressive speech. Still further research, especially in the newer areas of generative speech training and generalized speech usage, should continue to maintain the present momentum in the analysis of language development.

In Hobson and Duncan study (1979), nine profoundly retarded and institutionalized persons were taught, over a six-week period, to

associate gestural signs with a series of pictures depicting these acts and objects. In all cases, learning was observed to occur. Following a two-month period, during which all teaching procedures were suspended, the subjects were tested for retention of the material previously learned. Each subject evidenced a degree of retention, thus supporting the supposition that the communicative skills of retarded persons can be improved by sign learning techniques.

Kohl (1981) carried out a study with eight severely handicapped children who were given training on communicative signs that varied according to iconic or abstract touch or non-touch, and symmetrical or asymmetrical sign dimensions to determine the effects of motoric requirements on sign acquisition. It was reported that symmetrical signs and touch signs were acquired significantly faster than were non-touch signs. Results of the acquisition of iconic versus abstract signs were inconclusive.

A number of studies in the field of mental handicap provide evidence that it is possible to modify parents' linguistic style to produce a change in their children's verbal or non-verbal behaviour (Filler, 1976). It is suggested that changes in children's behaviour are produced by changing parents' strategies. Snyder and Maclean (1977) have stressed the value of training parents to maximize their own tendencies to provide appropriate language models. These studies have delineated the specific ways in which parents should modify their language, e.g. use fewer demands and questions and shorter mean length of utterance. As with most intervention programmes involving parents, however, these changes have been experimenter-initiated: the parents have been explicitly instructed as to how they should change their style of interaction in order to attain a specific objective with their child. Yet parents are experienced interactors with their own children, and this raises the question as to whether they could initiate their own

changes in linguistic style if given a language objective to work towards.

The primary aim of Cheseldine and McConkey (1979)'s study was to single out the effect of prescribing objectives for parents and to observe the teaching strategies, that parents spontaneously adopted. Parents with Down's Syndrome children who were at the one-two word stage of expressive language development were given a language objective to work towards with their child, but no instructions on how to attain this goal. The parents spontaneously altered their language strategies in their attempts. Some parents were more successful and differed in their strategies, using more target words in shorter 'statement' utterances. Parents who used a questioning or imitating strategy were less successful. The less successful parents were then shown how to alter their language strategies more appropriately to produce a greater improvement in their child's use of the target words.

Snyder and MacLean (1976) proposed a conceptual framework for analysing aberrant or retarded language development. Recent developments in psycholinguistics have led to a view of language acquisition as an interactive process involving external interactions between child and environment and internal interactions between cognitive holdings and processes. The child's active participation in these interactions is conceptualized as a system of language-acquisition strategies. These consist of both information-gathering strategies and information-processing strategies and are distinguished from the adult speaker's facilitation strategies. They suggest that aberrant or retarded language development may be viewed in terms of specific process deficits in one or more of these strategy systems. In their article, three pre-verbal information-gathering strategies identified as selective listening, establishment of joint reference, and feedback mechanisms were described.

Suggestions for future research and implications for intervention were discussed.

Predictive Assessment

Throne and Farb (1978) ask whether mental retardation can be reversed. In their studies mental retardation is attacked through intelligence training. To be retarded is to be relatively low in intelligence in comparison to the mean of the population. Therefore, raising the intelligence of a retarded individual toward the population mean is to reverse his or her retardation. According to the above authors, given the five conditions mentioned below, the answer appears to be in the affirmative. These conditions being that:-

- (1) mental retardation is defined behaviourally;
 - (2) the behaviour in question is identified by performances on tasks like those found on standardised intelligence tests but not elicited under the neutral conditions of standardised testing;
 - (3) such performance is deliberately and systematically trained to achieve non-retarded levels of proficiency;
 - (4) if such gains hold over time;
- and
- (5) if such results generalise from the trained performance to untrained performance from the same or related categories.

Intelligence tests such as the Stanford-Binet Intelligence Scale (Terman and Merrill, 1972), Peabody Picture Vocabulary Test (Dunn, 1959) and Wechsler Adult Intelligence Scale (Wechsler, 1955) have been widely used with moderately and severely retarded persons for placement and other purposes. The validity of these tests with this population have been questioned for several reasons:-

- (a) the response requirements of many

assessments penalize moderately and severely retarded persons, a population replete with multiple handicapping conditions;

- (b) the single administration format of standard tests untenably assumes that the persons' initial responses are reliable and that the person has a normal experiential background from which he has spontaneously learned knowledge and skills common to persons of the same age;

and

- (c) data from conventional tests is frequently inadequate as predictors of learning ability.

Hamilton and Budoff (1974) and Budoff and Hamilton (1976) provide support to the findings that a learning potential approach to the assessment of abilities of moderately, severely and profoundly retarded persons provides a fairer estimate of their capabilities than traditional intelligence measures.

Cobb(1969) has provided a summary of research literature on the predictive assessment of the adult retarded for social and vocational adjustment. He reaches thirteen conclusions, of which some will be mentioned here.

"The most consistent and outstanding finding of all follow-up studies is the high proportion of the adult retarded who achieve satisfactory adjustments by whatever criteria are employed - this also holds for the retarded at moderate and severe levels. This should guide the counsellor to the adoption of more generally optimistic expectation than has generally prevailed in the past. Indeed, the evidence suggests that it is more appropriate to make an assumption of positive adaptation on some meaningful criteria of employability and social integration until negative evidence appears, rather than to assume a poor prognosis until positive evidence appears. The latter attitude, which has been highly prevalent in the past, has the general effect of creating its own proof by failing to provide available means for facilitating successful adaptation. Every follow-up validation of predicted successes and failures has shown a higher rate of false negatives than of false positives..."

"Evidence from the major follow-up studies indicates that adult adaptation of the retarded may take considerable time, especially when retardation is related to social and cultural deprivation. The movement from instability to stability may take years but it may be greatly facilitated by flexible open-ended programmes of social-vocational training. Failure at any point should never be taken as conclusive. The general principle, supported throughout the research literature, is that predictions of adaptive success are generally more reliable than predictions of failure."

"Of particular significance to case workers is the finding from Parnick's research that predictive validity decreases rapidly over time and over the stages of training. This finding suggests that we are on much firmer ground in using predictive measures more as estimates of preparation for the next step in training or placement than as determiners of the longer-range future."

Conclusion

This chapter is devoted to a broad ranging review relating to the amelioration of various areas of functioning in mental handicap so that it provides the context for the experimental studies reported later, in Chapters 6 to 9. The balance of evidence suggests that, while there are considerable differences between normals and sub-normals in the rate of acquisition, the upper limits to attainment and to the amount of complexity of material learned, the learning processes themselves differ in degree rather than in kind. There is also some evidence for the view that a major deficiency in the severely handicapped individuals is a relative inability to learn spontaneously from ordinary unstructured life experience.

The experimental work reported here also suggests that the starting point on learning a task bears little or no relationship with potential responsiveness to training. It is probably because of this poor initial performance that the learning capabilities of the sub-normal have been so commonly underestimated. Moreover, the psychometric

approach, which employs solely a measure of initial performance, has reinforced this underestimation. This has led the author of this thesis to investigate the concept of rigidity which has been labelled as an essential feature of mental retardation. The following chapter reviews this concept in the retarded.

CHAPTER 3

REVIEW OF RIGIDITY STUDIES IN THE RETARDED

Review of Rigidity Studies in the Retarded

The previous chapter contains a review of experimental studies relating to the amelioration of various areas of functioning in the moderately and severely handicapped people. It is shown that much can be done to induce the development of cognitive and motor skills by appropriate training which, if repeated under long-term conditions, can significantly accelerate the intellectual development of handicapped persons. However, in practice, there exists ignorance regarding the extent to which training and education can assist handicapped individuals, thus leading to the reduction in demands and simplification of their lives. This has prompted the author of this thesis to investigate the concept of rigidity in this population.

Extensive reviews of the concept of rigidity in the general population have been reported by Levine (1955); Chown (1959); Goins (1962); and Leach (1967). The general concept has remained imprecise and one sympathises with the title of Chown's (1959) paper: 'Rigidity - a Flexible Concept'.

Various definitions of rigidity have been reported in the research literature: Schaie (1959) defines rigidity as:-

"A tendency to persevere and resist conceptual change, to resist the acquisition of new patterns of behaviour, and to refuse to relinquish old and established patterns."

Chown (1961) states:-

"Rigidity: a lack of change of behaviour where a change is necessary for success at the task, and where the subject knows that a change is likely to be demanded."

Birren (1964) considers the rigid individual as:-

"one operating under few and constricted

instruction sets."

Botwinick (1973) emphasises that:-

"poor discriminability itself may lead to rigidity."

These definitions agree in general outline but disagreement appears to stem from the failure to deal adequately with both definitional and methodological demands of the formulation.

From the writings of Kounin (1941a, 1941b) onwards there has been much discussion of rigidity as an essential feature of mental retardation. Various attempts have been made to explain the rigid behaviours of the mentally handicapped and these formulations have been made by the following authors:-

- (a) Kounin and Lewin
- (b) Goldstein-Werner-Strauss
- (c) Zigler
- (d) Heal and Johnson
- (e) Clarke and Clarke

The ideas of each will be considered in full.

Lewin and Kounin's Theory

In Lewin's (1936) general behaviour theory, the individual is treated as a dynamic system where the differences among individuals are stated to be due to the following factors:-

- (a) Structure of the total system;
- (b) Material and state of the system;
- (c) Its meaningful content.

According to Lewin, the first two factors are the most important ones to explain the behaviour of the mentally retarded. The retarded child is seen as being cognitively less differentiated (i.e. having fewer regions in the cognitive structure) than a normal child of the same CA. Although the retarded child resembles a younger normal child in respect of the number of cognitive regions, they are not to be regarded as entirely similar in terms of the material and state of the system.

Lewin defines rigidity as lack of fluidity between cognitive regions. However, he states that the lack of differentiation can also lead to rigid behaviours, i.e. inelasticity, concreteness, stereotypy, etc. To support his theory he has presented a considerable amount of observational material as well as the findings of one experiment. His experiment required groups of normal and retarded children of different CAs to draw moon faces until they were satiated on this activity. The longer satiation time displayed by the ten-year-old retarded children as compared to the ten-year-old normals is used as evidence to support the greater rigidity of the retarded. It is not clear from his experiment whether Lewin tested rigidity as an explanation in terms of fluidity of the system or in terms of degree of differentiation.

Kounin's work (1939, 1941a, 1941b, 1948) gives clear support to the hypothesis that retarded individuals are more rigid than normal individuals having the same degree of differentiation. Kounin has advanced the view that:-

"rigidity is a positive, monotonic function of CA."

According to Kounin, with increasing CA the individual becomes more differentiated, i.e. has more cognitive regions, which results in a lower incidence of rigid behaviours and the boundaries between regions become less and less permeable. Kounin, like Lewin, refers to 'rigidity' as:-

"that property of a functional boundary which prevents communication between neighbouring regions."

and not to phenotypic rigid behaviours as such.

Kounin (1941a, 1941b) supports his formulation by offering the findings of five experiments. Three groups of subjects were employed: older, retarded individuals, younger, retarded individuals and normals (the two retarded groups resided in an institution, whereas the normal

children did not). The degree of differentiation is defined in terms of the MA of an individual and thus controlling the factor by matching the three groups on MA. He also attempted to control motivational factors by having his subjects engage in each of the activities prior to the experiment proper.

As predicted from the theory, the three groups performed differently on certain instructions-initiated tasks, e.g. drawing cats until satiated, and then drawing bugs until satiated; lowering a lever to release marbles, and then raising the lever to release marbles.

The normals showed the greatest amount of transfer effects from task to task; the younger retarded a lesser amount of transfer effects and the older retarded the least amount of transfer. That is, following satiation on the first drawing task, both retarded groups drew longer on the second task than did normals, with the least co-satiation effects being observed in the older retardates. The co-satiation score is the measure of the degree to which performance on the first task influences performance on the second task.

Kounin (1941a) carried out another experiment on concept switching in which the child was given a deck of cards that could be sorted out on the basis of either one principle (form) or another (colour). The subject was asked to sort the cards one way and was then asked to sort the cards some other way. The older retarded found more difficulty in adjusting from one sorting principle to another than the normals. Thus, in those instances where the individual must, on his own, move from one region to another, the Lewin-Kounin formulation predicts that such cognitive movement would be more difficult for the retarded than for the normal individual.

Conclusion

'Topological Rigidity' is proposed by Lewin and Kounin to account for individual differences in the ability to change set. Lewin conceives of areas of experience (regions) that are separated by boundaries. These boundaries can vary in rigidity, brittleness, thickness, etc. Rigidity is defined as the degree of communication of one region with another and therefore, the ease with which an individual 'moves' from one region to another. According to Lewin and Kounin, retardates are inherently more rigid in their cognitive functioning than normals of the same MA (i.e. persons of the same degree of differentiation).

Goldstein, Werner and Strauss's Approaches

Goldstein (1942-43) has criticized both Lewin's and Kounin's positions on rigidity in the retarded and has put forward a two-factor theory of rigidity which differentiates between primary and secondary rigidity.

According to Goldstein, primary rigidity is independent of an impairment of higher mental processes. It manifests itself in a lack of ability to change from one 'set' to another. This deficiency becomes apparent only when the individual attempts to shift from one task to a second unrelated task. The difficulty here is not related to various tasks themselves. An individual suffering from primary rigidity is quite capable of solving individual tasks even if such tasks demand a high level of abstraction.

Goldstein has viewed secondary rigidity as an impairment of abstract thinking. He equates ability to think abstractly with 'mental capacity'. Thus, Goldstein agrees with Lewin and Kounin, that lack of differentiation results in a high incidence of rigid behaviours but disagrees with them concerning their assumption of a primary abnormality in the boundaries between regions. To Goldstein, all differences in the incidence of

rigid behaviour in the retarded originate from their relative lack of differentiation and from this factor alone. According to Goldstein, secondary rigidity is a result of an individual's dealing with a problem beyond his mental capacity. Rigid behaviours such as perseveration, are adaptive mechanisms which allow the individual to escape frustration. The retarded emit more of such behaviours because they encounter problems beyond their capacity more frequently than do normal individuals.

There is some difficulty in Goldstein's distinction between primary and secondary rigidity. According to Goldstein, primary rigidity implies subcortical damage which results in inability to change 'sets', from which ensue certain definite behaviours (i.e. inability to shift to a new task). Secondary rigidity implies cortical damage which results in an inability to think abstractly, from which ensue certain behaviours (i.e. perseveration or distractibility). It is difficult to understand how one is 'primary' and the other one 'secondary'. It can only be understood in terms of secondary rigidity being divorced from organic involvement. This being so, then Goldstein's secondary rigidity would become simply a general behaviour mechanism unrelated to retardation which would appear when any individual is confronted with a problem beyond his capacity. This general behaviour mechanism has been utilised to account for the appearance of certain rigid behaviours when individuals are faced with difficult or insoluble tasks.

One aspect of Goldstein's criticism of Kounin's work is worth mentioning. Goldstein has stated that Kounin's four drawing tasks did not require the person to move from one region to another. It appears that anyone who uses a theory which employs such concepts as 'degree of differentiation', 'region', 'overlapping situation', etc., to predict behaviours, must make an effort to define these concepts

independently of the operations which constitute the predicted behaviours.

Werner(1946) has also attempted to explain rigidity in the retarded and looked closely at Lewin's and Kounin's work with the retarded. Werner has suggested that since Lewin's second task had been a free-drawing one, quite different from his first task, but Kounin's second task had been a structured one, very similar to his first, it is likely that co-satiation is irrelevant. Rather, it seems that feeble-minded subjects are less easily satiated than normals on a repetitive and structured task, but less willing to embark on a free, imaginative one.

Werner and Strauss (1942) have followed up this work by re-analysing a series of experiments on word list repetition. The results have shown that brain-damaged subjects perseverated far more than normals. Werner has therefore been able to destroy Kounin's concept of segregation between personality sub-regions, since the application of this concept would have meant classifying the brain-damaged subjects as flexible, since their perseveration would have indicated lack of segregation.

Werner further clarifies the theoretical background to rigidity by pointing out that rigidity is not to be confused with stability. In a constantly changing environment, if behaviour is to be stable, response must be flexible. Differentiation of response is therefore essential to stability. It must not be confused with Kounin's segregation, which implies difficulty in shifting across figurative personality boundaries and is therefore a concomitant of rigidity.

Conclusions

Goldstein deals with two types of rigidity resulting from organic brain damage. 'Primary Rigidity' is the inability of a person to change from one train of thought to another. The person pays no attention at all

to stimuli which are unrelated to the matter in hand. 'Secondary Rigidity' is displayed when a person is faced with a problem which is too difficult for him; he prefers an incorrect answer to making no response at all.

Wener has shown that a mentally retarded person displays a different type of rigidity from a person with brain injuries. The former fails to solve problems because he oversimplifies them. The latter seizes on resemblances to problems which he has previously faced, and tries methods which are no longer applicable. For Werner, rigidity is a functional rather than a structural concept.

Zigler's View

Zigler (1972, 1973) re-examines the concept of rigidity in the retarded and states that the rigid behaviours observed in the retarded are most appropriately viewed as phenotypic phenomena stemming from a multitude of developmental and motivational factors, rather than being a direct outgrowth of the inherent rigidity of the retarded as postulated by Lewin and Kounin (1936, 1941a, 1941b). Zigler and his colleagues have studied many negative and inconsistent outcomes of experimental tests of Lewin and Kounin's concept of rigidity. They suggested the following motivational factors to explain the greater phenotypic rigidity of the retarded:-

- (1) Social deprivation and motivation for social reinforcement;
- (2) Social deprivation and the negative reaction tendency;
- (3) The reinforcer hierarchy;
- (4) Expectancy of success;
- (5) Outer-directedness.

(1) Social Deprivation and Motivation for Social Reinforcement

Zigler, Hodgden and Stevenson (1958) put forward the hypothesis that

institutionalised retarded children tend to have been relatively deprived of adult contact and approval, and hence have a higher motivation to procure such contact and approval than do normal children. In this experiment, the marked sensitivity of the retarded, as compared to the normals, to variations in the degree of social reinforcement, as well as to the marked shift by the retarded from one social reinforcement to another in behavioural indices, lend support to the social deprivation hypothesis.

Zigler (1961) proposed the hypothesis that, within an institutionalised population a relationship should exist between the degree of deprivation experienced and the amount of rigidity manifested. On the basis of pre-institutional social deprivation ratings, sixty retarded children were divided into two groups. The groups did not differ significantly on either MA, CA or length of institutionalisation. The study employed a socially reinforced, instruction-initiated two-part satiation game. The game was in the form of simple motor tasks, each having two parts, and each allowing the experimenter to secure a satiation, co-satiation and error score - similar to Kounin's tasks. The results confirm that the more socially-deprived subjects:-

- (i) spent a greater amount of time on the game;
 - (ii) more frequently made the maximum number of responses allowed by the game
- and
- (iii) evidenced a greater increase in time spent on part two over that spent on part one of the game.

Zigler, Balla and Butterfield (1968) confirm the above results and also offer support for the following views:-

- (1) The rigid behaviour observed in retarded individuals is a product of higher

motivation to maintain interaction with an adult and to secure approval from him through compliance and persistence.

- (ii) The institutionalised retarded subjects' higher motivation to interact with an adult is related to greater pre-institutional social deprivation such persons have experienced.
- (iii) Individual differences among the retarded in persistent and/or compliant behaviour can be related to differences in the amount of social deprivation experienced.

Similar results are also obtained with subjects of normal intelligence who have experienced similar social deprivation. Green and Zigler (1962) report an experiment with three groups of subjects: institutionalised retarded, non-institutionalised and normals. All three groups were equated on MA and the two retarded groups were also equated on CA. The results indicate that performance of the normals and the non-institutionalised retarded was similar. However, the institutionalised retarded showed relatively long satiation times, a perseverative behaviour which has been employed in other studies as evidence for the inherent rigidity of the retarded.

A further experiment by Zigler (1963) confirms the view that perseveration on open-ended satiation-type tasks is a result of an enhanced effectiveness of social reinforcers stemming from the greater social deprivation experienced, rather than a product of an inherent cognitive rigidity. The greater effectiveness of social reinforcement for both institutionalised normal and retarded children, as compared with non-institutionalised normal and retarded children, has also been found by Stevenson and Fahel (1961).

Harter and Zigler (1968) report that an adult experimenter is a more effective social reinforcer than a peer experimenter for the non-

institutionalised retarded. Thus, it appears that the institutionalised retarded child's motivation to obtain social reinforcement is relatively specific to attention and praise dispensed by an adult, rather than a more generalised desire for reinforcement dispensed by any social agent, e.g. a peer.

The studies outlined above indicate that certain behaviours of the institutionalised retarded that have been attributed to their inherent rigidity can more parsimoniously be viewed as a product of the greater social deprivation experienced by the institutionalised retarded child.

(2) Social Deprivation and the Negative Reaction Tendency

As noted earlier, Kounin employed a co-satiation-type task as one measure of rigidity. In this type of task, the subject is instructed to perform a response and is allowed to continue until he wishes to stop. He is then instructed to perform a highly similar response until again satiated. The co-satiation score is the measure of the degree to which performance on the first task influences performance on the second task.

Zigler notes a phenomenon which appears to be at considerable variance with the retarded individual's increased desire for social reinforcement (positive reaction tendency); the retarded child's reluctance and wariness to interact with adults.

Shallenberger and Zigler (1961) demonstrated that co-satiation effects are not the product of inherent rigidity but rather of the relative strength of certain motivational variables (i.e. positive and negative-reaction tendencies). These tendencies and their relative strengths seem to be the product of particular environmental experiences and, apparently, are open to manipulation and modification.

Harter and Zigler (1968) conducted a study which indicated that the institutionalised retarded suffer from a generalised wariness of strangers regardless of whether the strangers are adults or children. The co-satiation scores used to measure the negative-reaction tendency of the non-institutionalised retarded were very similar to those found with normal children of the same MA.

(3) The Reinforcer Hierarchy

The differences in performance between normals and retarded of the same MA is explained in terms of the reinforcer hierarchy. This reinforcer hierarchy pertains to the ordering of reinforcers in the individual's motivation system, from most to least effective. There is an assumption in the hypothesis that the positions of various reinforcers in the reinforcer hierarchies of normal and retarded children, differ.

Considerable evidence has been presented either indicating or suggesting that the reinforcer hierarchies of middle-class children differ from those of lower-class children (Douvan, 1956; Zigler and Kanzer, 1962; and Cameron and Storm, 1965). These studies indicate that middle-class children are more motivated to be correct for the sheer sake of correctness than are lower-class children. Terrell, Durkin and Wiesley (1959) and Cameron and Storm (1965) found that middle-class children did better on a discrimination learning task when an intangible, rather than a tangible reinforcer was employed, while lower-class children evidenced superior performance when the reinforcer was a tangible one. Stevenson and Zigler (1957) found that when tangible reinforcers were given, the institutionalised familial retarded were no more rigid than normal subjects of the same MA on a discrimination reversal-learning task.

Zigler and De Labry (1962) tested the hypothesis that middle-class

children should not be superior to either retarded or lower-class children of the same MA when these latter children are rewarded with more optimal reinforcers (i.e. reinforcers high in their hierarchies). Kounin's concept switching task was used under two reinforcement conditions with groups of institutionalised familial-retarded lower-class and middle-class children. Kounin's original reinforcer (the reinforcement that inheres in a correct response) was employed in one condition. In a second condition, the reinforcer was a tangible reward, a small toy. Half the subjects in each group received the tangible reinforcer and half received the intangible reinforcer for switching from one concept (either form or colour) to the other. The findings indicated that the retarded, normal and lower-class children did better (fewer trials to switch) in the tangible than in the intangible condition, while the normal middle-class children did slightly better in the intangible than in the tangible condition. Significant differences existed among the three groups who received intangible reinforcers. However, no differences were found among the three groups who received tangible reinforcers. Furthermore, no differences were found among the three groups that exhibited maximal performance (i.e. retarded-tangible, lower-class-tangible, and middle-class tangible).

(4) Expectancy of Success

The high expectancy of failure is another motivational factor advanced to explain the phenotypic rigidity of the retarded. The failure expectancy has been viewed as an outgrowth of a lifetime characterised by frequent confrontation with tasks with which the retarded are intellectually ill-equipped to deal.

The motivational explanation for the differences found in the performances of retarded and normals of the same MA on a partially reinforced three-choice problem was conducted by Gruen and Zigler (1968) They have

stated that it is the lowered expectancy of success originating from a high incidence of failure experiences, that causes the retarded to manifest maximizing behaviour (consistently responding to one stimulus). The same type of behaviour is found in children of normal intellect who have also experienced relatively high amounts of failure. Lower-class children would appear to have had such a background. The motivational position would, therefore, predict similarity in performance by retarded and lower-class children on a partially reinforced three-choice problem. The position that rigidity is inversely related to IQ (Lewin and Kounin formulation) would lead one to expect a dissimilarity in the performance of these two groups and a similarity in the performance of lower-class and middle-class children matched on IQ.

The Gruen and Zigler study (ibid) has stated that both the normal lower-class and retarded children made more maximising (persistent choice of the correct knob) responses than did the normal middle-class children. Contrary to the expectation generated by Lewin and Kounin formulation, the lower-class normal children showed more maximising behaviour than did the retarded children, although this difference did not reach a conventional level of statistical significance.

(5) Outerdirectedness

In addition to a lowered expectancy of success, the high incidence of failure experienced by the retarded generates a style of problem-solving characterised by outerdirectedness. That is, the retarded child comes to distrust his own solutions to problems, and therefore seeks guidance to action in the immediate environment. In certain instances, this results in behaviour that could be characterised as rigid.

Zigler, Hodgden and Stevenson (1958) have found that the institutionalised retarded tended to terminate their performance on experimental games,

following a suggestion from an adult experimenter that they might do so. The position here is that social deprivation resulted in an enhanced motivation for social reinforcers and, hence, greater compliance in an effort to obtain such reinforcement.

Turnure and Zigler (1964) have confirmed the hypothesis that retarded children are more outerdirected in their problem-solving and suggested the process by which the outerdirected style of the retarded is reinforced and perpetuated. There are undoubtedly many real-life situations in which the child is rewarded for careful attentiveness to adults. However, it is also clear that there will be many situations in which such attending will be detrimental to the child's problem-solving. Across tasks, optimal problem-solving requires a child to utilise both external cues and his cognitive resources. The retarded child's over-reliance on external cues is understandable, in view of his life history. The intermittent success accruing to the retarded child as a result of such a style, in combination with his generally lowered expectation of success across problem-solving situations, suggests the greater utility which such outerdirectedness would have for the retarded. Further work on the outerdirectedness hypothesis was conducted in a series of three experiments by Achenbach and Zigler (1968) and also by Sanders, Zigler and Butterfield (1968).

Conclusions

Zigler has argued that the rigid behaviours observed in the retarded are due to a multitude of developmental and motivational factors rather than a direct outgrowth of the inherent rigidity of the retarded.

These factors are as follows:-

- (1) Institutionalised retarded children tend to be deprived of adult contact and approval, and hence have a higher motivation to secure such contact and approval than do normal children.

- (2) The retarded children have a higher positive-reaction tendency than normal children. This is due to a higher motivation to interact with an approving adult. They also have a higher negative-reaction tendency, which stems from retarded children's more frequent negative encounters with adults.
- (3) Due to the environmental differences experienced by institutionalised retarded children, the positions of reinforcers in their reinforcer hierarchy will differ from the positions of the same reinforcers in the reinforcer hierarchy of normal children.
- (4) Institutionalised retarded children have learnt to expect, and settle for, lower degrees of success than have normal children.
- (5) There are differences in the characteristic mode of attacking environmentally-presented problems. The innerdirected person is one who employs his own thought processes and solutions in order to deal with problems. The outerdirected person is one who focuses on external cues, provided either by the stimuli of the problem or other persons, in the belief that such attention will provide him with a guide to action. The style adopted by an individual may be seen as a result of his past history. Individuals whose internal solutions meet with a high proportion of failure will become distrustful of their own efforts and adopt an outerdirected style in their problem-solving. Since the retarded experience a disproportionate amount of failure, they are characterised by this outerdirectedness. Many behaviours that are thought to inhere in mental retardation, e.g. rigidity may be a product of this cognitive style.

Heal and Johnson's Approach

Heal and Johnson (1970) reviewed the literature on inhibition deficits in retardate learning. According to them, distractibility and inflexibility in retardates can result from their inhibition deficit. It seems that either the retardate is rigid in his attention to a task and refuses to be distracted, or he is distracted by stimuli

that are extraneous to the task.

Inhibition is defined as withholding a response or suppressing stimulus input, when such action is adaptive. Inhibition is inferred from a change in behaviour that is occasioned by a change in the environment. In contrast to the usual learning constructs, the change is not an increase in the measured responsiveness, but rather a decrease.

Inhibition is seen as an adaptive process. Since inhibition is usually studied in some kind of extinction paradigm, this adaptiveness is usually defined in terms of the reduction in response output when the reward is reduced to zero.

Heal and Johnson make a distinction between response inhibition and stimulus inhibition. The studies relevant to the concept of rigidity under these two headings are described in the following two sections.

Response Inhibition

Response inhibition is defined in terms of suppression of a learned response, an instrumental process. The most popular form of instrumental learning is the two-choice simultaneous discrimination, in which the choice of one cue is associated with reward and the choice of the other with non-reward or with punishment. The usual interpretation of the learning that occurs in the simultaneous discrimination is that the subject learns to excite a response to the rewarded cue and inhibit a response to the non-rewarded cue.

The reviews of retardate discrimination learning (House and Zeaman, 1960; Stevenson, 1963; and Denny, 1964) conclude that the retardate lags behind his normal MA peer in the ability to perform two-choice simultaneous discrimination problems and, therefore may be deficient in his inhibitory processes.

If the retardate is deficient in instrumental discrimination learning, then the next step is to investigate the possibility that this deficit results from his failure to avoid the negative (non-rewarded) cue. Heal and Johnson conclude that there is only meagre evidence of a retardate deficit in the ability to inhibit responding to the negative cue. When the negative and positive cues are replaced by novel cues, the results tend to show that retardates rely more on the positive than on the negative cue, but the data showing that their reliance is greater than normals, is inconsistent at best.

Another area of study under response inhibition is transfer suppression. Transfer suppression refers to suppression of old learning that is no longer maximally rewarded, i.e. transfer suppression is to transfer learning what extinction is to simple learning.

If retardates have difficulty suppressing transfer in discrimination shifts then they should show greater evidence of original learning than normals when they are transferred to a new problem. In negative transfer paradigms, the retardate, with his presumed inhibitory deficit, should consistently show greater negative transfer than his normal MA peer.

One of the most direct tests of transfer suppression hypothesis is the comparison of retardates and normals on discrimination reversal. The learning of a reversal necessarily requires the subject to abandon the performance of his old habit. Heal and Johnson present twelve studies of discrimination reversal in which subjects were matched on MA. Inspection of these studies lead them to state that the retardate is inferior to his MA peer in the ability to perform discrimination reversal.

Another negative transfer paradigm that has received considerable attention is the extra-dimensional shift. This shift requires the

subject to classify or sort stimuli on the basis of one dimension (e.g. form) after he has been trained to classify or sort them on the basis of a different dimension (e.g. colour). For instance, a subject might be given coloured shapes and asked to put all the red objects in one pile and all the green in another (Stage 1), and then asked to put all the square objects in one pile and the round ones in another (Stage 2). For maximum interference between the two stages, it is critical that the same cues be used for the pre-shift and the post-shift problems. According to the transfer suppression hypothesis, retardates would have difficulty inhibiting Stage 1 learning as they learn Stage 2.

A review of the classification shift literature indicates greater difficulty for the retardate than his normal MA peer in shifting the dimension by which he classifies stimuli. However, the Sanders, Ross and Heal's (1965) finding that retardates surpassed normals is especially perplexing.

Proactive and retroactive inhibition paradigms in retardates are also reviewed by Heal and Johnson. An impairment in current learning that can be attributed to some prior learning is called proactive inhibition. An impairment in current relearning that can be attributed to some learning that has followed original learning is called retroactive inhibition. It appears that the retardates' short-term or long-term suppression of previously learned material is deficient. This may result in greater proactive interference with regard to either normal MA peers or normal peers.

Heal and Johnson state that the evidence regarding retroactive inhibition is less clear. The retardate did not differ significantly from his MA peer in two studies, showed less retroactive inhibition in two others, and

and did not differ from his CA peer in three studies.

Stimulus Inhibition

Stimulus inhibition involves inhibition of extraneous stimuli, and is classed as an attention process. Satiation phenomenon is studied in this section under the following headings: stimulus satiation, neural satiation, and reactive inhibition.

Stimulus satiation is measured by the degree to which a subject prefers a novel cue over a familiar cue. The studies by Terdal (1967a and b) suggest that normals satiate to repetitive stimuli more extensively than retardates of a comparable CA or a comparable MA.

According to Spitz (1963), cortical satiation builds up at a slower rate and dissipates at a slower rate in retardates than in their normal CA peers and possibly their normal MA peers as well.

It is suggested that reactive inhibition results from the energy lost in making a response. If responses are fairly well spaced, the inhibition from one response dissipates before another is made. If the responses are in close temporal proximity, however, the inhibition accumulates and impedes the performance of the response. If the retardate has a deficit in reactive inhibition, his performance under a massed-trials condition would not be impeded and would not differ from learning under a spaced-trials condition. The evidence is persuasive that reactive inhibition is more apparent in normals than in that of their retarded CA peers. No studies were found that compared the reactive inhibition of retardates and their MA peers.

Heal and Johnson's review of the studies to answer the question whether retardates, in general, are more distractible than non-retardates of a comparable mental age deals with this question in two parts:-

- (1) research using novel or distracting cues that are extraneous to the learning task;
- (2) research using novel cues that are embedded in the task.

Two studies by Ellis, Hawkins, Pryer and Jones (1963) and by Girardeau and Ellis (1964) indicate that there is no evidence to suggest that the retardate is more distractible than MA peers. Belmont and Ellis (1968) in a series of experiments, conclude that the retardate is, if anything, less distractible than his CA peer and becomes distractible only with experience. In contrast to the above studies, Sen and Clarke (1968a and b) presented evidence to suggest that the retardate is more distractible than his CA peer. Their results led to the conclusion that susceptibility to distraction is negatively correlated with mental age and/or task ease.

The experiments by Bryant (1967a and b) suggest that, when novelty is embedded in the cues of the task it is associated with greater performance decrement in retardates than in normals. These results stand in contrast to those cited above. It might be that the distinction between inhibition and generalisation reduction is relevant here. According to Heal and Johnson, perhaps the retardate responds to global cue compounds, which he is unable to recognise when some of their component parts are changed. That is, perhaps the retardate shows a greater generalisation decrement, but not greater distractibility, than the normal.

Conclusions

Heal and Johnson's (1970) review of the literature on inhibition deficit in retardate learning concludes as follows:-

- (1) The findings are reasonably supportive of a retardate deficit in response inhibition. While there are many contradictory findings, this support

is clear in the case of transfer suppression (discrimination reversal, classification shifts and proactive interference). The only difficult result was the failure to find consistently that the retardate has more difficulty than the normal in learning to avoid the negative cue in a discrimination learning task.

- (2) There seems a reasonable support for the proposed retardate deficit in stimulus inhibition. The evidence is found primarily in reference to the retardate CA peer. However, the most critical test, distraction by extraneous cues, is almost completely non-supportive. Retardates did not appear to be distracted any more than normals by stimuli that were extraneous to the learning task. On the other hand, retardates showed a greater performance decrement than normals when novel cues were embedded in the learning task.
- (3) Some of the data reviewed might relate to an abstraction deficit in the retardate. Perhaps, the retardate responds to global compound cues and not to the abstract components of which they were composed.
- (4) It is possible that retardates' encoding system is weaker which may account for retardates' tendency to persevere abnormally to some strategy that is not maximally rewarded.

Clarke and Clarke's Review

The research literature concerning transfer of learning in the severely and mildly handicapped people was critically examined by Clarke and Clarke (1974a, 1974b and 1977). They point out the gap between research and practice, and state that it is usually characterised by an underestimation of what can be achieved. Grant, Moores and Whelan (1973) expressed surprise:-

"...that this underestimation should still occur nearly two decades after the published findings of Clarke and Hermelin (1955) who demonstrated that, although the severely subnormal had exceedingly low initial ability

levels in industrial and other tasks, these bore little relationship to the much higher levels that could be achieved with training."

Clarke and Clarke (1977) also state that:-

"It is still not known why some professionals appear to be very much more successful than others at releasing the social and learning potentials of retarded persons."

This being so, the need to investigate the concept of rigidity in mental handicap by employing transfer of learning paradigm becomes obvious. The rationale being, that if mentally handicapped individuals are inherently rigid, then training on cognitive tasks would not, by itself, be able to assist them in better transfer because they would find it difficult to shift from one task to another.

Experimenters have attempted to study variety of training and transfer of learning by providing groups of subjects with various numbers of tasks and studying their performance on subsequent transfer problems. Three variables are involved in such a design: the number of tasks, the number of trials per task, and the total number of trials. The basic formula which relates these three variables is:-

$$\text{Number of Tasks} \times \text{Number of Trials per task} = \text{Total Number of Trials}$$

A number of different manipulations are possible from this formula. Harlow (1949) in his classic paper in this field held trials per task constant and varied numbers of problems and hence total trials. The learning set resulting from the experiment can be attributed either to varying number of problems or total trials. In experiments investigating overlearning, a different manipulation of the above variables can be illustrated. The number of tasks is held constant (usually at one), and trials per task and thus total number of trials, are varied. The most widely-adopted strategy has been to hold total number of trials constant which varies the number of tasks, and hence

trials per task. There are three possible solutions to the basic problem:-

- (a) Training on one task for many trials produces better transfer than diverse training;
- (b) Transfer is a function of the number of training problems;
- (c) There is no relationship between the amount of transfer and the number of training problems.

Reviewing the literature on within-problem variability (wpv) and transfer, Sedlak (1976) concludes that variability during training whether it be within problems or between problems, is important for transfer. Furthermore, if there is variability within problems then varying the number of problems will not increase the amount of transfer (Levine, Lavinson and Harlow, 1959; Levine, Harlow and Pontrelli, 1961; Behar, 1961; Rumbaugh and Prim, 1963; Sterrit, Goodenough and Harlow, 1963; and Tracy, 1965). If, on the other hand, there is no more than unavoidable within-problem variability then training on diverse problems will increase the amount of transfer (Callantine and Warren, 1955; Duncan, 1958; Morriset and Hovland, 1959; and Paul and Noble, 1964).

Sedlak (ibid) further concludes that it is meaningless to look at the problem of variability and transfer simply by varying the number of tasks presented during training as has been done in the past. Rather variability should be seen as being possibly present within trials (e.g. Posner and Keele, 1968) and within problems (e.g. Tracy, 1970), or between problems in a training programme (e.g. Morriset and Hovland, 1959).

The way in which variability influences transfer is basically the same, no matter where in the training schedule it is introduced. The question remains: How does variability aid learning? Evans (1959, personal communication reported by Tracy, 1970) has pointed

out that if a rule is that which remains constant over a collection of trials within a problem, then what is not part of the rule must be due to within-problem variability. It follows that:-

- (a) before the rule can be learned and used as a basis for transfer, any tendencies for the subject to respond to exceptions to the rule, must be extinguished;

and

- (b) providing within-problem variability, will aid the elimination of responses to exceptions to the rule.

An object discrimination problem is used to illustrate this theoretical point. If, on Trial One, the animal picks the correct stimulus and there is no within-problem variability (i.e. the stimuli's positions are not reversed on Trial Two), the animal will probably repeat its response. The animal may be responding to at least two features of the correct stimuli; its shape (which is relevant dimension and therefore part of the rule) or its position (which is not part of the rule). Unless within-problem variability is introduced to the problem, the animal will not learn just the rule, and therefore its performance on a transfer test is likely to be poor. This argument is very similar to the one underlying error factor theory (Harlow, 1959).

Evans' (1959; Personal Communication reported by Tracy, 1970) point can be modified and extended to the situation where training on a variety of problems is compared with that on one. Here again, if a rule is one which remains constant over problems, then whatever is not part of the rule must be due to between problem variability. It again follows that:-

- (a) responses to exceptions of the rule must be eliminated if the rule is to serve as a basis for transfer;

and

- (b) giving a variety of problems will aid

the elimination of such responses.

Bruner (1957) and Gagné (1962) emphasise the importance of specifying the exact nature of learning in transfer. Gagné (ibid) adopted a technique of splitting up a task into component sub-processes and investigating their availability to subjects. Much of the same approach has been employed in Sedlak's (1976) experiments. Sedlak's work with severely subnormal individuals, split the tasks into attentional and categorical processes, which is consistent with Gagné's formulation of a hierarchical order of skills. The problem of attentional versus categorical transfer, was approached by comparing transfer after training in matching and sorting tasks. The experiment showed that institutionalised adults, trained on sorting tasks, showed greater transfer than a group given matching tasks.

Given that attentional processes are not of primary importance in enhanced transfer performance after varied training, two different hypotheses are put forward by Sedlak.

The first hypothesis is that constantly-trained subjects acquired only stimulus-response associations and not a process to categorise information. Diversely-trained subjects were not able to perform successfully by learning specific associations and they were forced to adopt a strategy that could cope with a variety of tasks. The role of variety is therefore analogous to that of within-problem variability which minimises the probability of reinforcement after inappropriate responses. In summary, this hypothesis stresses that, by the end of training, constantly and diversely-trained subjects were employing different types of strategy and that only the latter transferred successfully.

The second hypothesis, on the other hand, is that both types of subjects were using a categorical process by the end of training. The difference between them was in their ability to apply this process in the transfer situation. This formulation stems from the work of Campione and Brown (1974). They argued that if a strategy was used and transferred, then it must have been stored and recalled. They also postulated that, during the acquisition of a strategy, it was stored in association with situational cues. The probability of it being subsequently retrieved was then a function of the similarity between the contextual cues of the training programme and those of the transfer task. Campione and Brown (ibid) presented evidence consistent with this formulation. They demonstrated that transfer was enhanced by increasing the similarity of the formats of the training and transfer tasks.

The conclusions reached by Sedlak (1976) indicate that diversity could be beneficial because it allowed subjects to store strategies in association with many cues; since subnormals are deficient in attending to dimensions of a task, they may require more variety than other subjects before enough dimensions are attended to and stored.

Conclusion

Clarke and Clarke (1974) have reviewed experimental work on variety of training and transfer of learning in mentally handicapped people. Rigidity in this population may be viewed as a result of low demand and fewer activities. Research carried out in this area leads to the question of whether training on few problems, with many trials on each, produces better transfer than giving subjects many problems for just a few trials each.

Rigidity, as a concept, has elicited a great deal of controversy and a considerable volume of research. The general concept has remained imprecise. In this chapter, various theoretical formulations to explain the rigid behaviours of the mentally retarded have been described.

These positions are summarised below.

- (1) According to Lewin (1936) and Kounin (1941a, 1941b) retardates are inherently more rigid than normals of the same MA. The Kounin and Lewin's theory of rigidity states that with MA held constant, the older and/or more retarded an individual, the more will his behaviours be characterised by dynamic rigidity, i.e. greater rigidity in the boundaries between regions. Therefore, rigidity is regarded as a cause, rather than a form, of behaviour.
- (2) Goldstein (1942-1943) deals with two types of rigidity resulting from organic brain damage. 'Primary rigidity' is defined as the inability of a person to change from one train of thought to another, and 'secondary rigidity' is displayed when a person is faced with a problem which is too difficult for him; he prefers an incorrect answer to making no response at all.
- (3) Werner (1946) has shown that defectives display a different type of rigidity from those with brain injuries. The former fail to solve problems because they oversimplify them. The latter seize on resemblances to problems which they have previously faced, and try to use methods which are no longer applicable.
- (4) Zigler (1972, 1973) re-examines the concept of rigidity in the retarded, and states that the rigid behaviours observed in the retarded are most appropriately viewed as phenotypic phenomena stemming from a multitude of developmental and motivational factors, rather than being a direct

outgrowth of inherent rigidity. The motivational factors to explain the greater phenotypic rigidity of the retarded are:-

- (a) Social Deprivation and Motivation for Social Reinforcement;
 - (b) Social Deprivation and the Negative Reaction Tendency;
 - (c) The Reinforcer Hierarchy;
 - (d) Expectancy of Success; and
 - (e) Outerdirectedness.
- (5) Heal and Johnson (1970) state that distractibility and inflexibility in retardates can result from their inhibition deficit. They suggest that retarded persons' cognitive functioning is impaired by:-
- (a) their inability to inhibit a previously acquired habit; and
 - (b) their susceptibility to disruption by novel stimulation.
- (6) Much research has been reviewed by Clarke and Clarke (1974a, 1974b, 1977) on transfer of learning in mentally retarded people. Research in this area leads to the question of whether training on few problems with many trials on each, produces better transfer than giving subjects many problems for just a few trials each. Hence, rigidity in this population may be viewed as a result of low demand and fewer activities.

Much of the experimental work reported in the literature on the mentally retarded compares the performance of the institutionalised subjects with non-institutionalised retarded or normal children. The subjects chosen for all the experiments carried out in this thesis lived in large institutions (hospitals). It seems, therefore, appropriate to review the studies outlining the effect of institutional experience on the behaviour and development of retarded persons.

C H A P T E R 4

THE EFFECTS OF INSTITUTIONAL
EXPERIENCE ON THE BEHAVIOUR
AND DEVELOPMENT OF RETARDED PERSONS

The Effects of Institutional Experience on the
Behaviour and Development of Retarded Persons

The mentally handicapped people who participated in the experiments which are reported in this thesis have lived in large hospitals for a number of years. The effects of such institutionalisation on the behaviour and development of retarded people have been reported in a number of studies. Therefore, a review of such studies is important for several reasons. At a theoretical level, many researchers have involved comparisons of non-institutionalised non-retarded individuals with institutionalised retarded individuals. In these studies, it is impossible to determine which effects are attributable to institutionalisation as compared to mental retardation per se (Baumeister, 1967; Katz and Rosenberg, 1969; and Hagan and Huntsman, 1971). Secondly, a sound knowledge concerning the effects of institutionalisation is extremely helpful in formulating social policy for mentally retarded persons.

Zigler and Balla (1977) have studied three classes of variables which are important in understanding the effects of institutionalisation and these are as follows:-

- (a) the characteristics of the person;
- (b) nature of the institution;
- (c) measures of the behavioural status, and growth of retarded persons.

(a) The Characteristics of the Person

The effects of institutionalisation have been found to be different as a function of such factors as the person's sex, diagnosis, developmental level, and chronological age.

Cutts and Lane reported as long ago as 1947 that long-term institutionalised retarded residents were less capable verbally than were short-term residents, although the two groups were similar in performance IQ. Lyle (1959, 1960a) found verbal deficits but not performance deficits when he compared institutionalised to non-institutionalised groups. He suggested that an important reason might be the relative lack of warm verbal stimulation in most institutionalised settings (Lyle, 1960b).

Clarke, Clarke and Reiman (1958) found that the IQs of patients from very adverse backgrounds increased more than IQs of patients from less adverse backgrounds after they were institutionalised. The patients from very adverse backgrounds had maximum initial change that slowed to a steady improvement during the six-year test period.

Zigler and Williams (1963) found that the increase in motivation for social reinforcers was related to the amount of pre-institutional deprivation that the individuals had experienced. Individuals who came from relatively good homes showed a much greater increase in their motivation for social reinforcers than did individuals coming from more socially deprived homes.

Zigler, Butterfield and Capobianco (1970) studied the same individuals previously seen by Zigler and Williams (1963). They followed up the subjects after seven years and ten years of institutional experience. Their findings support the view that institutionalisation was less depriving for individuals from poor homes than for those from good homes. More important was the discovery that the effects of pre-institutional social deprivation were still in evidence after ten years of institutionalisation. They emphasise the point that social deprivation is a phenomenon that, once experienced, is built into the motivational structure of the individual and subsequently mediates his

inter-actions with his environment.

Zigler and Balla (1972) studied the developmental course of responsiveness to social reinforcement in institutionalised retarded and non-institutionalised non-retarded children with MAs of approximately seven, nine and twelve years. They report that institutionalised retarded children seem to be severely deficient in the development of the reliance upon internal resources that determines much of their effectiveness in the adult world. They also found clear evidence that in institutional policy of encouraging many contacts with the community does promote psychological growth.

(b) Nature of the Institution

Institutions for retarded persons continue to be seen as uniform entities producing monolithic behavioural consequences.

King, Raynes and Tizard (1971) have conducted extensive and sensitive cross-institutional studies of resident-care practices. For retarded persons to measure the social-psychological characteristics of the institutions, they developed a Resident Management Practices Inventory. This inventory taps institution-orientated care practices at one extreme, versus resident-oriented practices at the other.

The items in the inventory can be grouped along four dimensions. The first dimension is called Rigidity of Routine, and concerns the inflexibility of management practices. At this extreme, neither individual differences among residents nor unique circumstances are taken into account by the staff in their inter-actions with residents. The second dimension is called Block Treatment, and concerns the regimentation of residents before, during and after specific activities, e.g. meal time. The third dimension referred to as Depersonalisation, concerns a measure of the presence or absence of opportunities for

residents to have personal possessions, privacy, or situations allowing self-expression and initiative. The fourth dimension, referred to as Social Distance, concerns the limitation of inter-action between staff and resident to formal and specific activities and the use of physically-separated areas of congregation between the staff and those who care for them.

Using this inventory, King et al. (ibid) investigate three types of facilities for retarded persons; mental deficiency hospitals ranging in size from one hundred and twenty-one to one thousand six hundred and fifty residents; voluntary homes from fifty to ninety-three residents; and local authority hostels (group homes) from twelve to forty-one residents.

The care practices are found to be more resident than institution-orientated in the group homes and more institution-orientated in the mental deficiency hospitals, with the voluntary homes falling between. Of particular interest is the finding that, once the type of institution is taken into account, there is no tendency for management practices to be associated with institution size. In other words, type rather than size of institution is the important determinant of care practices. When type of institution is taken into account, no relationship is found between the number of residents in each living-unit and the care practices observed, nor is a relationship found between resident-to-staff ratios and care practices. Finally, King et al. report that the level of retardation of residents in the individuals' living units is not an over-riding determinant of care practices.

McCormick, Balla and Zigler (1975) studied the resident care practices in one hundred and sixty-six living units from nineteen institutions in the United States, and eleven institutions in the Scandinavian countries.

They report that simply increasing expenditures or personnel will not necessarily guarantee better care for retarded persons. Rather, it is how these personnel are utilized in the settings. They also report that large institution size is found to be very significantly related to larger living-unit size, high employee-turnover rate, low cost per resident per day, a low ratio of aides to residents, a low proportion of professional staff to resident, a low number of volunteer hours per resident per year, more adverse opinions concerning retarded persons, and more institution-oriented care practices.

(c) Behaviour Status and Growth of Retarded Persons

McCormick, Balla and Zigler (1975) report that several of the characteristics of the institutions are associated with the behaviour of the residents. The larger the size of the institution, the greater the motivation of the individuals to receive adult attention and support. This finding was the single instance in which institution size was predictive of the residents' behaviour.

They also report that there is considerable evidence that depriving socializing conditions produce wariness of adults. The larger the number of individuals in a living-unit, the greater the wariness of the individuals who lived in the unit. Increased wariness is found in settings with a high employee-turnover rate.

There is evidence suggesting that some institutions socialize their residents in the direction of reduced behavioural spontaneity and/or conformity. Zigler and colleagues point out that such conformity is probably purchased at too high a psychological cost. The conforming and imitative person disrupts spontaneous solutions to problems and may be ill-equipped to function in the much less organised and predictable environment outside the institution.

Residents of high MA were found to be less motivated for social attention and support than were residents of low MA. Thus, retarded children, like their peers of average IQ, seemed to move from dependency to autonomy as their cognitive level became higher. Evidence was also found indicating that the higher the MA level, the greater the wariness.

The higher the cognitive level of the person, the less he employs imitation in problem-solving efforts, and the lower the IQ of the person, the more failure experiences he has when employing his own cognitive resources and thus, the greater tendency for imitativeness.

Finally, individuals who had experienced frequent changes of parenting figures before they were institutionalised were both more motivated to attain the attention and support of an adult and more wary of doing so, i.e. deprived individuals have both a typically high positive and negative reaction tendencies (Zigler, 1971; Zigler and Balla, 1976).

Conclusion

It has been pointed out in this chapter, that any comprehensive understanding of the effects of institutional experience requires a consideration of:-

- (a) the characteristics of the person;
- (b) nature of the institution;
- and
- (c) behaviour status and growth of the retarded person.

Factors such as person's sex, diagnosis, developmental level, and chronological age have been found to play an important role in determining the effects of institutionalisation. Furthermore, a retarded person's response to institutionalisation is particularly determined by the nature of his experience prior to institutionalisation.

With regard to the nature of the institution, it is important to go beyond the simple question of size and look for other relevant demographic variables e.g. cost, number of staff per patient, employee-turnover rate, and type of organization. The growth and behavioural status of retarded people depends upon the size of the institution. The larger the size of the institution, the greater the motivation of the individuals to receive adult attention and support. There is evidence to suggest that some institutions socialize their residents in a way that reduces behavioural spontaneity and increases conformity. Thus, the conforming person distrusts spontaneous solutions to problems and may be ill-equipped to function in a much less organised and predictable environment outside the institutions. Thus, the effects of institutionalisation are manifested in the quality of life of retarded persons in terms of cognitive and motivational development.

CHAPTER 5

PLAN OF RESEARCH

CHAPTER 5

Plan of Research

Introduction

Rigidity in the retarded is usually inferred from such behaviours as inability to shift concepts, stereotypy, inelasticity, or concreteness. A review of research, relating to the concepts of rigidity in the mentally handicapped, was reported earlier in Chapter 3. An ongoing debate has revolved around the study of cognitive processes in retarded, as compared to the non-retarded, persons. This is reflected in the controversy between proponents of 'developmental' and 'deficit or difference' theories. Developmental positions (Zigler, 1969; Humphreys and Parsons, 1979; and Kamhi, 1981) maintain that persons differing in rate of development (operationally defined as IQ) but equated for level of development (operationally defined as MA) will not differ in the formal cognitive processes they employ in reasoning and problem-solving. However, most difference theories (Kohlberg, 1968; Das, 1972; and Milgram, 1973) generate the prediction that retarded persons will be cognitively inferior to non-retarded individuals of similar MA.

Bortner and Birch (1970) have argued that it is essential to make a distinction between cognitive capacity and cognitive performance in the retarded if one is to be most effective in developing approaches to the habilitation and education of mentally handicapped children and adults. One such approach, according to the author of this thesis, is to study the mentally handicapped persons' ongoing behaviour by using transfer of training paradigm. Transfer of training as a phenomenon, occupies a central position in almost all types of learning exhibited by human organisms. Whatever the nature of the learning task with which

an individual is confronted, previous experiences have an effect on the individual's performance. The question remains to what extent severely and moderately handicapped people are able to generalise learned responses to new situations. If they are inherently rigid, as stated by difference theorists, then no amount of training will enable them to benefit from one situation to another since they will not be able to shift concepts or dimensions.

Taking into account the comprehensive review by Clarke and Clarke (1974, 1977) on transfer of training with mentally handicapped people and an up-to-date review of research findings on amelioration reported in Chapter 2, it became obvious that rigidity concepts required further investigation. The experimental studies on learning transfer have indicated that, with environmental stimulation and formal training, the behaviour of individuals at all levels of intellectual functioning can be markedly improved.

Rouse (1965), Corter and McKinney (1968) and McKinney and Corter (1971) have attempted to improve productive thinking and cognitive flexibility with mildly handicapped and bright normal subjects. The investigations, which are described in Chapters 6, 7, 8 and 9, were primarily aimed at providing training to increase cognitive flexibility in severely and moderately handicapped people and to evaluate the effectiveness of such programmes. In these experiments, rigidity/flexibility is seen as a continuum and is operationally measured in terms of total scores on a transfer or criterion task. The investigations reported in this thesis were carried out in a very busy clinical setting between 1975 and 1980.

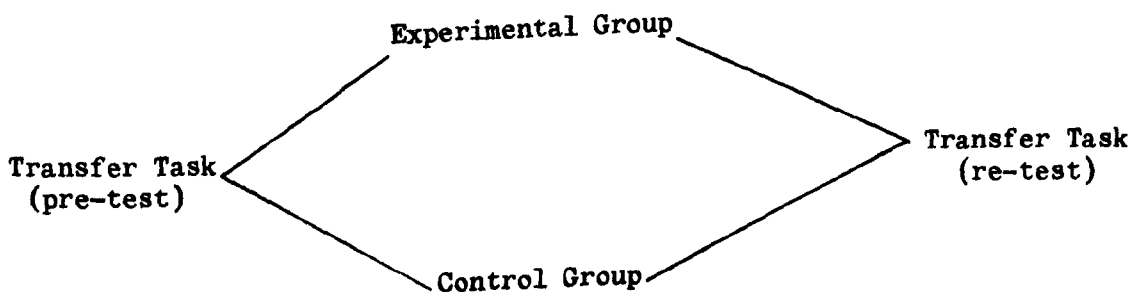
Design

The general design for all the experiments is illustrated diagrammatically in Figure 3 which was first reported by Clarke, Cooper and Henney (1966).

All subjects are first tested on the transfer task, and then formed into matched pairs. Each pair is matched on transfer task and other relevant variables, e.g. IQs, chronological age, sex, etc. One member of each pair is then randomly assigned to either an experimental or a control group. The experimental group is given training in a particular area of flexibility for a limited period of time. The same amount of time is spent by the experimenter with the control group, participating in recreational activities rather than training. Thus, exposure to the experimenter is identical for both groups.

After training, all subjects are re-assessed on the transfer task again. The rationale of this design being, that any observed differences on re-test between groups can then be attributed to the differences in training. Any additions to this general design are described in the individual experiments.

Figure 3. General Design



Subjects

For each experiment, a large number of subjects were tested on transfer tasks before forming matched pairs. As indicated in the design, the subjects were matched in pairs, primarily on a transfer task but also on other relevant variables, such as IQs, chronological age, sex, and where possible, individual profiles on various sub-tests of transfer tasks. IQs reported in the experiments have been taken from the

assessment reports of the subjects. These assessments were carried out by psychologists up to three years earlier prior to the start of present investigations. The matching data on all the variables are reported in each experiment. Those with physical handicaps, e.g. visual or auditory, were not included in the experiments. Each experiment had different subjects, i.e. the same person was not seen in more than one experiment. No other restrictions were imposed on subjects' backgrounds.

The individuals referred to in the experiments have been living in large hospitals, (size of hospitals varied from six hundred to one thousand beds). The records obtained from medical case notes of subjects indicated that all these persons had been residing in these hospitals for at least eight to thirty years, although some could have lived in different institutions in their earlier lives. It was not possible to obtain a reliable record relating to their length of stay in any particular institution. The effects of institutionalisation are widely documented in the research literature, and a brief review of these studies has been outlined in Chapter 4.

During the experiments, all subjects had been living in the wards, and were attending either the junior schools in the case of children, or training centres in the case of adults, within the hospital grounds. All participated willingly in the experiments.

Materials

Transfer Tasks

Flexibility is operationally measured in terms of a transfer task administered in each experiment. All subjects were given transfer tasks individually at pre-test and re-test following training. Different transfer tasks were employed in each investigation. No

corrective feedback was given to any individual when tested at any trial on transfer tasks.

The Cognitive Flexibility Test (CFT) developed by McKinney (1966) was administered in the first experiment. This consisted of six sub-tests with two representing each type of 'Flexibility'. Perceptual Flexibility consisted of two sub-tests: Embedded Figures and Figure-Ground Reversal. Conceptual Flexibility consisted of two sub-tests: Form Classification and Picture Classification. Spontaneous Flexibility also consisted of two sub-tests: Classification and Tell About This. The Cognitive Flexibility Test is described in detail in Appendix A₁.

The second experiment employed the Embedded Figures sub-test of the CFT (see Appendix A₁). The Children's Embedded Figures Test (CEFT) developed by Witkin, Oltman, Raskin and Karp (1971) was also used in this investigation. The test material was divided into two sets of twelve items, each of which had previously been equated for difficulty. The details of the Children's Embedded Figures Test are described in Appendix B₂.

In the third study, the Figure-Ground Reversal sub-test of the Cognitive Flexibility Test was administered as a transfer task. This is described in Appendix A₁.

The experimenter devised four transfer tasks for the last investigation, namely, a cancellation task, making picture objects, sorting shapes, and packing cocktail sticks in a container. These tasks are described in detail in Appendix D₁.

Training Tasks

Different training tasks were devised for each experiment. In the first study, the original flexibility training programme devised by Corter and

McKinney (1968) for mildly retarded and normal children was modified and adapted to meet the needs of severely and moderately handicapped persons. The original programme consisted of forty-two exercises with fourteen for each of the three areas of flexibility: Perceptual, Conceptual and Spontaneous. These training exercises were judged to be too difficult for moderately and severely handicapped persons, hence twenty-eight of the easier exercises were chosen, nine for the perceptual area, nine for the conceptual and ten for spontaneous flexibility. These are reported in Appendix A₂.

In the second investigation, Embedded Figures training was given to three different groups: Group II received Corter and McKinney's Perceptual Training Programme; Groups I and III received training exercises devised by the experimenter. These training exercises are described in Appendix B₂.

Training exercises for the third experiment, Figure-Ground Reversals were designed by the experimenter, and are described in detail in Appendix C.

For the fourth experiment, a total of eight tasks were designed by the experimenter, and are described in detail in Appendix D₂.

Procedure

Transfer and training tasks were administered individually to all subjects. No corrective feedback was given to any individual when tested on transfer tasks at each trial of the experiment (i.e. pre-tests and re-tests after training).

All subjects, both from experimental and control groups, were seen by the experimenter on average for ten to fifteen minutes daily for a limited period of time. When the subjects were not with the

experimenter, they attended their regular place of work in the training centres, or the school within the hospital grounds.

The subjects in the experimental group attempted, on average, two to three exercises a day, with training individualised for particular weaknesses. The criterion for successful learning was either three correct consecutive trials, or three correct performances in five trials. If subjects failed to understand the concept of a particular exercise after five to six sessions, that particular exercise was abandoned. The subjects in the control condition spent, on average, the same amount of time with the experimenter. Thus, daily exposure to the experimenter is similar for both groups.

The training tasks were analysed into their components, and accuracy and correct movements were stressed throughout training. Practice on different training tasks was continued beyond the point at which a skill is learnt (emphasis on over-learning). The presentation of training tasks was varied from trial to trial, in order to avoid position learning. Attention was drawn to relevant aspects of the training tasks.

Where appropriate, subjects from the experimental group were taught by using duplicate materials. The experimenter acted as a model, and demonstrated to the subjects how the particular exercise was to be done. The subjects were encouraged to match the tasks presented by the experimenter in specified sequences. Where necessary, the subject was physically assisted by the experimenter, then encouraged verbally, to accomplish the task, and finally given the opportunity to perform the task without physical or verbal assistance. Corrective feedback was given to subjects throughout training periods. Verbal reinforcements, in terms of 'good boy' or 'girl', 'well done', etc were given liberally.

Every effort was made to teach verbal concepts. Emphasis was placed on shift or change. Revision of concepts and procedures was carried out using materials from previous relevant exercises before starting a new exercise.

Experimenter

All the investigations reported in this thesis were carried out by the author herself. However, in the fourth experiment, pre- and post-test measures were obtained 'blind' by two independent members of training staff who were employed by the Hospital where the study was undertaken.

Results

The total scores on transfer tasks were recorded at each trial of an experiment, i.e. at pre-test and re-tests after training. Performance of both the experimental and the control groups were analysed, using analysis of variance techniques. The computational procedures of analysis of variance are based on descriptions by Winer (1962) and McNemar (1962). The purpose and interpretation of each analysis are described in the experiments.

Graphic illustration of average performances of both experimental and control groups at various trial points were illustrated for each experiment. Individual profiles of matched subjects, illustrating a greater variability of performance after training, were also presented graphically for each experiment.

* Group Means for each experiment are listed in Appendix E.

CHAPTER 6

EXPERIMENT 1

CHAPTER 6

Introduction

Various theoretical positions have been advanced to explain the differences in the amount of rigidity manifested by mentally handicapped individuals and normal children of the same MA. However, the experimenter is unable to find any study other than the work of Rouse (1965), Carter and McKinney (1968), and McKinney and Carter (1971) with mildly handicapped and bright normal persons who have attempted to improve flexibility. These studies have been of great interest to the author and therefore, are described in some detail.

Rouse (1965) investigated the effects of a training programme on the productive-thinking characteristics of educable, retarded children enrolled in public school special classes. All subjects were administered pre-tests on the Product Improvement and Circles Sub-tests of the Minnesota Tests of Creative Thinking. Experimental subjects were administered thirty thirty-minute lessons by their regular classroom teachers. The lessons included as activities: brainstorming solutions to problems; sessions aimed at clarifying the development of principles used in altering objects; increasing observational skills; originality; and improvisation. Control subjects received the regular programme of their special class. Following the six-week treatment period, all subjects were again administered the Product Improvement and Circles Tests. The improvements in the experimental subjects were significantly superior to those of the control subjects in all areas tested: fluency, flexibility, originality, and elaboration.

The main purpose of Carter and McKinney's (1968) study was to develop a process-orientated training programme, designed to provide subjects with reinforced practice in making various cognitive shifts, to test

the effectiveness of their training programme in increasing subjects' performance on both flexibility-type tasks and the Binet Intelligence Scale. They were also interested in comparing the retarded and normal subjects on flexibility test variables to see if training provided any additional information concerning the rigidity hypothesis for retarded children.

The authors devised the Cognitive Flexibility Test from a large number of tests hypothesized to measure flexibility. Cognitive flexibility was then operationally defined as the weighted sum of scores on these tasks.

Their training employed a large number of different exercises involving a variety of materials in three areas of flexibility:- Perceptual, Conceptual, and Spontaneous. Efforts were made to teach appropriate verbal concepts, such as 'figure', 'ground', 'part', 'whole', 'alike', and 'different', etc.

The subjects were thirty-two mildly subnormal children attending special education classes and thirty-two above-average normal children in kindergarten, matched for MA and sex, and each group split into two, with sub-groups allocated randomly to teaching or control conditions. The experimental groups received cognitive flexibility training for twenty days in sessions that lasted between thirty and forty-five minutes. Control groups participated in their usual classroom activities. At the conclusion, experimental and control groups were re-tested on the Stanford-Binet and the Cognitive Flexibility test battery. The Stanford-Binet re-tests were carried out by three experienced examiners, who had not pre-tested the same children and had not taken part in the training programme.

Results indicated that for the experimental group the mean change in

flexibility score between pre- and post-test was highly significant ($P < 001$). The mean change for the retarded controls was not significantly different from zero, although the normal controls had achieved significantly higher scores ($P < 001$). Mean IQ increases for experimental groups were as follows: for retarded 6.25, and for normals 10.19, these both being significant. For the controls, however, non-significant gains were reported.

These authors considered that their results supported earlier findings of greater difficulty in concept shifting in retardates as compared with normals, but, as they indicated, their normals were 'bright' and the two groups were not matched for social class, so that such results are somewhat equivocal. However, the training programme was effective in producing significant increases in flexibility, and it is of interest that a hypothesis that retardates and normals would respond differently was unsupported.

The IQ increases were significantly greater for the trained than for the controls, and this appeared to indicate some generalisation from training to other areas of cognitive functioning. However, the authors properly listed the limitations of their study and were cautious in their interpretations. An important point is that, although retardates gained significantly in flexibility from a training programme, above-average normal children, subjected to the same programme, gained more.

The above study was repeated by McKinney and Corter (1971) on fifty-six mildly retarded children to establish whether training in perceptual and cognitive shifts would improve the performance on flexibility measures and on the Binet and WISC Scales. The training was carried out by classroom teachers for thirty to forty-five minute sessions over a period of approximately two months. The results again showed that

training was effective in increasing cognitive flexibility in the instruction group. However, it did not facilitate performance on tasks which were independent of training, i.e. increase in IQ score, as had been reported in the earlier study. Further analysis showed that instruction improved performance on variables measuring verbal fluency and concept formation. However, significant increases were generally limited to those which shared some content with the training exercises. Thus, transfer was specific rather than general.

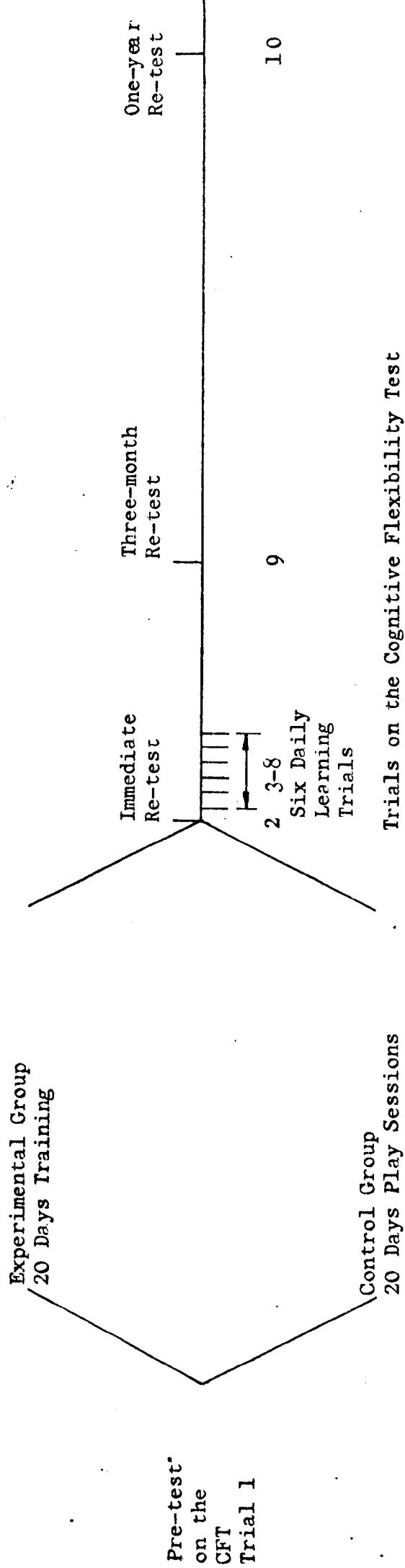
The research reported by McKinney and Corter (1971) demonstrated the facilitative effects of special training with the educable retarded and bright normal children on flexibility test variables. Although the initial flexibility score of normals was significantly higher than that for retardates, the mean difference in change of scores between the two groups following training was not significant.

Much research reviewed by Clarke and Clarke (1973) has suggested that there has been an underestimation in many quarters of what can be achieved with children and adults below IQ 50. The work of Corter and McKinney appeared to warrant replication with severer grades of mentally handicapped, and the present study aimed to assess the possibility of improving the cognitive flexibility of moderately and severely retarded children and young adults.

Design

The 'Cognitive Flexibility Test' (CFT) developed by McKinney (1966) was used as criterion task. Two groups of subjects were matched on the criterion task (Trial 1), and were randomly allocated to experimental and control conditions. The experimental group received flexibility training for twenty sessions, while the control group was seen for the same length of time for activities other than training. Thus, exposure

Figure 4 Design for Experiment 1 - Cognitive Flexibility Test (CFT) as a Criterion Task

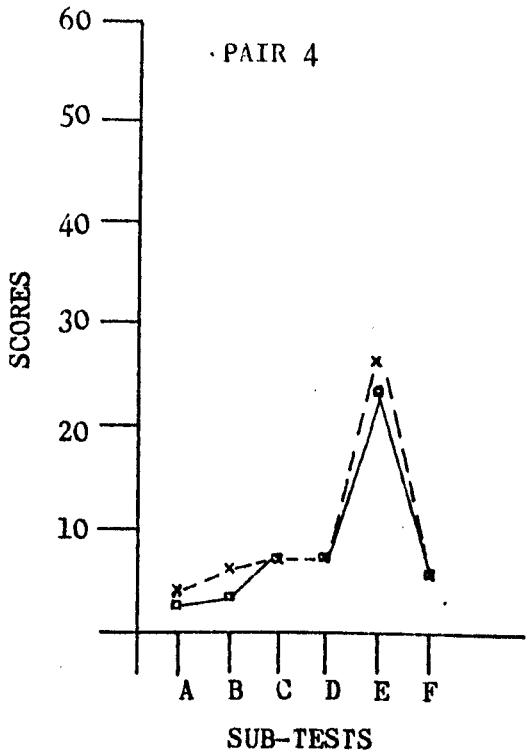
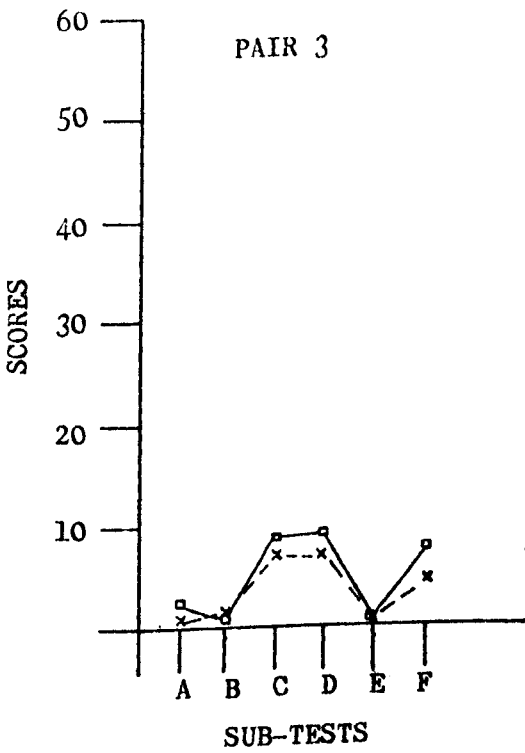
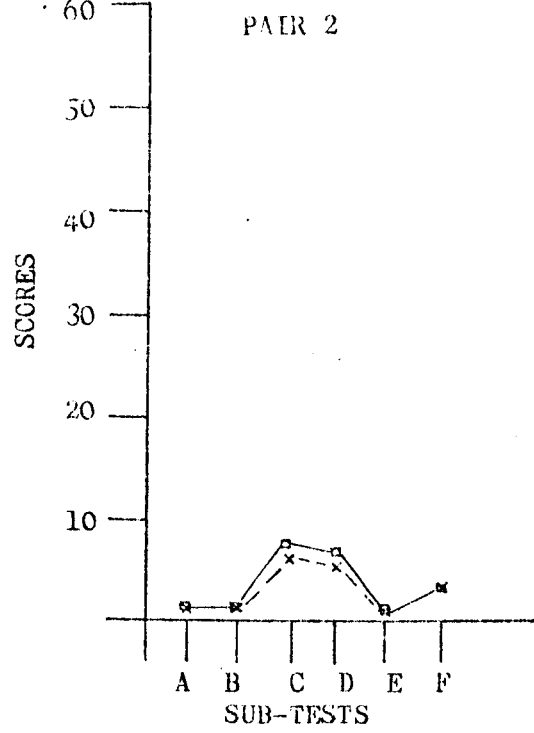
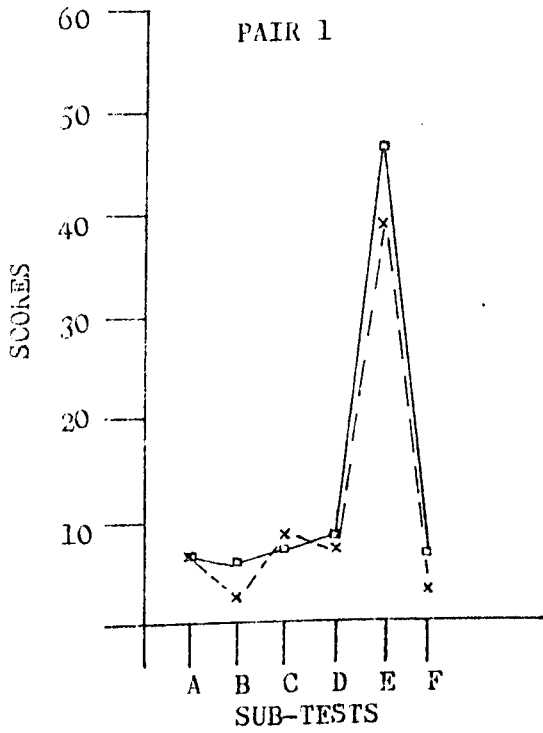


to the experimenter was identical for both the groups. After training, all subjects were reassessed on the criterion task (Trial 2). The rationale being, that any observed differences between the two groups on test could then be attributed to the differences in training methods. After the second trial, both the experimental and control groups were exposed to a further six learning trials (Trials 3, 4, 5, 6, 7, and 8), to see whether this minimal exposure to practice on the CFT task would cause the induced differences to disappear. Both groups were again assessed on the CFT after three months (Trial 9) and nine months (Trial 10) to see if changes induced during the training period would have any lasting effect. The design adopted is illustrated diagrammatically in Figure 4.

Subjects

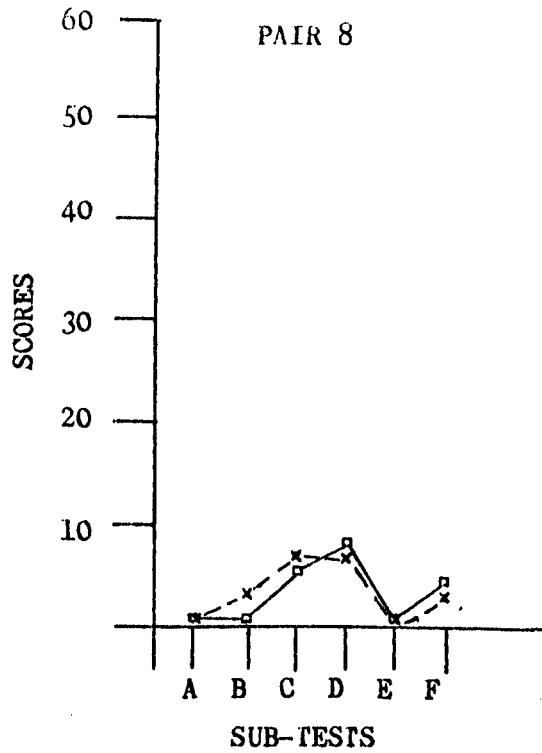
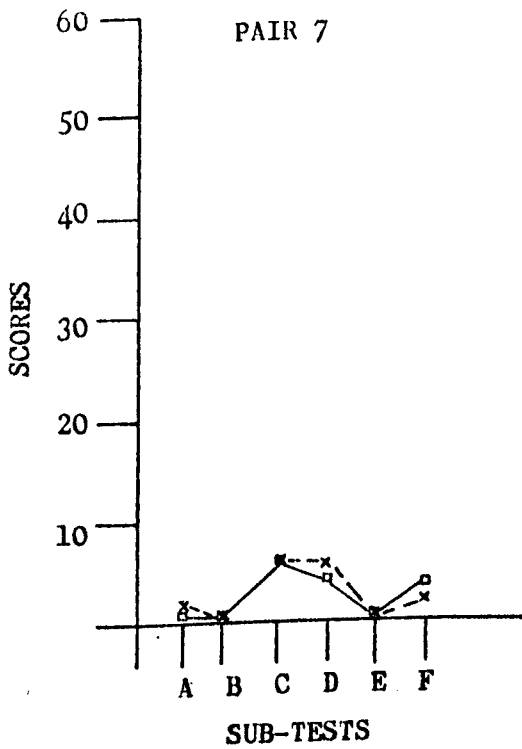
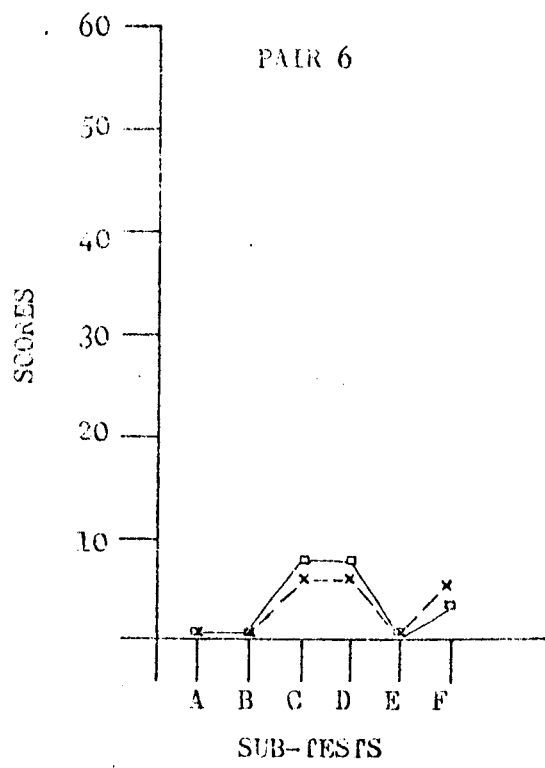
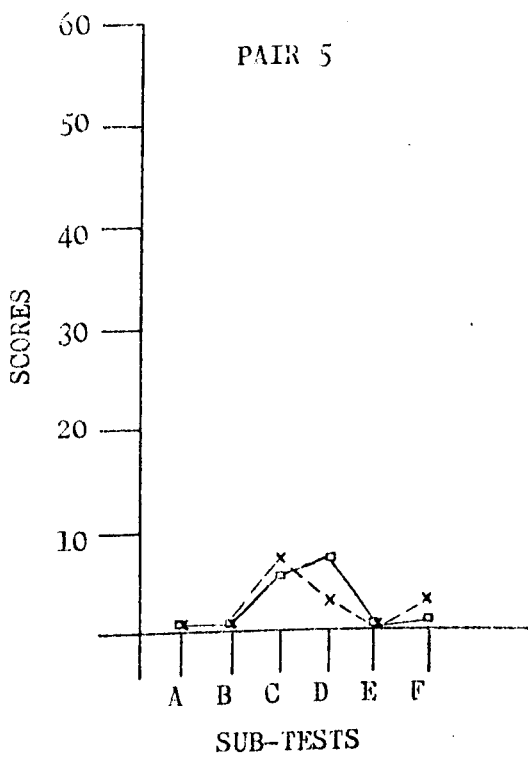
The experiment was carried out in a large hospital. The residents attended either a school or an adult training centre which were situated within the hospital grounds. Forty-six subjects from this institution were assessed on the Cognitive Flexibility Test. Residents with visual or auditory handicaps were not included in the experiment. Then, two groups of twelve subjects were formed in matched pairs on total pre-test score of the Cognitive Flexibility Test, chronological age, profiles on the six sub-tests of the transfer task gained at pre-test, and Stanford-Binet IQs. They had previously been assessed on the Stanford-Binet Scale by psychologists over a period of three years, immediately prior to this present investigation. Table 2 below summarises the matching data, and Figures 5.1, 5.2, and 5.3 illustrate the profiles of all subjects on the six sub-tests of the Cognitive Flexibility Test. These sub-tests are as follows:-

- A - Embedded Figure
- B - Figure-Ground Reversals
- C - Form Classification



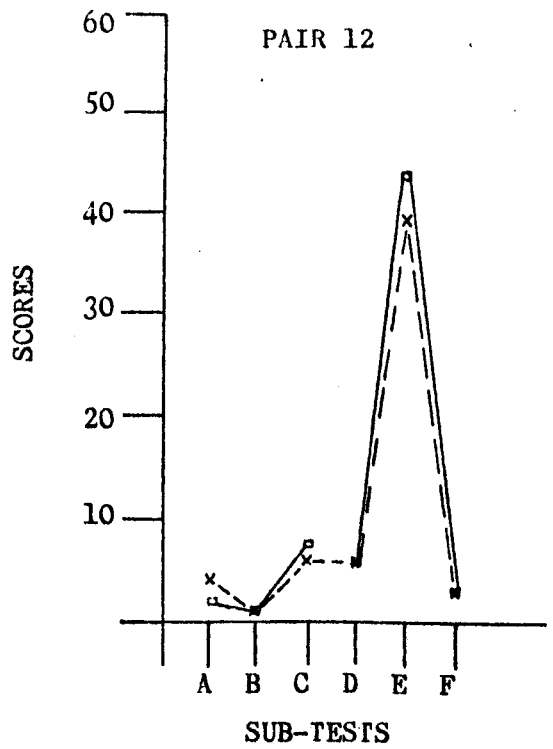
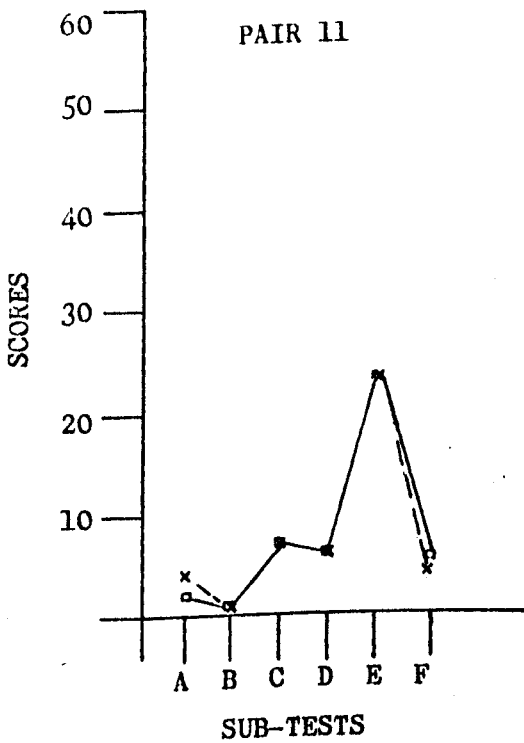
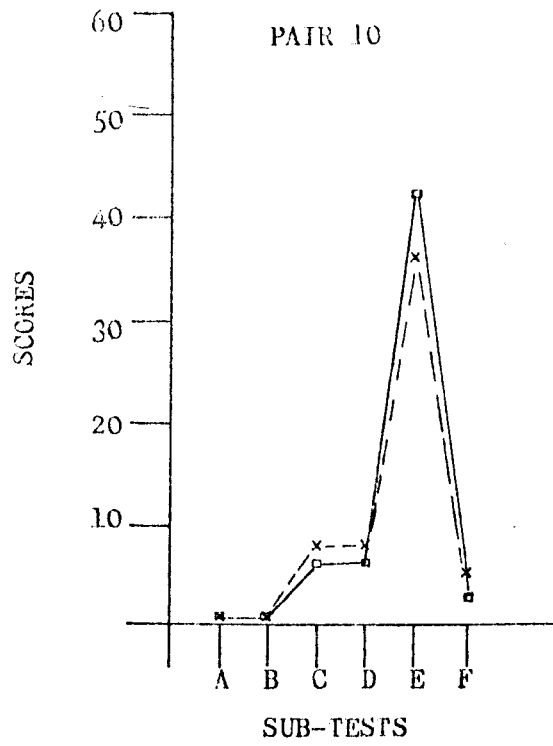
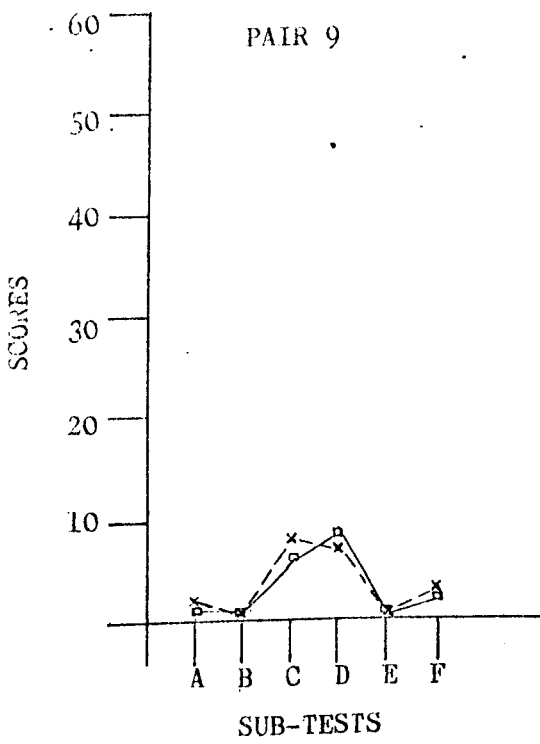
—— Expt. Subjects
 - - - - Cont. Subjects

Figure 5.1 Subjects Matched in Pairs on Individual Sub-tests of the Cognitive Flexibility Test



— Expt. Subjects
 - - - Cont. Subjects

Figure 5.2 Subjects Matched in Pairs on Individual Sub-tests of the Cognitive Flexibility Test



— Expt. Subjects
 - - - Cont. Subjects

Figure 5.3 Subjects Matched in Pairs on Individual Sub-tests of the Cognitive Flexibility Test

D - Picture Classification
 E - Classification
 F - Tell About This

Table 2

MATCHING DATA FOR EXPERIMENTAL AND CONTROL GROUPS

Cognitive Flexibility Score *			Stanford-Binet IQ		CA	
	Experimentals	Controls	Experimentals	Controls	Experimentals	Controls
MEAN	10.48	10.98	36.3	37.3	17.7	18.3
RANGE	5.3-22.3	5.8-18.7	27-53	25-47	10.24	11.27
N	12	12	12	12	12	12
SEX	M = 8 F = 4	M = 8 F = 4				

* Raw scores of sub-tests were converted to a scale from 0-10 with a possible total, therefore, of 60.

Materials

Transfer Task

As noted earlier, the 'Cognitive Flexibility Test' developed by McKinney (1966), was used as the criterion of Transfer Task. This consists of six sub-tests, with two representing each type of 'flexibility'. Part I aims to measure Perceptual Flexibility, which is defined as the ability to re-order a stimulus array in several ways (sub-tests: Embedded Figures and Figure-Ground Reversal); Part II, Conceptual Flexibility, is the ability to re-order or categorise concepts in several ways (sub-tests: Form Classification and Picture Classification); and Part III, Spontaneous Flexibility, measures the ability to shift ideas in the rapid production of information (sub-tests: Classification and Tell About This).

McKinney devised the 'Cognitive Flexibility Test' for the educable retarded and bright normal children. For the present experiment the content of the test remains unchanged, the general and specific administration of the test had to be adapted to suit the needs of the moderately and severely handicapped adults and children. The details of the 'Cognitive Flexibility Test', a test form, directions for administration, and scoring are reported in Appendix A₁.

The Cognitive Flexibility Test yielded raw scores ranging from 7-80 for the six sub-tests. In order to equate the weighting for the groups, these raw scores were converted on a scale ranging from 0-10, with a possible total of 60, so that direct comparisons could more usefully be made.

Training Tasks

The original training programme of Corter and McKinney covered all three areas of flexibility by exposing the subject to intensive practice on relevant materials. This consisted of forty-two exercises, with fourteen for each of the three areas. It seemed à priori that a number of these exercises would prove to be too difficult for moderately and severely handicapped subjects. Hence twenty-eight of the easier exercises were chosen, nine for the perceptual area, nine for the conceptual, and ten for spontaneous flexibility.

In addition, wherever necessary, the instructions and the contents of these exercises were modified to meet the needs of the severely handicapped people. The details of all training tasks are reported in Appendix A₂.

To illustrate the relationship between transfer and training measures, related training and transfer tasks from conceptual flexibility area are reported here. In the transfer task, the subject is presented

simultaneously with four shapes: two circles, with a cross marked in one of them, and two triangles, with a cross marked in one of them. The subject is then required to sort these shapes into groups of two according to two different principles (e.g. shape and context element).

In the related training tasks, the experimenter showed to the subjects, a red rectangle, a yellow square, and a red circle and a yellow ellipse. The experimenter demonstrated to the subjects how to pair two things together which look the same, i.e.g. two round things and two things with four corners. Then the experimenter showed another way to put two things together that look the same, e.g. two red things together and two yellow things together. Subjects were also taught the names of colours, shapes, and verbal concepts, such as 'same', 'different', etc.

Procedure

All subjects were administered the transfer and training tasks individually. Subjects attended their regular place of work in the training centre or school within the hospital grounds. Each subject from both groups was seen by the experimenter for ten minutes per day for five days of the week for either training or (if a control) for recreational activity.

The subjects in the experimental group attempted, on average, three exercises per day, with training individualised for particular weaknesses. The criterion for successful learning was either three correct consecutive trials or three correct performances in five trials. If, after five to six sessions, the subject failed to grasp the concept of a particular exercise, that particular exercise was abandoned. The subjects from control groups were given recreational activities, e.g. listening to stories, playing card games, colouring pictures, etc.

Where appropriate, the individuals from the experimental group were

taught by modelling procedure. By using duplicate materials the experimenter acted as a model, and demonstrated how the particular task was to be done. They were required to match the tasks presented by the experimenter in specified sequences. Where necessary, the subject was physically assisted by the experimenter, then encouraged verbally to accomplish the task, and finally, given the opportunity to perform the task without physical or verbal assistance.

Every effort was made to teach the appropriate verbal concepts, e.g. 'alike', 'different', 'part', 'whole', 'figure', 'ground', 'reversal', etc. Emphasis was placed on shift or change. Since the subjects were severely and moderately handicapped, it was not possible to teach all of these verbal concepts. Non-verbal methods of illustration and gestures were used to put across these concepts. Corrective feedback and verbal reinforcement were given liberally. Revision of concepts and procedure was carried out using materials from previous relevant exercises before starting a new exercise.

It was noted that, on average, experimental subjects were able to complete 66 per cent of the Perceptual, 48 per cent of the Conceptual, and 62 per cent of the Spontaneous Flexibility Tasks.

Results

For this investigation, the total score on the Cognitive Flexibility Test (CFT) was recorded at each trial i.e. at pre-test (Trial 1), re-test after training (Trial 2), six further learning trials after re-test (Trials 3, 4, 5, 6, 7 and 8), three-monthly re-test (Trial 9) and one-yearly re-test (Trial 10). Figure 6 illustrates the average findings of the experimental and the control groups at various stages of the experiment. Figures 7.1 to 7.12 illustrate paired subjects' (experimental and control) performances at each trial.

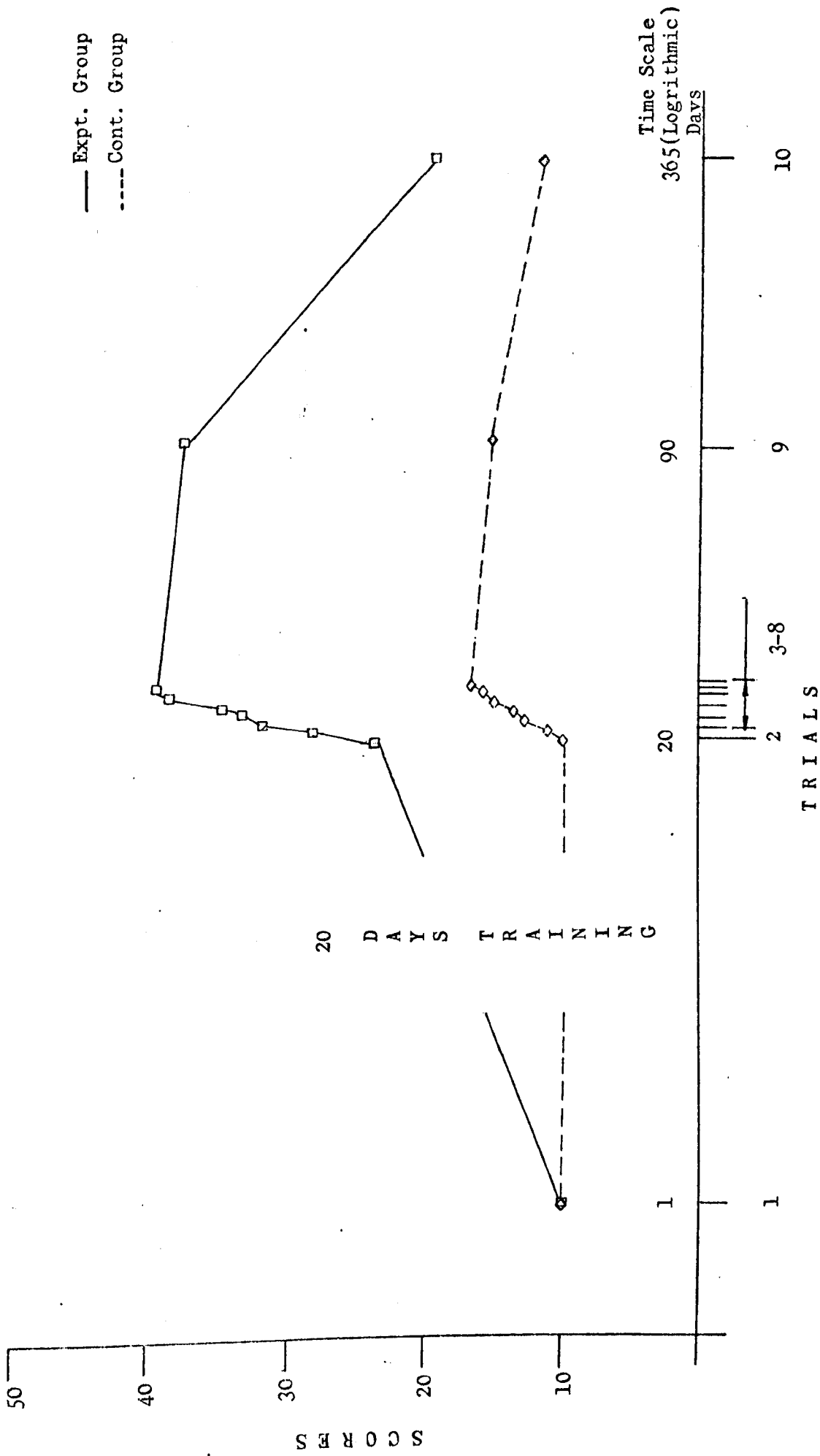


Figure 6 Average Scores of the Experimental and Control Groups on the CFT at Various Stages of the Experiment

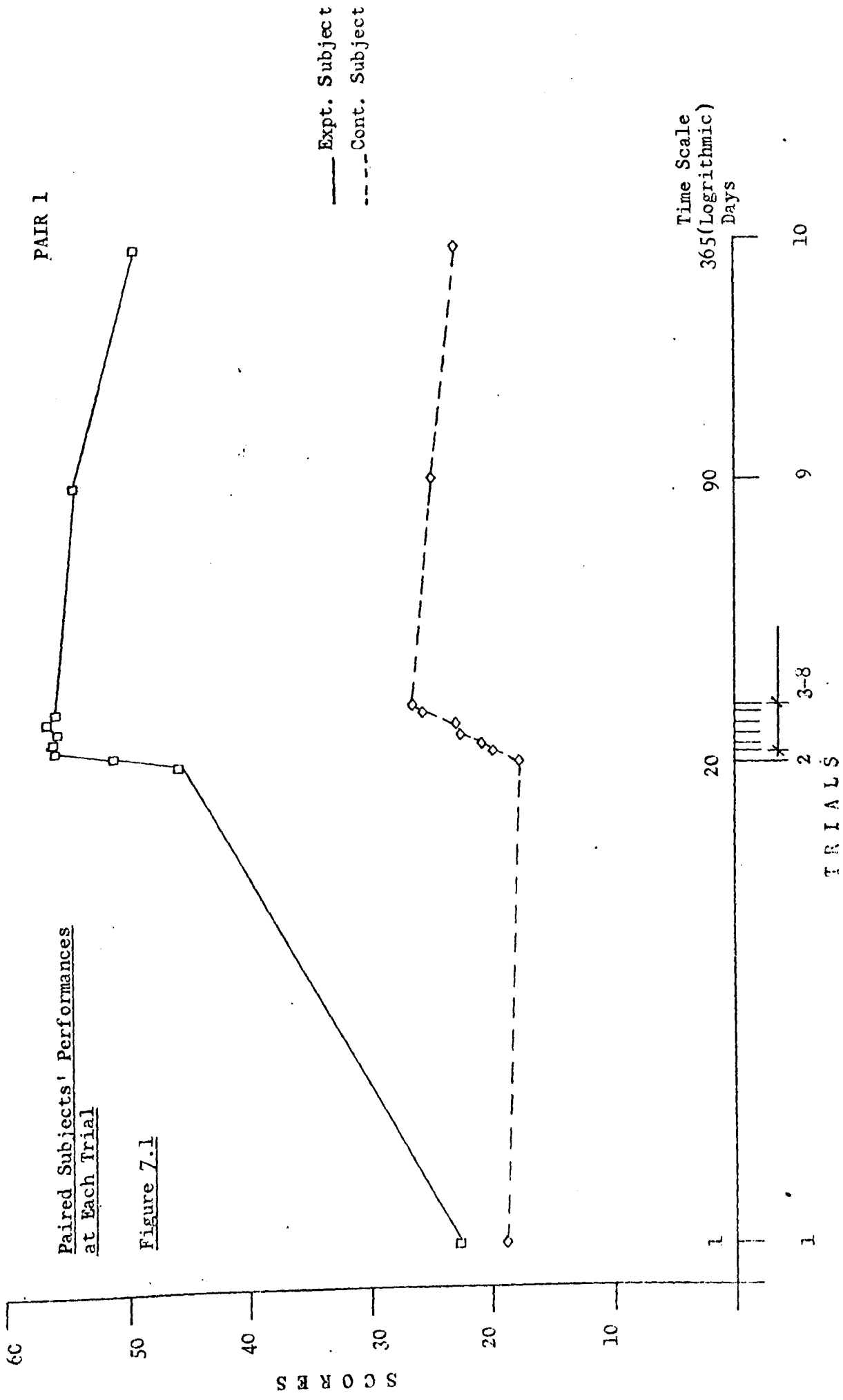
A three-way analysis of variance Groups x Trials x Pairs was computed with repeated measures on two factors (Groups and Trials). The results are summarised in Table 3. Comparison between experimental and control groups included performances combined at four trial points (2, 8, 9 and 10) i.e. on re-test, on sixth learning trial, three-monthly re-test, and one-yearly re-test. The Groups x Trials interaction ($F = 10.67$, $3/33$ df, $P < .001$) indicates that the difference between the groups at each trial point was not the same indicating that the effect of one factor was dependent on the level of the other variable.

Table 3

Three-way Analysis of Variance with Repeated Measures
on Two Factors (Groups and Trials)

Source	Sum of Squares	df	MS	F	P
Blocks (Groups)	5395.499	1	5395.499	28.57	<.001
Columns (Trials)	2473.949	3	824.650	32.82	<.001
Subjects (Pairs)	6550.726	11	595.521	3.15	<.05
B x C	742.331	3	247.444	10.67	<.001
B x S	2077.301	11	188.846	8.14	<.001
C x S	829.214	33	25.128	1.08	NS
B x C x S	765.343	33	23.192		
TOTAL	18834.364	95			

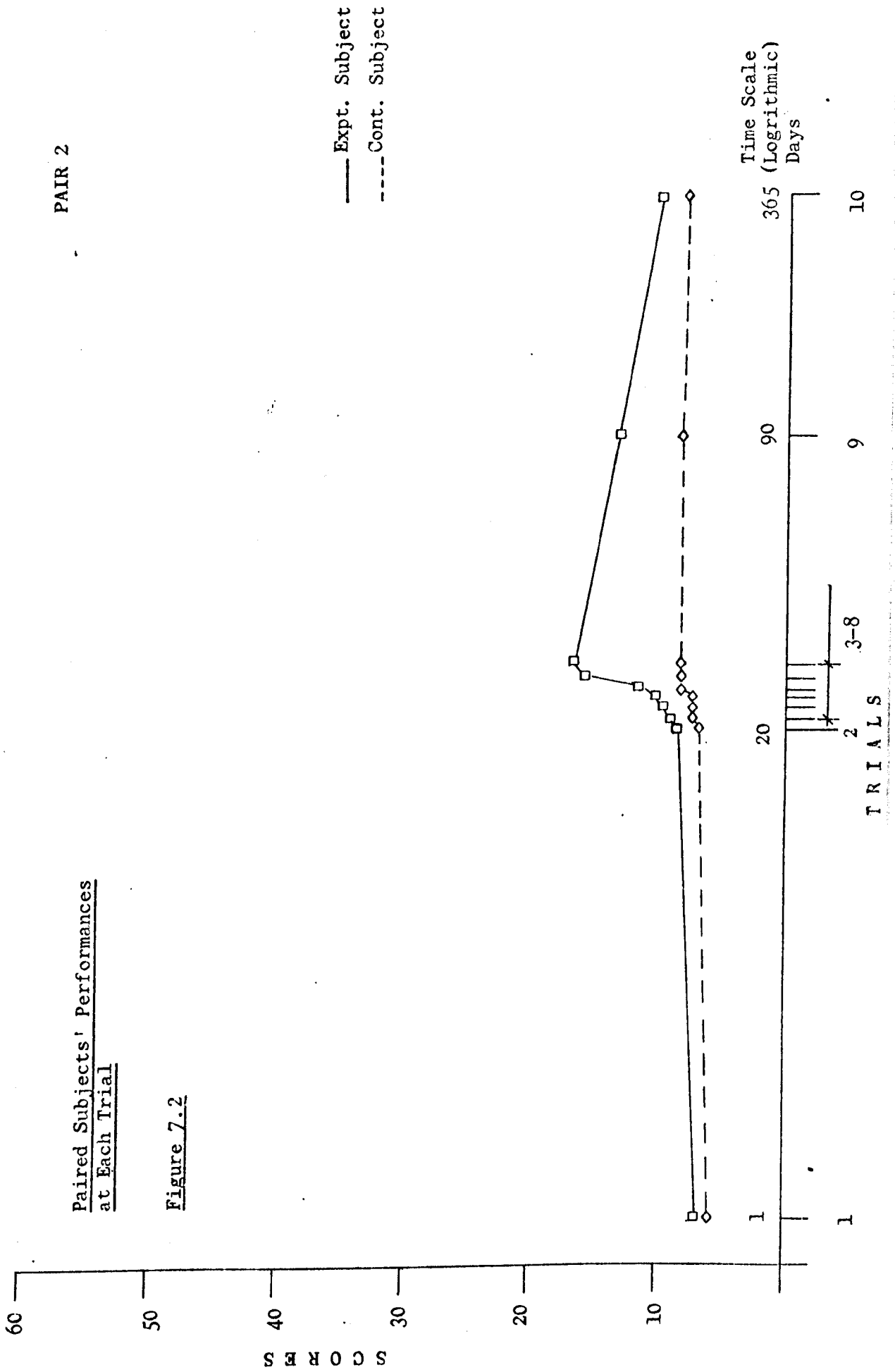
A two-way analysis of variance Groups x Trials was also computed, with repeated measure on one factor (Trials). Here, the effect of matched pairs was negated, hence the significance estimates between groups were extremely conservative. The results are summarised in Table 4.



PAIR 2

Paired Subjects' Performances
at Each Trial

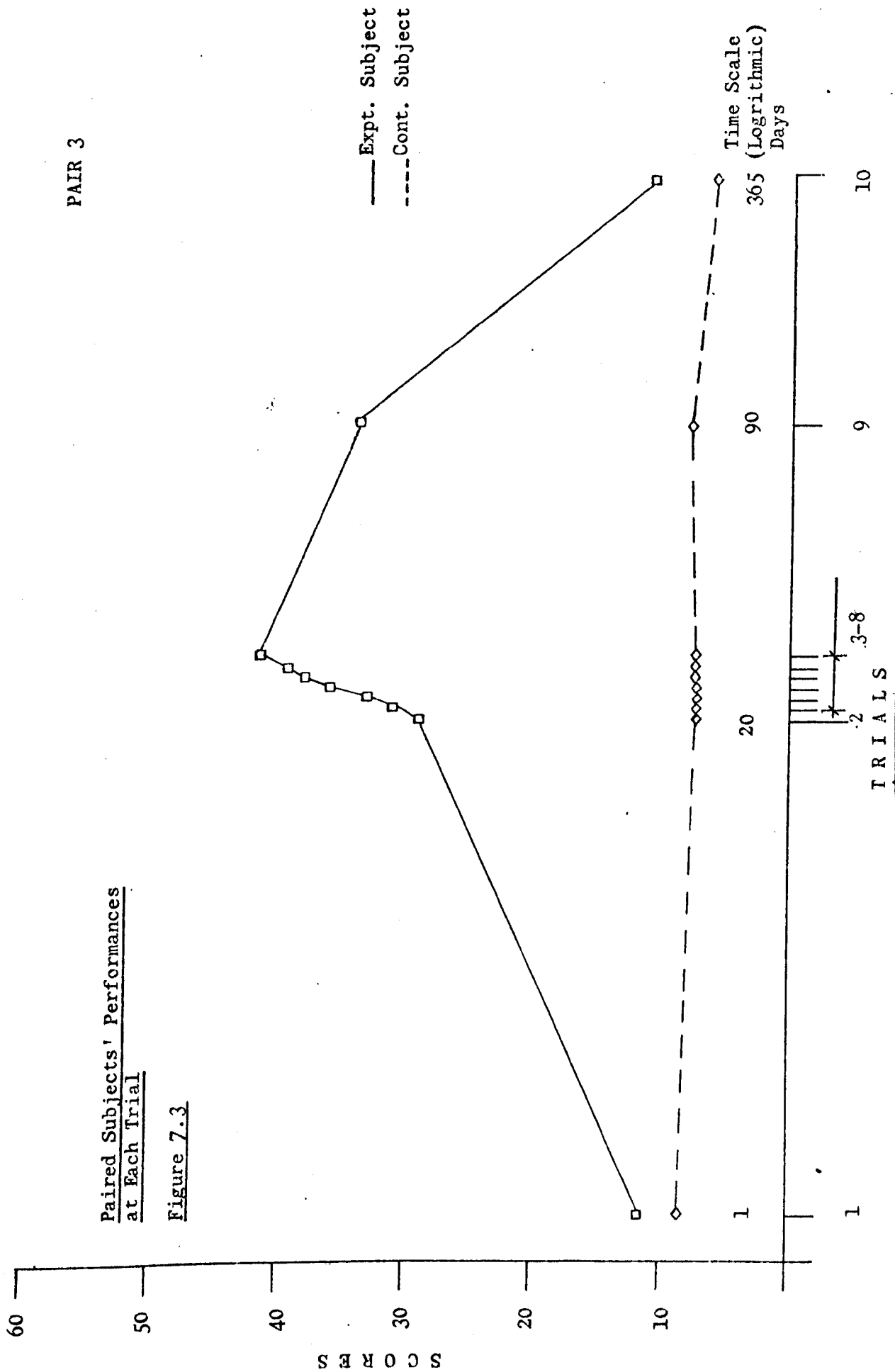
Figure 7.2



PAIR 3

Paired Subjects' Performances
at Each Trial

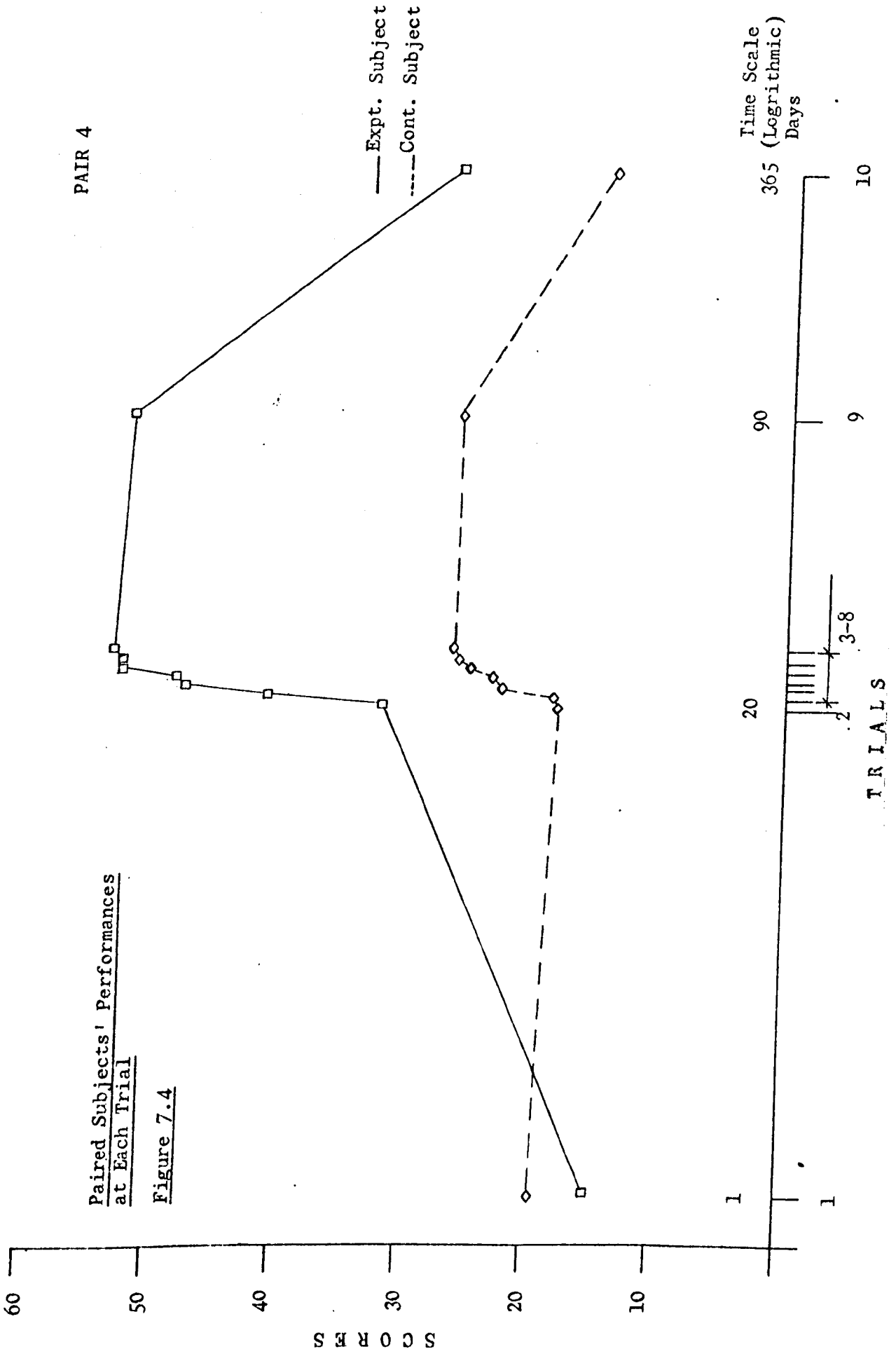
Figure 7.3



PAIR 4

Paired Subjects' Performances
at Each Trial

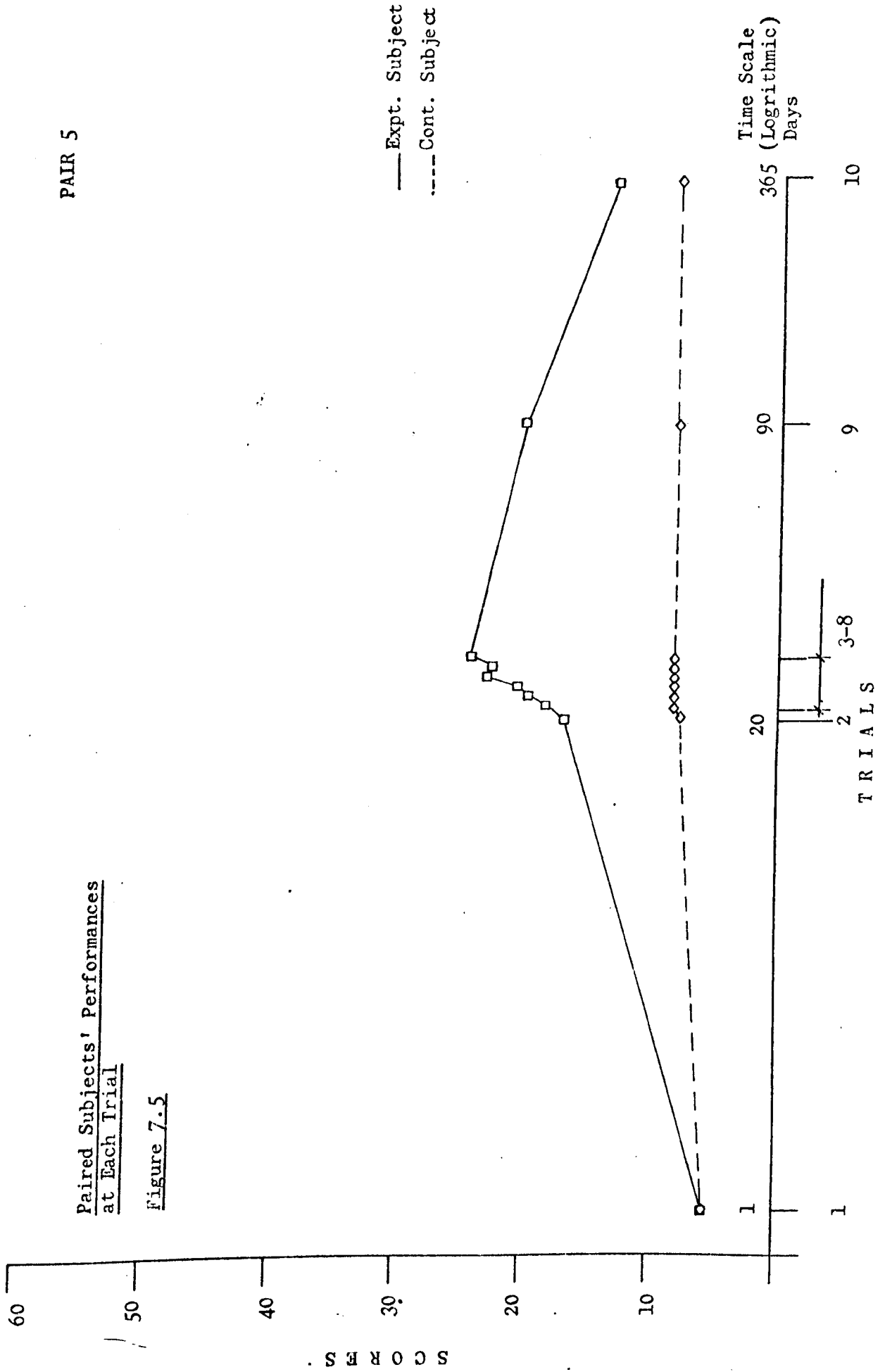
Figure 7.4



PAIR 5

Paired Subjects' Performances
at Each Trial

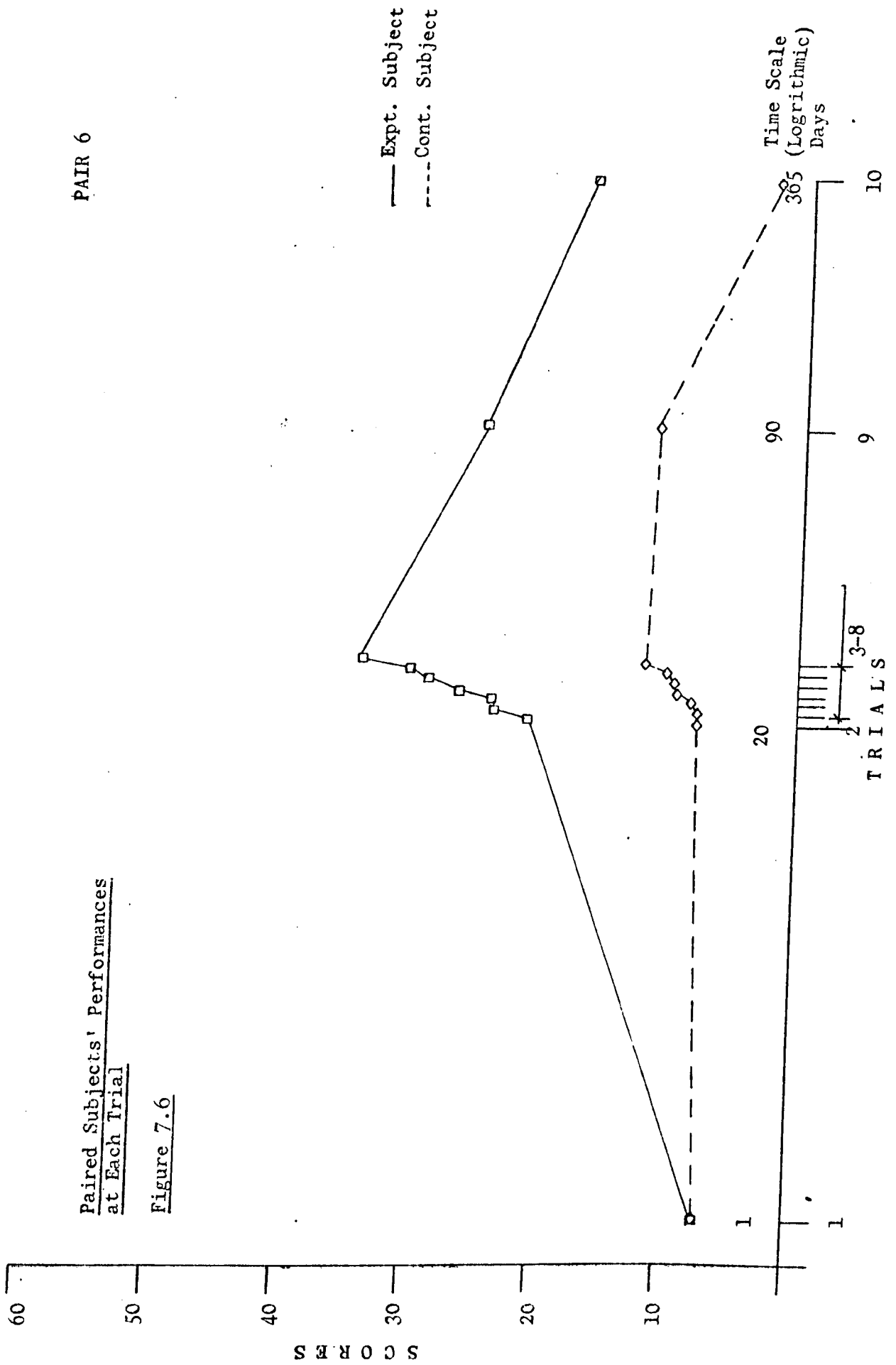
Figure 7.5



PAIR 6

Paired Subjects' Performances
at Each Trial

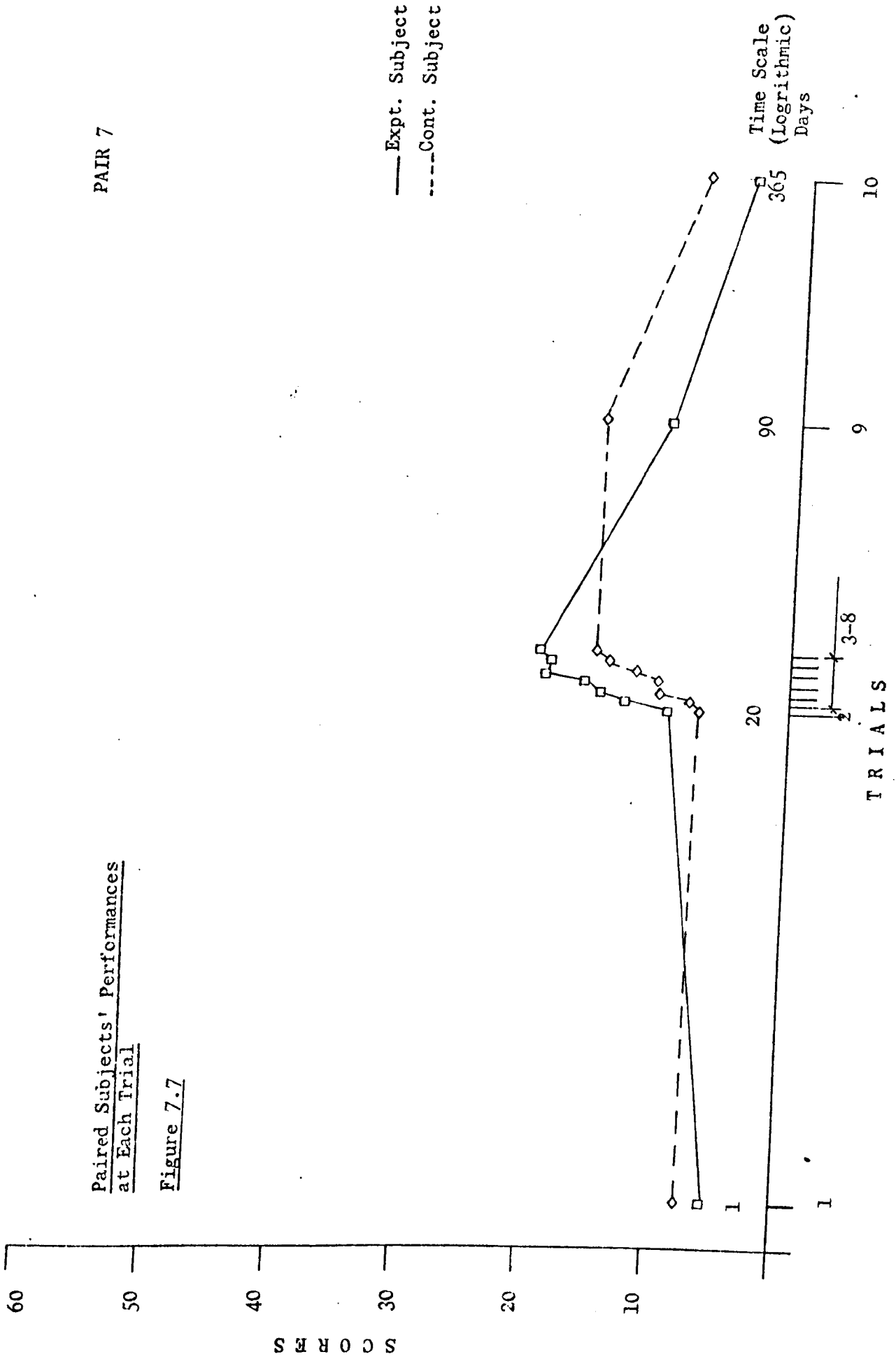
Figure 7.6



PAIR 7

Paired Subjects' Performances
at Each Trial

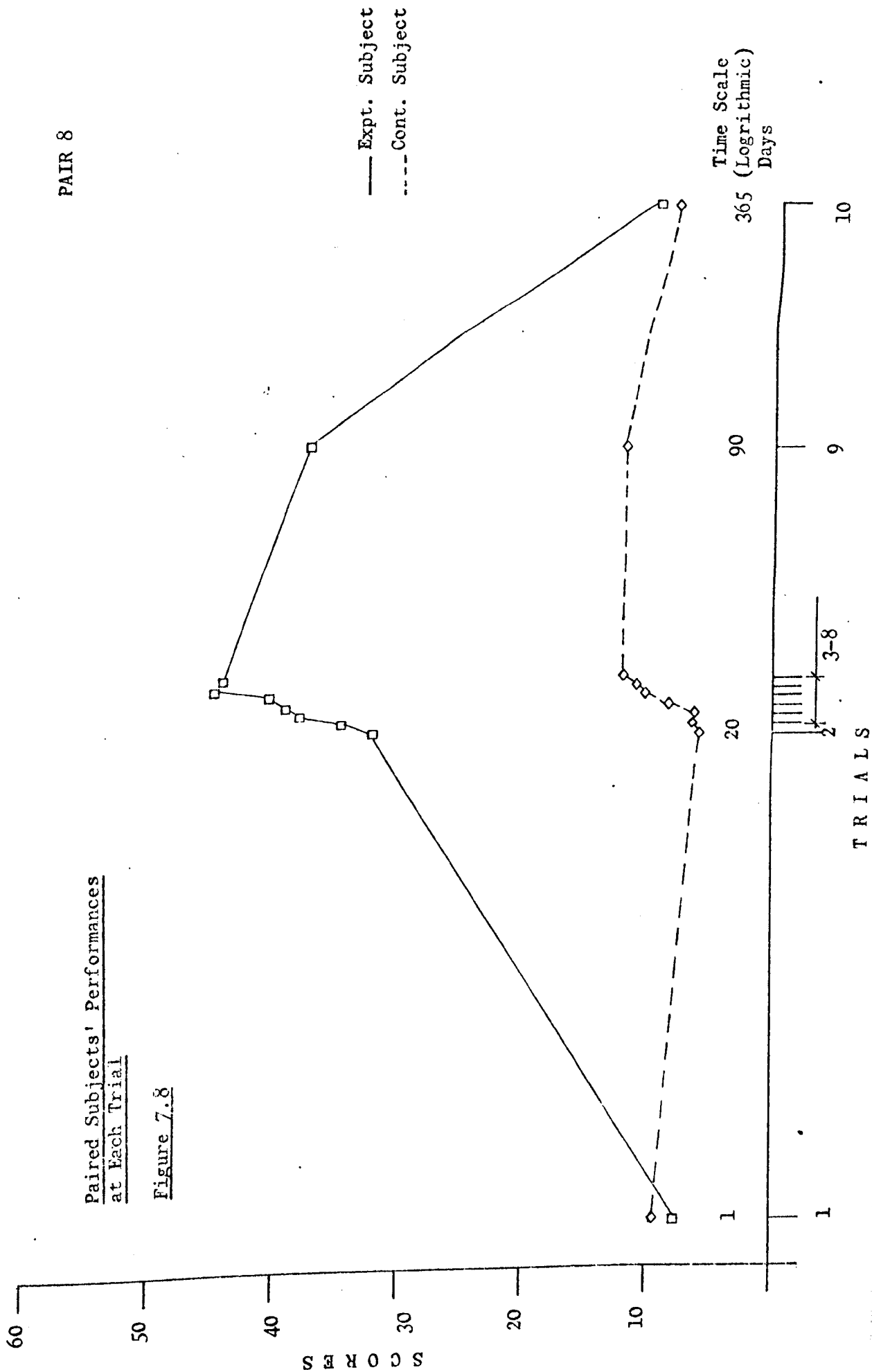
Figure 7.7



PAIR 8

Paired Subjects' Performances
at Each Trial

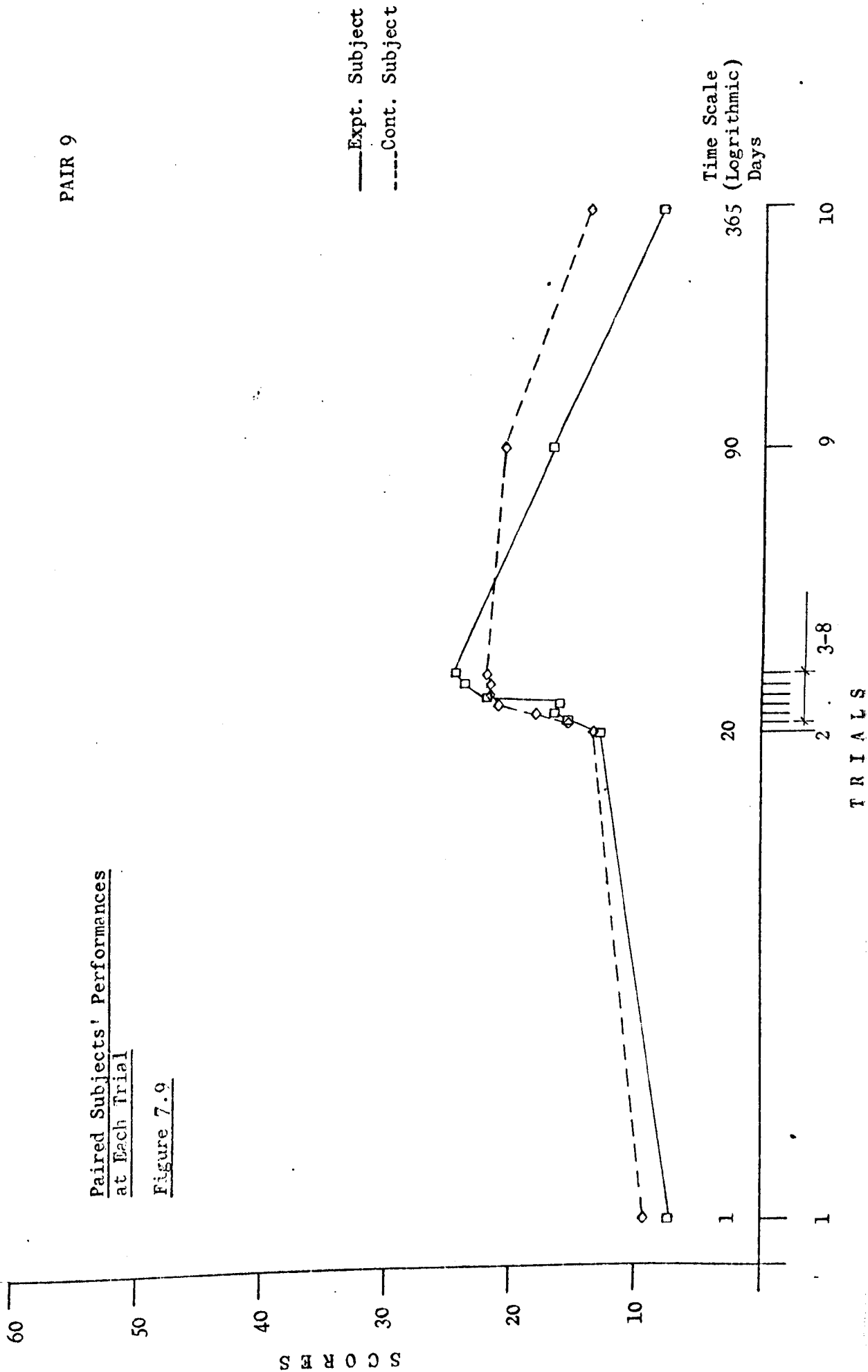
Figure 7.8



PAIR 9

Paired Subjects' Performances
at Each Trial

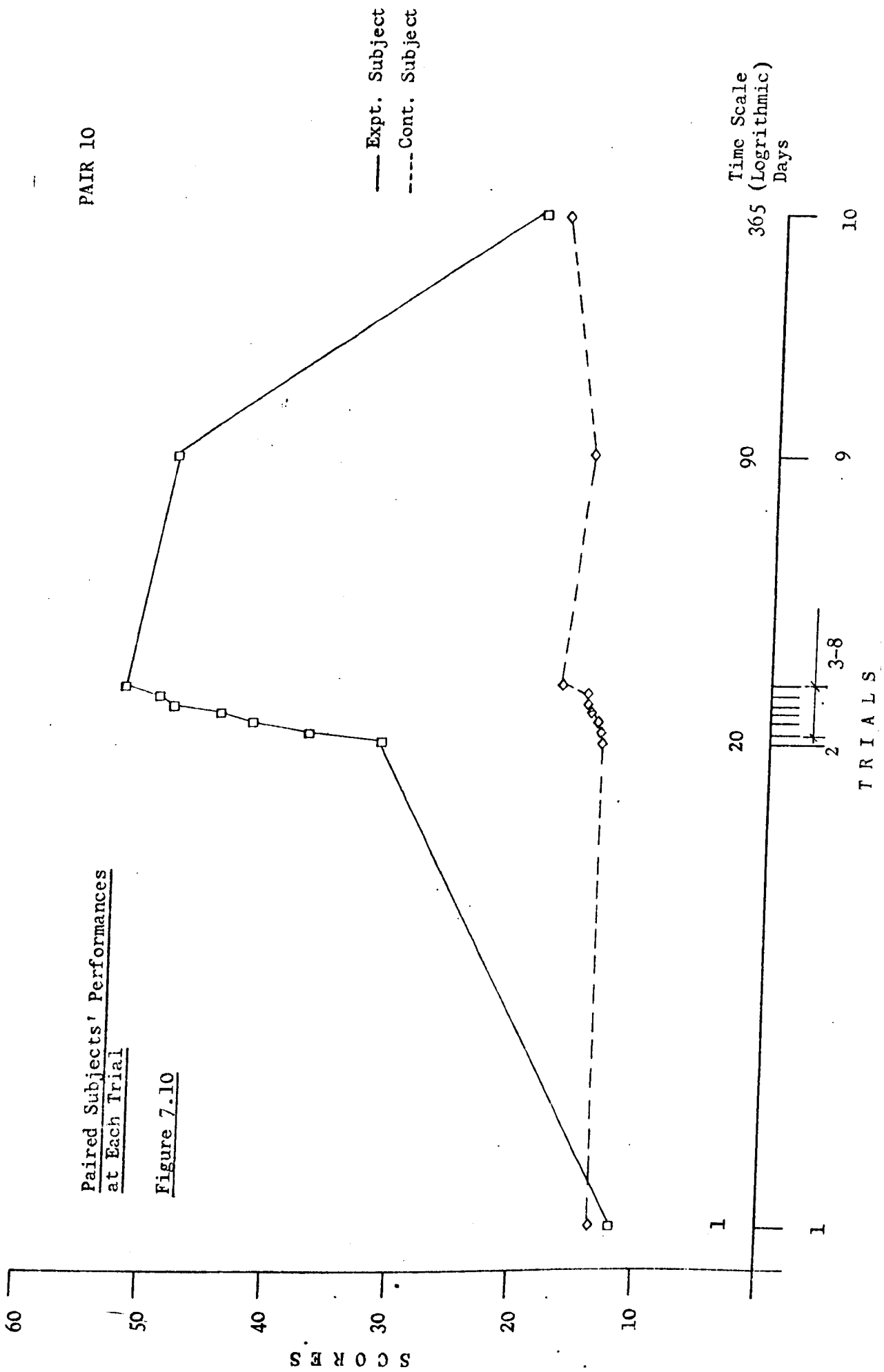
Figure 7.9



PAIR 10

Paired Subjects' Performances
at Each Trial

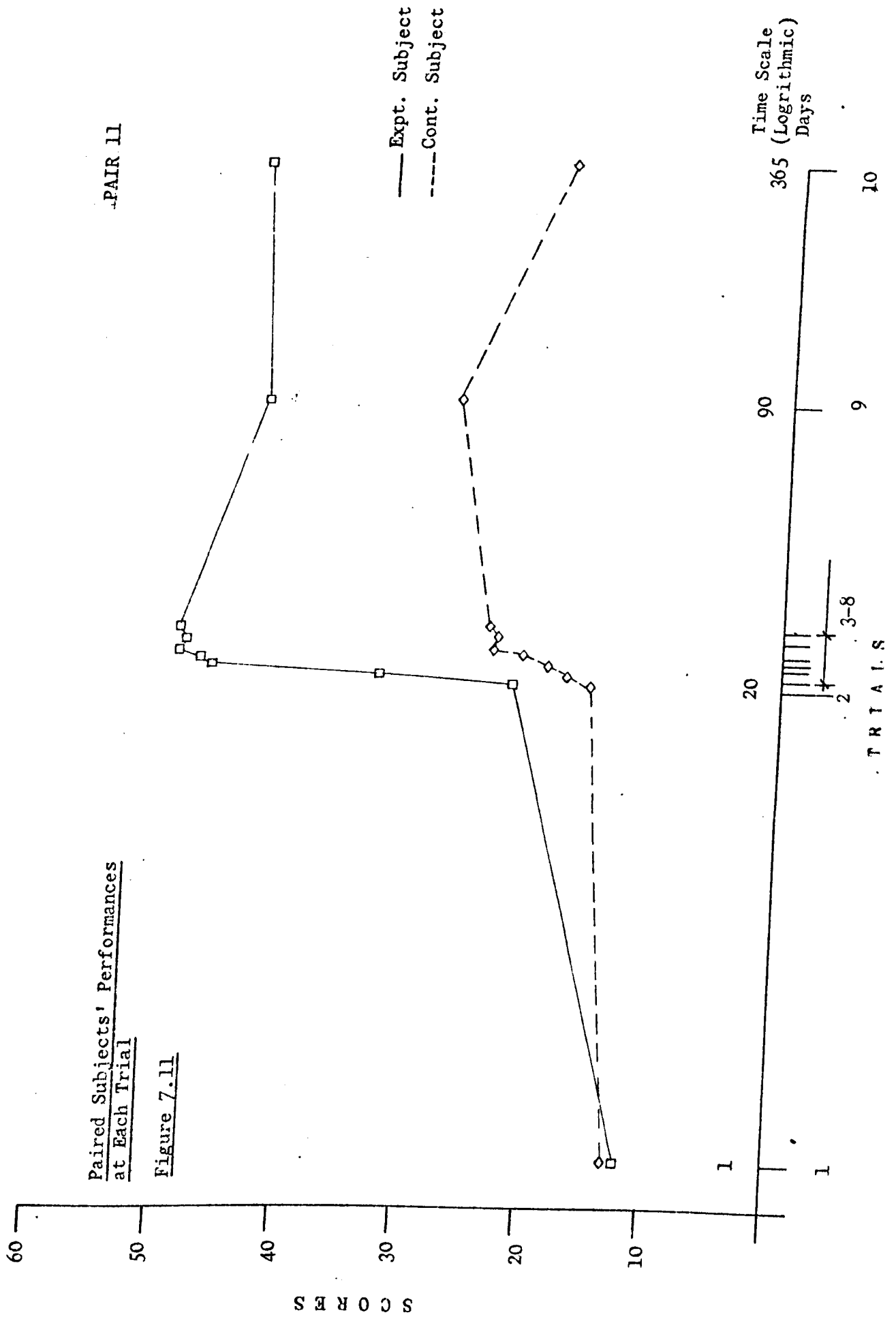
Figure 7.10



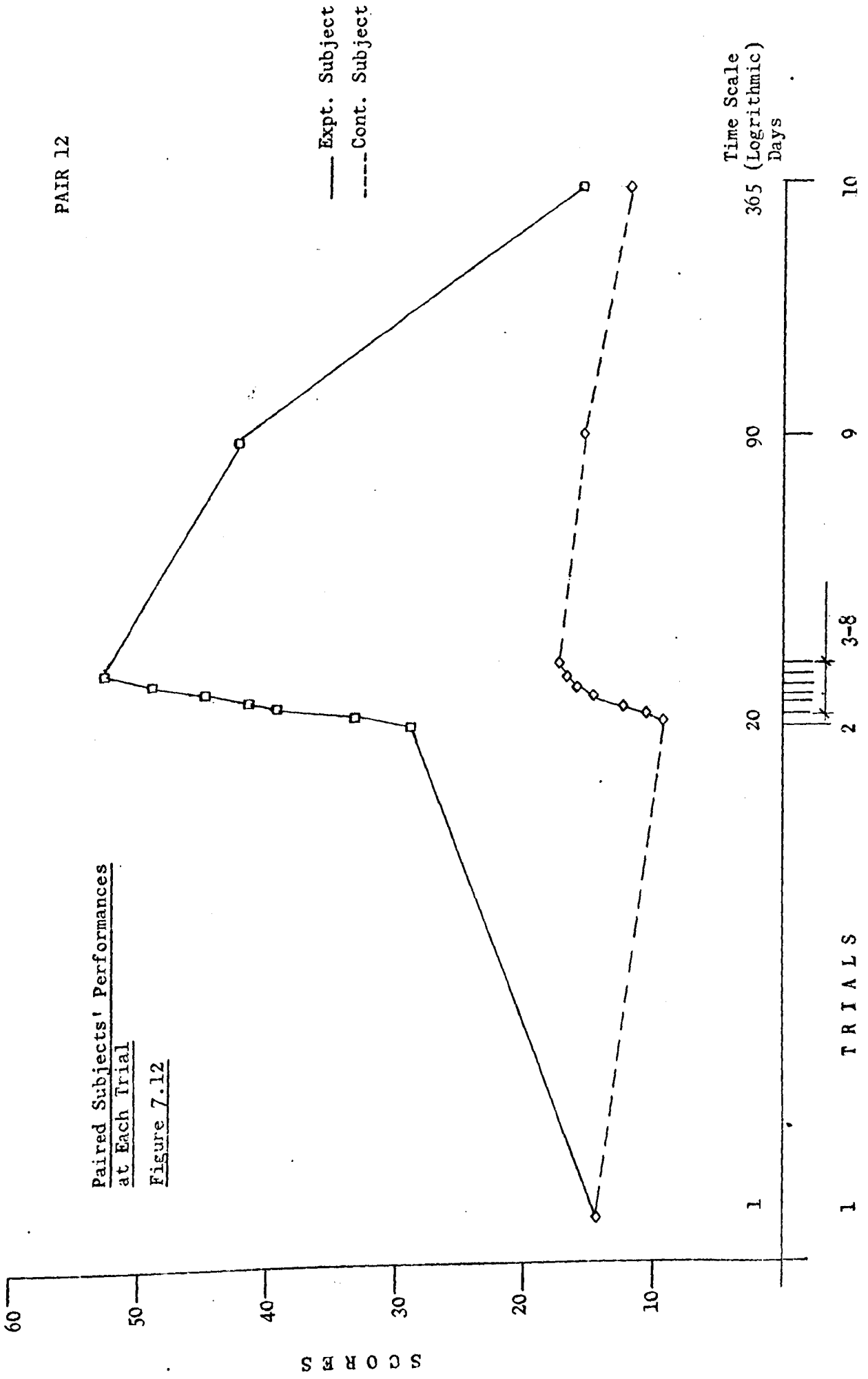
Paired Subjects' Performances
at Each Trial

PAIR 11

Figure 7.11



PAIR 12



Paired Subjects' Performances
at Each Trial
Figure 7.12

It is noted that the interaction between Groups x Trials is significant ($F = 10.24$, $3/66$ df, $P < .001$) which indicates that, after training, the experimental group differed significantly from the control group on Trial 2 of the CFT, i.e. re-test after training ($F = 9.17$, $1/88$ df, $P < .01$; see A at B_1). On Trial 8, the differences between groups widened even further ($F = 26.18$, $1/88$ df, $P < .001$; see A at B_2). After a lapse of three-months of non-practice, the differences between groups were reduced ($F = 14.79$, $1/88$ df, $P < .001$; see A at B_3). After a further nine months of non-practice, the differences induced by training disappeared (see A at B_4).

A three-way analysis of variance on Trials 2 and 8, i.e. before and after six learning trials on the CFT was performed, in order to look at interaction between increase in performance and groups. The results are summarised in Table 5. A significant interaction between the two variables was found ($F = 27.64$, $1/11$ df, $P < .001$) which shows that the increase in performance i.e. learning, was greater in the experimental group than the control group. It must be emphasised that this improvement refers to actual and not proportional increases.

A two-way analysis of variance on the difference scores between Trials 1 and 2 was computed with repeated measures on one factor (sub-tests), to see if the groups performed differently on six sub-tests of the Cognitive Flexibility Test. These results which are summarised in Table 6 show that there was a reliable interaction between Groups x Sub-tests ($F = 3.71$, $5/110$ df, $P < .01$). The improvement on six sub-tests were in the following order: the most gain was in Form Classification and Picture Classification Sub-tests, covering Conceptual Flexibility; followed by Classification and Tell About This Sub-tests, covering Spontaneous Flexibility; and the least improvement was observed in Figure-Ground Reversals and Embedded Figure Sub-tests covering

Perceptual Flexibility.

Table 4

Two-way Analysis of Variance with Repeated Measures
on One Factor (Trial)

Source	Sums of Squares	df	MS	F	P
Betw Subjs	14023.53	23			
Groups (A)	5395.499	1	5395.499	13.757	<.01
Sub W Gps	8628.028	22	392.183		
Within Subj	48100.837	72			
Trials (B)	2473.949	3	824.649	34.132	<.001
A x B	742.331	3	247.443	10.241	<.001
B SWG	1594.557	66	24.159		

One-way Analysis of Variance at Each Level

A at B ₁	1065.334	1	1065.334	9.170	<.01
A at B ₂	3042.001	1	3042.001	26.186	<.001
A at B ₃	1718.734	1	1718.734	14.795	<.001
A at B ₄	311.760	1	311.760	2.683	NS
Error	10222.59	88	116.1657		
B at A ₁	2904.755	3	968.251	40.076	<.001
B at A ₂	311.525	3	103.841	4.298	<.01
Error	1594.557	66	24.159		

Table 5

Three-way Analysis of Variance with Repeated Measures
on Two Factors (Groups and Trials)

Source	Sums of Squares	df	MS	F	P
Blocks (Groups)	3853.784	1	3853.874	34.79	< .001
Columns (Trials)	1241.349	1	1241.349	64.68	< .001
Subjects	2860.136	11	260.012	28.35	< .001
B x C	253.461	1	253.461	27.64	< .001
B x S	1218.533	11	110.776	12.08	< .01
C x S	211.088	11	19.190	2.09	NS
B x C x S	100.857	11	9.169		
TOTAL	9739.298	47			

Table 6

Two-way Analysis of Variance with Repeated Measures
on One Factor (Sub-Tests)

Source	Sum of Squares	df	MS	F	P
Betw Subjs	302.263	23			
A(Groups)	193.673	1	193.673	39.23	<.001
Subjs W Gps	108.589	22	4.935		
Within Subj	184.703	120			
B(Sub-Tests)	30.303	5	6.060	5.04	<.001
A x B	22.313	5	4.462	3.71	<.01
B SWG	132.085	110	1.200		

One-way Analysis of Variance at Each Level

A at B ₁	5.703	1	5.703	3.12	NS
A at B ₂	18.375	1	18.375	10.07	<.01
A at B ₃	68.343	1	68.343	37.48	<.001
A at B ₄	47.601	1	47.601	26.10	<.001
A at B ₅	46.481	1	46.481	25.49	<.001
A at B ₆	29.481	1	29.481	16.16	<.001
Error	240.675	132	1.823		
B at A ₁	51.450	5	10.290	8.56	<.01
B at A ₂	1.167	5	.233	.19	NS
Error	132.085	110	1.200		

Although it was noted that no significant relationships existed between the number of training exercises completed and gain on re-test, or between age and gain, however, a growing relationship emerged between exercises completed, and scores on learning trials, subsequent to re-test. Thus, correlations by learning trial 3 were 0.63 ($P < .05$); by trial 4, 0.75 ($P < .01$); by trial 5, 0.71 ($P < .01$); and on trial 6, 0.67 ($P < .02$). On trials 7 and 8 the values had declined slightly to 0.62 and 0.61 ($P < .05$), respectively, ($N = 12$ experimental group only).

A significant relationship, 0.58 ($P < .05$) existed between the CFT pre-test score and amount of gain at re-test, indicating that the better the initial ability, the greater the responsiveness to training.

Discussion

The aim of the present study was to see if there was any possibility of improving the cognitive flexibility of moderately and severely retarded children and young adults.

As noted, the experimental and control groups were matched closely on total pre-test score of the CFT, CA, profiles on the six sub-tests of the CFT gained at pre-test, and Stanford-Binet IQs. Amount of exposure to daily sessions with the experimenter was also controlled. The results indicated that, after training, the experimental group differed very significantly from the control group with the Cognitive Flexibility Test. Differences widened during the following six learning trials. These trials were given to both groups to see whether this minimal exposure to practice on the CFT task would cause the differences to disappear. Further analysis indicated that these increases in performances were actual and not proportional, hence learning in the experimental group was greater than in control group. After a lapse of three months of non-practice, the differences between groups were

still significant. However, after a further nine months of non-practice, the significant differences induced by training had disappeared.

It is of interest that improvement occurred in the Conceptual Flexibility and the Spontaneous Flexibility areas. Less effect was apparent on the Perceptual Flexibility tasks, also evidenced in the results of McKinney and Corter (1971).

Nevertheless, quite apart from differences in the type of sample employed in Corter and McKinney's study and the present investigation, there remain other differences to which attention should be directed. Using mildly retarded children, Corter and McKinney found greater training effects on immediate re-test than occurred in the present more-handicapped sample, but their daily training period was at least four times longer than in the present experiment, so the results must be seen in this context. Corter and McKinney also employed group training, whereas the present approach was individual, and therefore less economical of experimenter's time. Again, for the mildly retarded children there was no three-month or one-year re-test to check the stability of the changes induced, as in the current experiment. Unlike Corter and McKinney, there was no repetition of Stanford-Binet, in which more generalised cognitive changes might be assessed. Thus, the transfer which the present results yielded was relatively specific, and there was lack of opportunities to test for more general non-specific transfer which earlier work (e.g. Clarke, Clarke and Cooper, 1970) had indicated, but the general findings relate closely to the theme of Bortner and Birch, (1970) who stressed the potential differences between capacity and competence when changed conditions of demand are imposed. They also relate to the fact that the potential performance

of persons below IQ 50 has been widely underestimated, leading to a circularity of poor care, poor training opportunities (if any), and hence, poor outcome.

CHAPTER 7

EXPERIMENT 2

CHAPTER 7

Introduction

Perceptual tasks are used frequently to study rigidity, in particular, hidden objects tests (Chown, 1959; Leach, 1967). The subject is asked to find as many embedded objects as possible in pictures similar to those found in children's magazines. Numerous embedded objects are present, and it is supposed that rigid subjects will have difficulties in locating them and thereby produce a shorter list.

It is reported that the young child has a tendency to categorise and react to an entire stimulus, rather than to label its separate parts. This is particularly true of unfamiliar or non-meaningful stimuli. If the stimulus is ambiguous e.g. ink blot, the older child attends to, and labels, component parts of the stimulus to a greater degree than the younger child e.g. he is more apt to say "Butterfly with the wings and head".

Of course, if the child has not yet learned the word that applies to an entire stimulus but has learned labels for the parts, he may name the parts of the stimulus. One might formulate a tentative rule about the child's categorizations during early development. If internal parts of a stimulus are not distinctive (as in an ink blot), the older child is more likely than the younger to differentiate the stimulus. Moreover, if the younger child has a popular label to apply to the whole stimulus, even though the internal parts might be distinctive, he will be more likely than the older child to categorise the whole rather than the parts. It is only when the younger child has difficulty identifying or labeling the whole, and does not have any difficulty with the parts, that he will attend to the latter rather than the former.

It seems that the young child's preference for reacting to the whole stimulus rather than the parts, interferes with his ability to notice changes in the internal parts of a stimulus.

Hartlage (1971) studied eighteen retarded workers in a sheltered workshop and reported that visual-spatial ability was an accurate predictor of performance on three manual tasks: the assembly of electrical components, packing of merchandise, and folding and packing of containers.

Jackson (1973) found that the abilities measured by the performance section of the Wechsler Intelligence Scale for Children (WISC), which contains sub-tests involving visual and spatial relations, are more related to the employment adjustment of retarded persons than are the abilities measured by the verbal section of the WISC. Thus, it appears that visual-spatial skills play an important role in the educational and vocational lives of retarded persons.

The importance of understanding and manipulating relations of a visual or spatial nature has been emphasised in the education of retarded individuals. Connor, Serbin and Freeman (1978) designed a study to evaluate the effects of training on a visual-spatial task of the performance of educable mentally retarded (EMR) children. EMR children were randomly assigned to either a visual-spatial training condition or a control group. The children who received training showed a gain from pre-test to post-test on the Children's Embedded Figure Test that corresponds to approximately four years of maturation in non-retarded children. The performance of the children in the control group on the post-test was not significantly different from their performance on the pre-test.

In the first experiment, severely and moderately retarded subjects showed

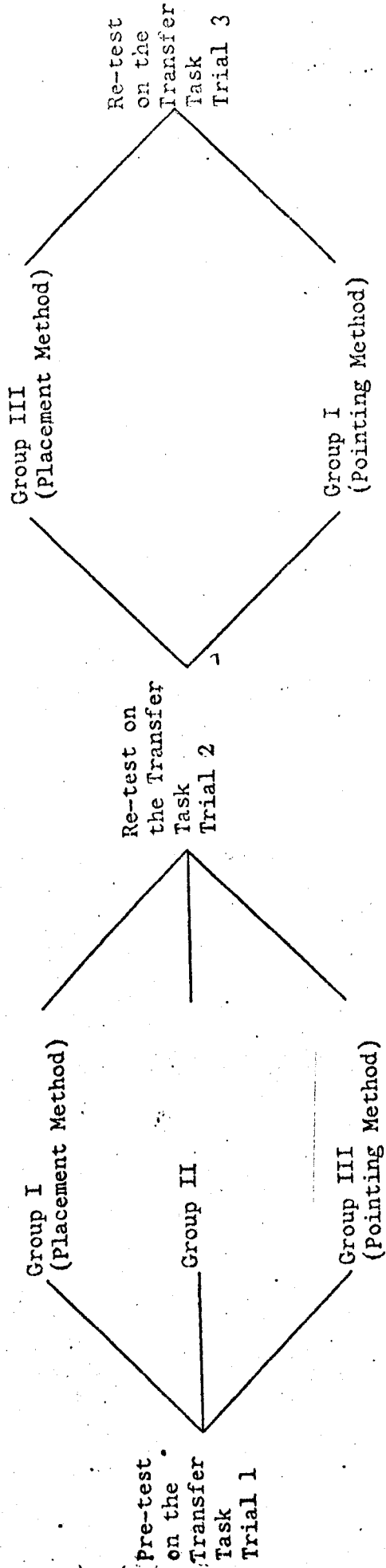
significant improvement in cognitive shifts after training. However, most improvement occurred in Conceptual and Spontaneous areas and less in Perceptual Flexibility areas. The perceptual processes involved in Embedded Figure and Figure-Ground Reversal are complex, therefore, further investigations in these areas were carried out in two separate experiments. In this experiment, the effectiveness of training programmes in Embedded Figures is investigated.

Design

The design for this experiment is illustrated diagrammatically in Figure 8. The Embedded Figure Sub-test of the CFT and Children's Embedded Figure Test (CEFT) are used as criteria for transfer tasks. Three groups of ten subjects each were formed and matched on the transfer tasks (Trial 1) and randomly allocated to one of the three training conditions. Groups I and III received training in embedded figures designed by the experimenter. Both of these groups received the same training exercises, but Group I was taught by 'Placement Method', while Group III received training by 'Pointing Method'. Group II received perceptual training as in the first experiment. This training programme was devised by Corter and McKinney (1968) for the mildly handicapped and bright normal children and was modified to meet the needs of the severely and moderately handicapped individuals. All the three groups received training for ten days, and were then re-tested on the transfer tasks (Trial 2). The rationale of the design being, that any observed differences on re-test amongst the three groups can then be attributed to the differences in training experienced by each group.

After re-test on the transfer tasks, a cross-over design was applied to Groups I and III. Using the same training exercises as in the first part of the design, Group I received training by 'Pointing Method', while Group III was given training by 'Placement Method'. Both groups

Figure 8 Design for Experiment 2 - Embedded Figure Tests as Transfer Tasks



received training for a further ten days and were re-tested again on the transfer tasks (Trial 3). The rationale for the second part of the design being, that any observed differences on re-tests between Groups I and III can then be bridged and attributed to different training methods.

Subjects

For this investigation, sixty-four residents from a large hospital were tested on the Embedded Figure sub-test of the CFT and the Children's Embedded Figure Test (CEFT). Then three groups of ten subjects each were formed. Besides matching on the two transfer tasks they were also matched on Stanford-Binet IQs and chronological age. The summary of the matching data is given in Table 7. The individuals chosen for this experiment did not participate either in the first or in subsequent experiments.

Table 7

Matching Data for Three Groups

Groups	Embedded Figure Sub-Test of the CFT	Children's Embedded Figure Test (CEFT)	IQ on Stanford-Binet	CA (in years)
I (N=10) Mean Range	1.1 0-3	1.6 0-3	37.6 28-47	23.6 12-28
II (N=10) Mean Range	1.1 0-3	2.3 0-7	34.6 26-44	25.8 15-37
III (N=10) Mean Range	1.1 0-3	0.9 0-3	38.0 27-51	26.8 14-42

Material

Transfer Task

(a) Embedded Figure Sub-test of the CFT

This is a sub-test of the Cognitive Flexibility Test which was developed by McKinney (1966). The subject is shown a simple figure and is required to find a similar figure which is embedded in a complex figure. The total score on this sub-test is 7. The details of materials, scoring, and administration are described in Appendix A₁.

(b) Children's Embedded Figure Test (CEFT)

This test was developed by Wilkin, Oltman, Baskin and Karp (1971). The test consists of a specific-geometric shape embedded in a set of complex figures. The subject is presented with a series of coloured designs and two simple cut-out forms, namely a TENT and a HOUSE. The subject is required to find such simple cut-out forms which are embedded in a complex figure. The total score on this test is 25. The details of materials, scoring, and administration are described in Appendix B₁.

Training Tasks

Two different sets of training tasks were employed to teach three groups of subjects. One set was developed by Corter and McKinney (1968) and the other was designed by the experimenter.

(a) Group II was taught by selecting nine training exercises from Corter and McKinney's programme. The selected exercises: 2, 5, 7, 9, 14, 16, 18, 23 and 26 are described in detail in Appendix A₂.

(b) Groups I and III were taught by the programme devised by the experimenter. Training started by teaching the subjects to recognise and differentiate various geometrical shapes. These shapes were first presented in three-dimensions. The subjects were then shown the same geometrical shapes drawn on paper. Thus, the idea of differentiating shapes in two-dimensions was introduced. Later on, more complex training exercises were introduced to give practice in finding figures embedded in large visual fields. This set consisted of nine training exercises and is described in detail in Appendix B₂.

Procedure

All residents from the three groups were seen individually on transfer tasks at pre-test and re-tests. No corrective feedback was given to any individual when tested on the transfer tasks.

After pre-test, all subjects from the three groups were taught for eight to twelve minutes every day, for a period of ten days. Group II was taught by Corter and McKinney's programme, whilst Groups I and III received training exercises devised by the experimenter.

Subjects in Group I were at first taught by 'Placement Method', and then by 'Pointing Method', whereas experimenters in Group III received training, first by 'Pointing Method', followed by 'Placement Method'.

The testees who learned by 'Placement Method' were given a cut-out stimulus shape or figure, and were required to find that particular shape in a complex visual field and then to place it on top of its appropriate shape. Thus, subjects were involving themselves more

in the task by manipulating the stimulus figure. This should have enhanced the cue-distinctiveness of stimulus qualities. They also received immediate knowledge of the results.

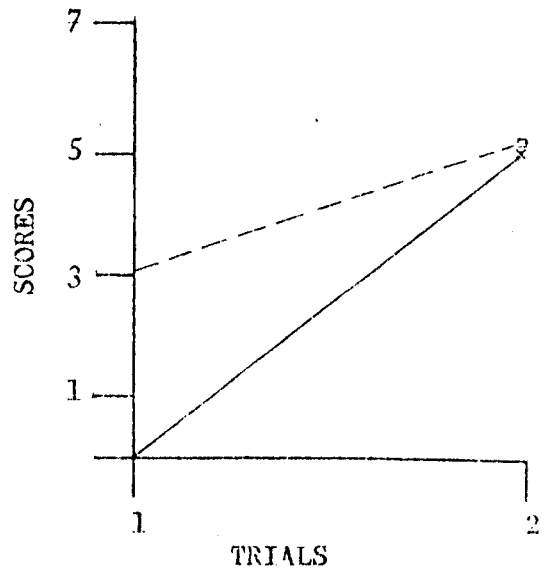
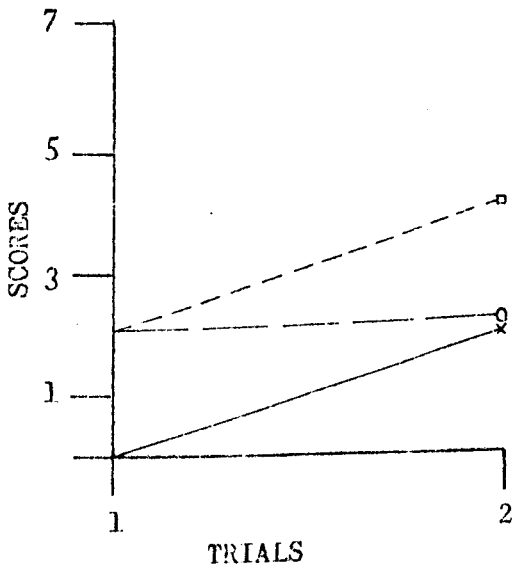
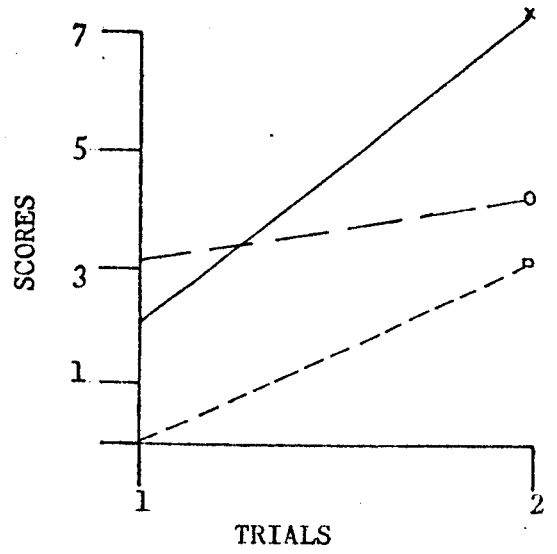
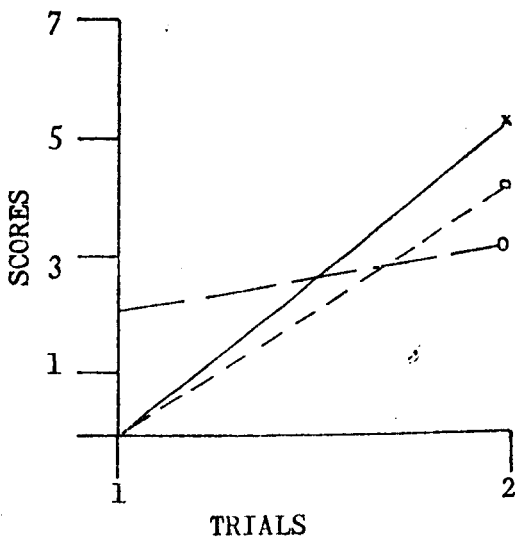
The individuals who received training by 'Pointing Method' were shown a stimulus figure and were merely required to point out the stimulus shape in a complex visual field. Thus, they did not receive as much feedback as the persons learning by 'Placement Method'.

Subjects received corrective feedback during training. Accuracy and correct movements were stressed throughout this period. Presentation of training tasks was varied from trial to trial to avoid position learning. Where they had difficulty in following verbal instructions or understanding concepts, the experimenter used duplicate materials for training exercises and demonstrated how a particular exercise was to be done. The subjects were encouraged to match the tasks presented by the experimenter in specified sequences, and later encouraged to accomplish the tasks without assistance.

All individuals were well-motivated to participate in the experiment. When they were not with the experimenter, they attended either their regular place of work or school within the hospital grounds.

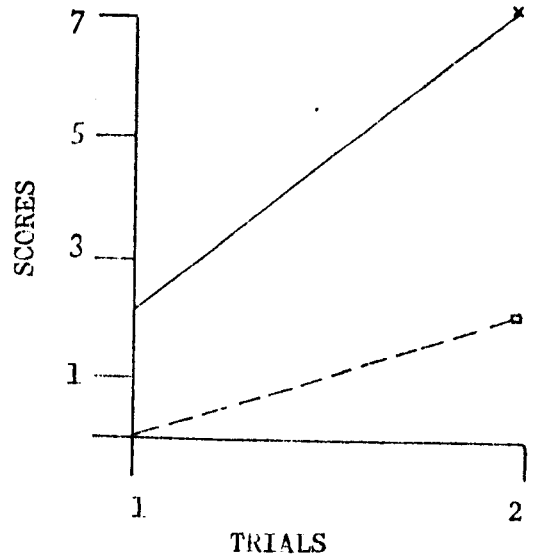
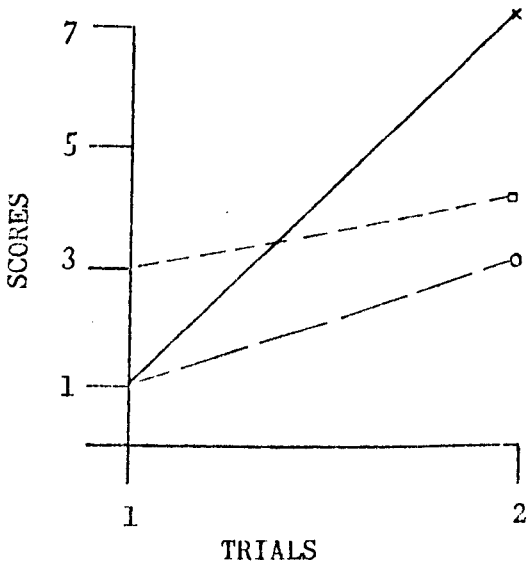
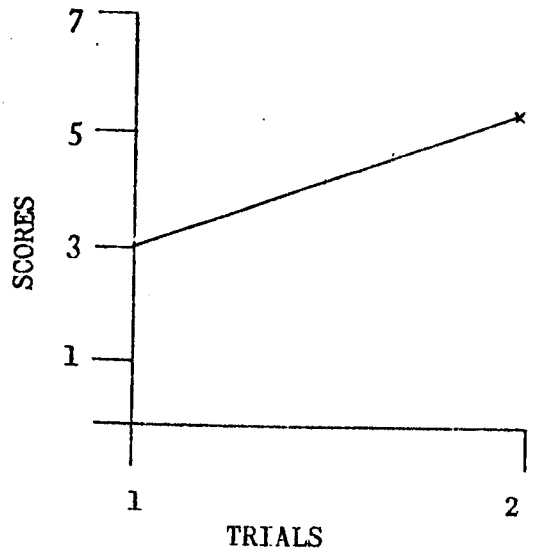
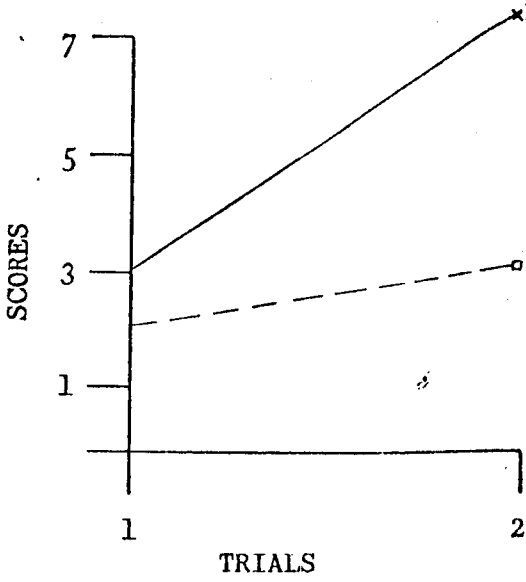
Results

For this investigation, total score on the two transfer tasks i.e. Embedded Figure Sub-test of the CFT and Children's Embedded Figure Test (CEFT) were recorded at each trial, at pre-test (Trial 1), re-test after first training period (Trial 2), and re-test after second training period (Trial 3). Figures 9.1, 9.2, and 9.3 illustrate the performances of the three groups I, II, and III on Trials 1 and 2. The performances of Groups I and III on the Embedded Figure Sub-test of the CFT at Trials 1, 2, and 3 is shown in Figures 10.1, 10.2, and 10.3.



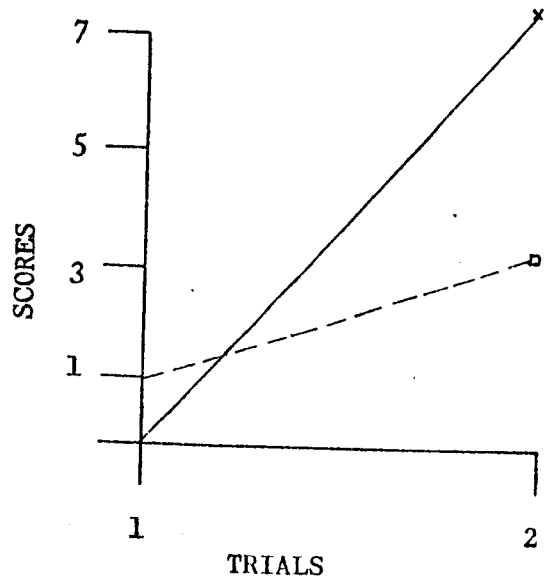
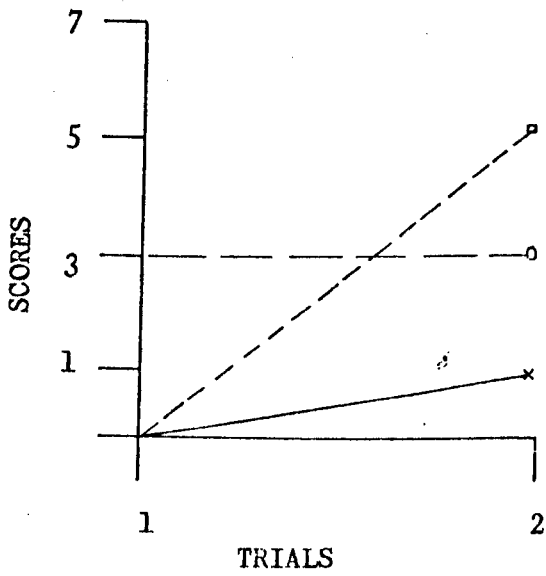
——— Subject in Group I
 - - - Subject in Group II
 . . . Subject in Group III

Figure 9.1 Performances of Subjects in Groups I, II and III on the Embedded Figures Sub-test of the CPT at Trials 1 and 2.



——— Subject in Group I
 - - - Subject in Group II
 - - - Subject in Group III

Figure 9.2 Performances of Subjects in Groups I, II and III on the Embedded Figure Sub-test of the CFT at Trials 1 and 2



——— Subject in Group I
 - - - Subject in Group II
 . . . Subject in Group III

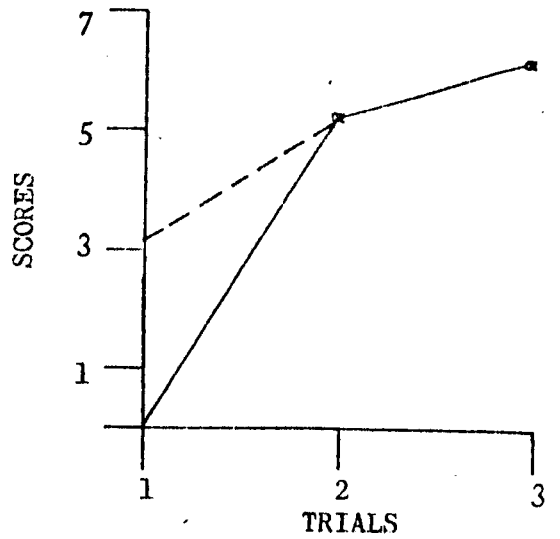
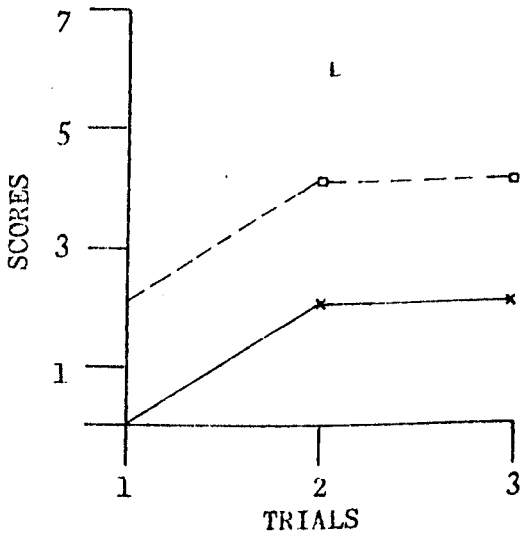
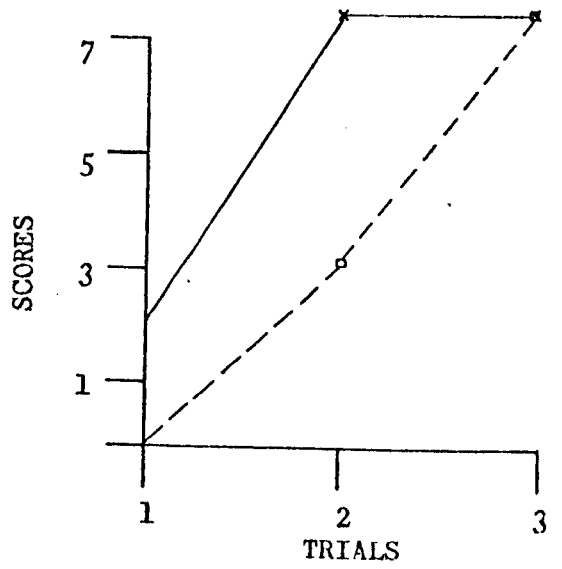
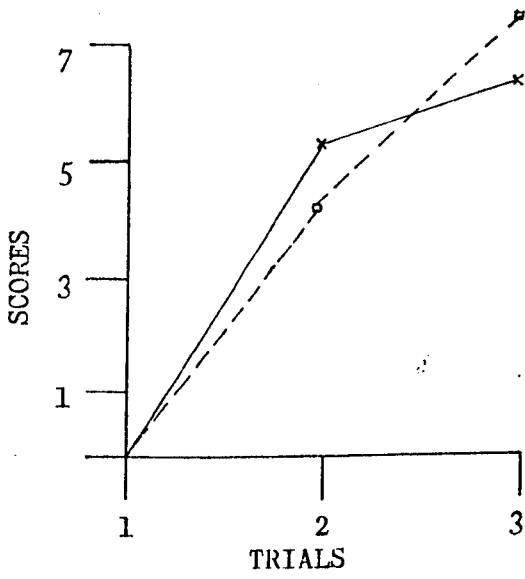
Figure 9.3 Performances of Subjects in Groups I, II and III on the Embedded Figure Sub-test of the CFT at Trials 1 and 2

A two-way analysis of variance, with repeated measures on Trials 1 and 2, was computed for Groups I, II, and III on the Embedded Figure Sub-test of the CFT. The results are summarised in Table 8. Here, the effects of matched pairs was negated, hence the significance estimates amongst groups were extremely conservative. It is noted that the interaction between Groups x Trials was significant ($F = 16.93$, $df\ 2/27$, $P < .001$). One-way analysis showed that the group who was taught by the programme devised by the experimenter and trained by 'Placement Method' improved the most ($F = 82.68$, $df\ 1/27$, $P < .001$). The group trained by 'Pointing Method' also improved significantly after training ($F = 22.68$, $df\ 1/27$, $P < .001$). However, the group which received training by Corter and McKinney's method did not improve.

As described above, a similar two-way analysis of variance was carried out on the Children's Embedded Figure Test scores. The results are described in Table 9. A reliable interaction was present for Groups x Trials ($F = 10.79$, $df\ 2/27$, $P < .001$), indicating that the group taught by 'Placement Method' improved more ($F=49.51$, $df\ 1/27$, $P < .001$) than the group trained by 'Pointing Method' ($F = 9.24$, $df\ 1/27$, $P < .01$). However, little improvement was seen in the group taught by Corter and McKinney's programme.

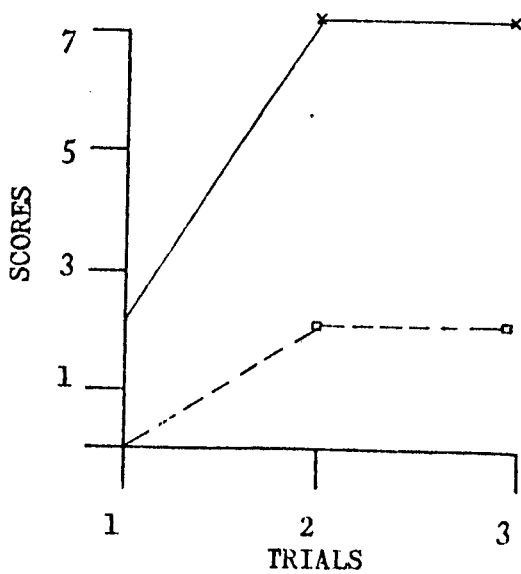
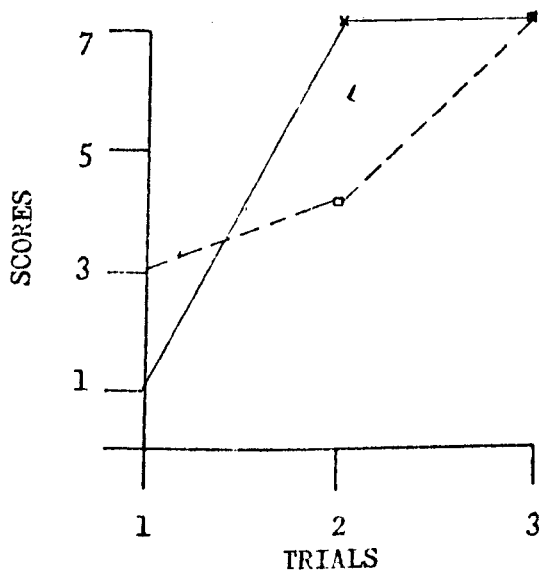
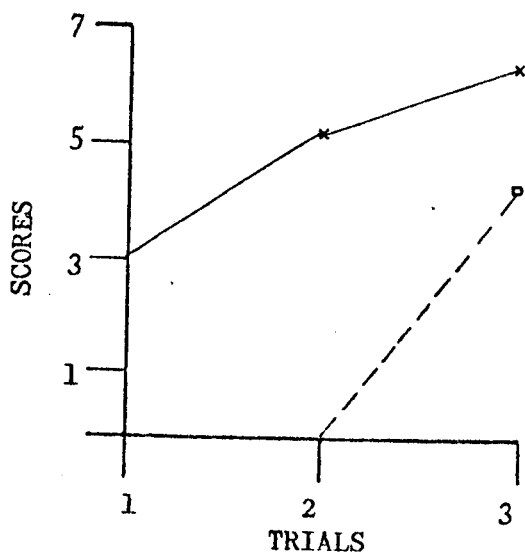
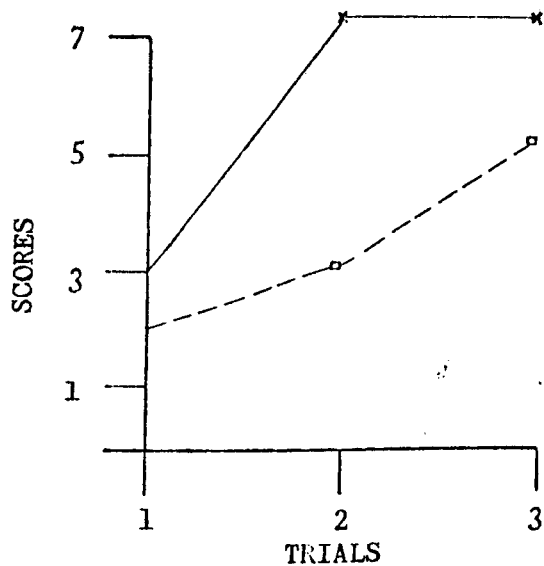
Two-way ANOVAS on the difference in scores between Trial 1 and Trial 2, and Trial 2 and Trial 3, was carried out to see if groups trained by 'Placement' and 'Pointing' methods improved differentially after receiving training by either method.

The results are summarised in Table 10. A significant interaction between Groups x Amount of Learning due to the two different training techniques, was indicated ($F = 9.66$, $df\ 1/18$, $P < .01$) on the Children's Embedded Figure Test. It is noted that there has been more learning



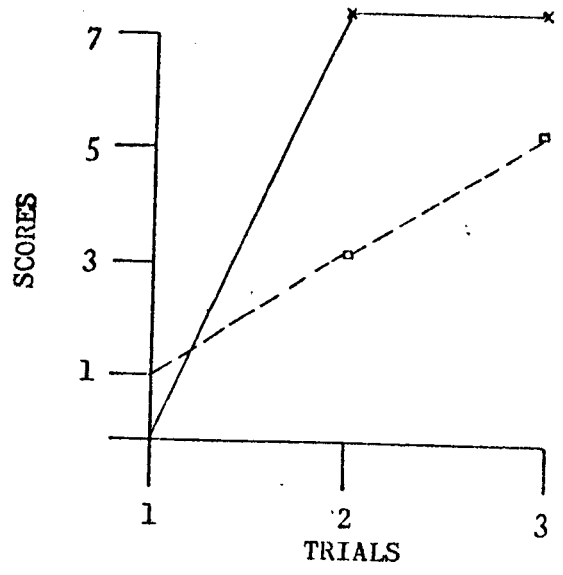
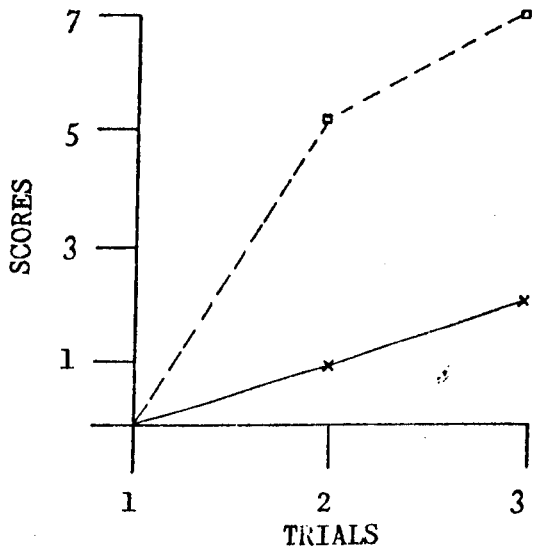
——— Subject in Group I
 - - - Subject in Group III

Figure 10.1 Performances of Subjects in Groups I and III on the Embedded Figure Sub-test of the CFT at trials 1, 2 and 3



——— Subject in Group I
 - - - Subject in Group III

Figure 10.2 Performances of Subjects in Groups I and III on the Embedded Figure Sub-test of the CFT at Trials 1, 2 and 3



——— Subject in Group I
 - - - - Subject in Group III

Figure 10.3 Performances of Subjects in Groups I and III on the Embedded Figure Sub-test of the CFT at Trials 1, 2 and 3

between Trial 1 and Trial 2 in Group I than in Group III. Similarly, Group III showed more learning between Trial 2 and Trial 3 than Group I, for the same period. However, the aggregate effect of training periods is not significantly different between the two groups. Similar results are obtained on the Embedded Figure Sub-test of the CFT which are summarised in Table 11.

Table 8

Two-way Analysis of Variance with Repeated Measure on Trials
With the Embedded Figure Sub-Test of the CFT

Source	Sum of Squares	df	MS	F	P
Betw Subjs	140.733	29			
A(Groups)	36.133	2	18.066	4.66	<.05
Subjs W Gps	104.600	27	3.874		
Within Subj	142.000	30			
Trials(B)	77.066	1	77.066	72.05	<.001
A x B	36.133	2	18.066	16.93	<.001
B SWG	28.800	27	1.066		

One-way Analysis of Variance at Each Level

A at B ₁	.000	2	.000	.00	
A at B ₂	72.266	2	36.133	14.62	<.001
Error	133.400	54	2.470		
B at A ₁	88.200	1	88.200	82.68	<.001
B at A ₂	24.200	1	24.200	22.68	<.001
B at A ₃	.800	1	.800	.75	NS
Error	28.800	27	1.066		

Table 9

Two-way Analysis of Variance with Repeated Measure on Trials
With the Children's Embedded Figure Test

Source	Sum of Squares	df	MS	F	P
Betw Subjs	612.733	29			
A (Groups)	130.833	2	65.416	3.66	<.05
Subjs W Gps	481.900	27	17.848		
Within Subj	570.000	30			
Trials (B)	248.066	1	248.066	37.43	<.001
A x B	143.033	2	71.516	10.79	<.001
B SWG	178.900	27	6.625		

One-way Analysis of Variance at Each Level

A at B ₁	7.266	2	3.633	.29	NS
A at B ₂	266.600	2	133.300	10.89	<.001
Error	660.800	54	12.237		
B at A ₁	328.050	1	328.050	49.51	<.001
B at A ₂	61.250	1	61.250	9.24	<.01
B at A ₃	1.800	1	1.800	.27	NS
Error	178.900	27	6.625		

Table 10

Two-way ANOVAS on the Difference Scores Between Trial 1 and Trial 2;
and Trial 2 and Trial 3 of Groups I and III on the Children's Embedded
Figure Test

Source	Sums of Squares	df	MS	F	P
Betw Subjs	185.900	19			
A	.400	1	.400	.038	NS
Subj W Gps	185.500	18	10.305		
Within Subj	454.000	20			
B	28.900	1	28.900	2.671	NS
A x B	230.400	1	230.400	21.300	<.001
B SWG	194.700	18	10.816		

One-way Analysis of Variance at Each Level

A at B ₁	105.800	1	105.800	10.017	<.01
A at B ₂	125.000	1	125.000	11.835	<.01
Error	280.200	36	10.561		
B at A ₁	211.250	1	211.250	19.530	<.001
B at A ₂	48.050	1	48.050	4.442	NS
Error	194.700	18	10.816		

Table 11

Two-way Analysis of Variance on the Difference Scores Between Trial 1 and Trial 2; and Trial 2 and Trial 3 of Groups I and III on the Embedded Figure Sub-Test of the CFT (Repeated Measures on Trial)

Source	Sums of Squares	df	MS	F	P
Betw Subjs	73.600	19			
A	2.500	1	2.500	.632	NS
Subj W Gps	71.100	18	3.950		
Within Subj	90.000	20			
B	25.600	1	25.600	10.997	<.01
A x B	22.500	1	22.500	9.665	<.01
B SWG	41.900	18	2.327		

One-way Analysis of Variance at Each Level

A at B ₁	20.000	1	20.000	6.371	<.05
A at B ₂	5.000	1	5.000	1.592	NS
Error	113.000	36	3.138		
B at A ₁	48.050	1	48.050	20.642	<.001
B at A ₂	.050	1	.050	.021	NS
Error	41.900	18	2.327		

Discussion

As noted earlier, one of the tests used frequently to study rigidity is a perceptual task, in particular, a hidden object test. It is assumed that rigid persons will find difficulty in identifying embedded figures. Therefore, the aim of the investigation was to evaluate the effectiveness of training programmes in embedded figure task with severely and moderately handicapped people.

The results of the present study indicate that the training programmes devised by the experimenter were very effective in teaching visual-spatial dis-embedding, as measured by the two transfer tasks. After training, the subjects who initially reacted to the whole stimulus were able to notice changes in the internal parts of a stimulus.

Two groups trained by the programmes devised by the author, performed noticeably better than the group taught by Corter and McKinney's method. The training exercises devised by the experimenter were well graded in terms of level of difficulty, and were broken down into smaller, simple steps. In attempting some of the training exercises devised by Corter and McKinney, the subjects spent a considerable amount of time in colouring pictures (see Exercises 7, 14, 18, etc., in Appendix A₂), thus distracting attention from learning the concepts of parts and wholes, i.e. learning to break up an organised field in order to keep a part separate from the complex visual field.

The superiority of 'Placement Method' over 'Pointing Method' may be due to the fact that the learner was involved in manipulating stimulus figures, which directed his attention to more relevant details. The cue-distinctiveness of stimulus qualities should enable the subjects to differentiate and separate various objects. Furthermore, training by 'Placement Method' also provided subjects with immediate knowledge of

results, whereas individuals taught by 'Pointing Method' received relatively less corrective feedback.

It seems that, in order to discriminate among complex visual forms, the individual must become sensitive to the critical features that differentiate various forms. Further support within the framework of distinctive feature training is reported by Guralnick (1975) with the moderately handicapped children.

The training procedure used in the present study was also quite brief, and specifically designed to teach the skill of visual-spatial dis-embedding. More extensive training exercises, which would involve exposure to a greater variety of visual-spatial materials, may be necessary to improve performance on more than one type of visual-spatial measure. Studies suggest that visual-spatial skills are strongly related to the employment success of retarded persons (Hartlage, 1971; Jackson, 1973; and Connor et al., 1978). Further examination of the long-term stability of training effects and the relationship of improvements in these skills, to the educational and employment adjustment of retarded persons, is needed.

CHAPTER 8

EXPERIMENT 3

CHAPTER 8

Introduction

Although sensory perception may be considered basic to cognitive functioning, psychologists have concerned themselves much less with the operation of sensory and perceptual processes in the mentally subnormal than with other areas of cognition. Spivack (1963), reviewing this field, concluded that the paucity of research data on perceptual processes is striking, and the results are too fragmentary to permit meaningful integration. The situation has not changed substantially to date.

In dealing with many perceptual and cognitive phenomena, one must make a distinction between an individual's capacity and his performance. In the case of geometric figures and their reversals, the researchers have indicated that the young child is capable of making the distinction but his overt responses do not ordinarily reflect his ability.

Hendrickson and Muehl (1962), in their study of kindergarten children, found that specific training of directional cues of the letters 'd' and 'b' facilitated transfer to a paired-associate task involving these letters, in comparison to a control.

Bijou (1968) devised a programme using the matching-to-sample technique, to first teach subjects to select a correct form irrespective of its orientation, and then to distinguish rotated matches from rotated mirror-images. This programme was successful for both young children and retardates. It is to be observed that experience in this task facilitated mirror-image discrimination to new nonsense forms, as well as to alphabet letters.

Working with kindergarten children, Williams (1969) found that delayed matching-to-sample pre-training on the discrimination of letter-like

forms, in which the comparison stimuli were transformations of standards (right-left, up-down, 90 degree and 180 degree transformations), produced superior discrimination performance, in comparison to a group in which the comparison stimuli were different forms.

Caldwell and Hall (1969) were able to produce a substantial decrease in confusion errors for the letters 'd', 'b', 'q', and 'p', with kindergarten children as subjects. This was accomplished by using overlays of nonsense forms in pre-training, and requiring the children to match a standard to a choice of stimuli varying in orientation. A correct match required attention to the orientation dimension. Teaching this 'same-different' concept with orientation relevant was successful in producing very few confusion errors, using letters in the transfer test. A second group, which also used the overlay method but could rotate it to produce the correct match, thereby making orientation irrelevant, performed very poorly; in fact, more poorly than a control group who were pre-trained on the task with only form and size differences.

Koenigsberg (1971) attempted to determine exactly what components and characteristics of these pre-training procedures are necessary to produce a positive effect, with respect to orientation discrimination. Procedures, such as super-imposition of standard and comparison, tracing, observation of superimposition, etc., were tested with pre-school children. The results indicated that demonstrations of the orientation differences were sufficient to produce the positive effects.

Clearly then, at least for the orientation dimension, various types of discrimination pre-training can have positive effects. Doyle (1967), in her article, 'Perceptual Skill Development - A Possible Resource for Intellectually Handicapped', concluded that accuracy in perceptual judgment did not appear to be lock-stepped to intellectual development.

Since errors of rotation and reversal, especially mirror-image type reversals, are prominent in the mentally handicapped, the present experiment is an attempt to investigate the effects of perceptual training in Figure-Ground Reversals.

Design

The general design for this experiment is illustrated diagrammatically in Figure 11.

Figure-Ground Reversal Sub-test of the Cognitive Flexibility Test developed by McKinney (1966), was used as the criterion or transfer task. Two groups of fifteen subjects each were matched on the criterion task (Trial 1) and were randomly allocated to experimental or control conditions. The experimental group received training devised by the author for fifteen days, and the control group spent the same amount of time with the experimenter in colouring pictures, telling stories, playing card games, etc. Thus, exposure to the experimenter was identical for both groups. After training, all subjects were re-assessed on the transfer task (Trial 2).

Subjects

Forty-six subjects from a large hospital were tested on Figure-Ground Reversal Sub-test of the CFT, and then two groups, of fifteen subjects each, were formed. Besides matching on the transfer task, the subjects were also matched on Stanford-Binet IQs and chronological age. The summary of the matching data is shown in Table 12.

The subjects chosen for this experiment did not participate either in the previous experiments or in the subsequent experiment. At the time of the experiment, they were living in the hospital, and were attending adult training centres or school, within the hospital grounds.

Figure 11 Design for Experiment 3 - Figure-Ground Reversal Sub-test of the CFT as a Criterion Task

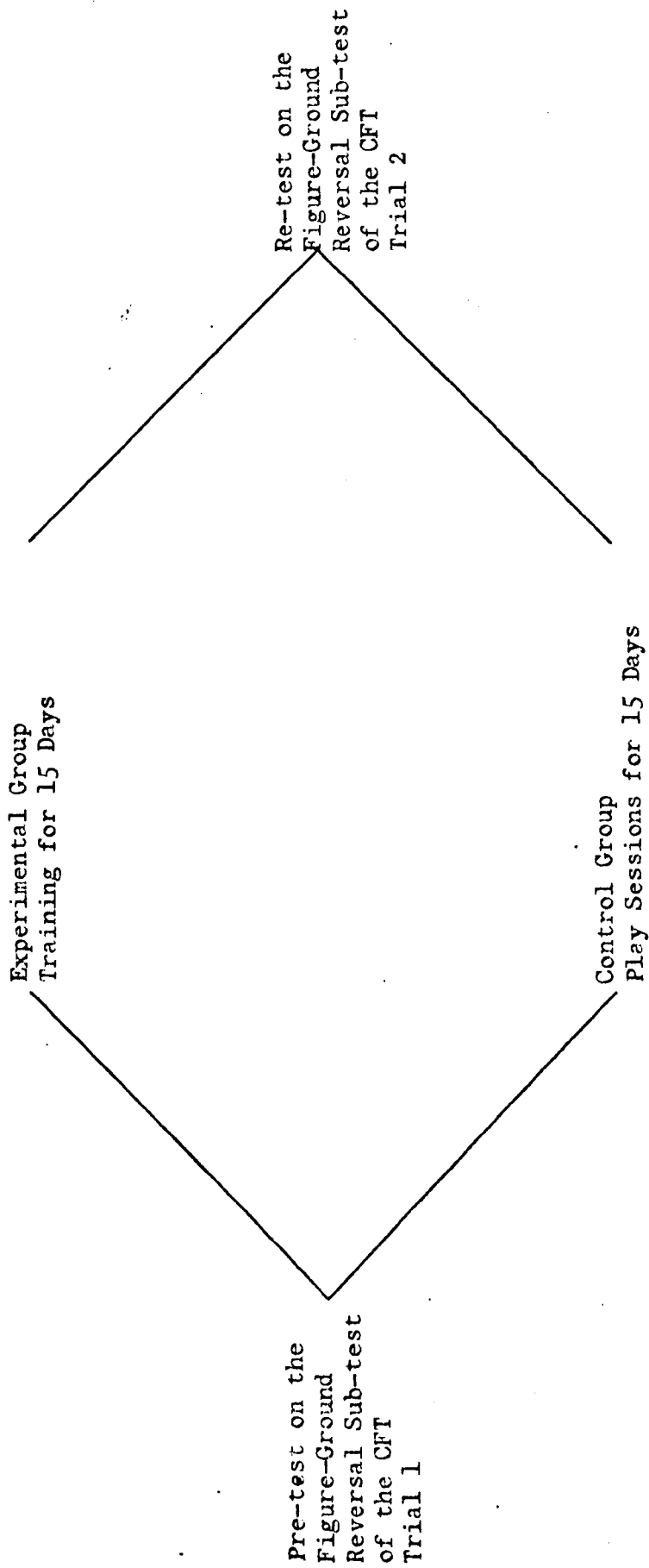


Table 12

Matching Data for Experimental and Control Groups

	Figure-Ground Reversal Score		Stanford-Binet IQs		Chronological Age (in years)	
	Experimental Group	Control Group	Experimental Group	Control Group	Experimental Group	Control Group
MEAN	0	0	38.67	38.20	27.6	26
RANGE	0	0	28-47	30-51	12-39	11-42
N	15	15	15	15	15	15

Materials

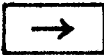




Transfer Task





As noted earlier, for this experiment Figure-Ground Reversal Sub-test of the Cognitive Flexibility Test (CFT), developed by McKinney (1966), was used as a transfer task. The subject was presented with a paper showing rows of different figures. Each row consisted of five figures, and the subjects were required to find the reverse, or opposite, of the Figure contained in the left-hand square.






The total score on this sub-test is fourteen. The details of materials, scoring, and administration are described in Appendix A₁.

Training Task

Twenty training exercises were devised by the experimenter to teach subjects the concept of Figure-Ground Reversal.

The exercises started with training subjects to differentiate and learn directions. For example, the stimulus figure  was given to the subjects, together with four individual figures pointing in different directions:    

Pupils were taught to face the arrows, for example:  
or to face the arrows away from each other, for example:  
When they understood the concept of mirror-image in visual fields, they were then taught the concept of opposite. Various other directions, e.g. up, down, diagonal, left, right, etc., were used to teach the concept of 'opposites', and emphasis was placed on finding the opposite of stimulus figures.

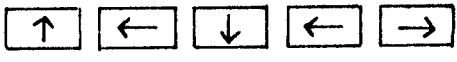
Gradually, the concept of Figure-Ground Reversals was introduced. The subjects were given the stimulus figure:  with four other figures, for example:    
and were taught to reverse the figure and background, in order to find opposites. More exercises were introduced to practice the concept of opposite directions, and reversing figure and background.

The details of materials and procedure are described in Appendix C.

Procedure

All the subjects were seen individually on transfer task at pre-test and re-test (Trials 1 and 2). None received corrective feedback when they were tested on the transfer task.

All members of the experimental group attempted two to three training exercises each day, with training individualised for particular weaknesses. The experimenter acted as a model, and the subjects were shown how a particular exercise was to be done. Accuracy and correct movements were stressed throughout the training period. Presentation of materials was varied from trial to trial to avoid position learning. Every effort was made to teach the verbal concepts of opposite or reversal. Subjects were seen on average eight to twelve minutes each day. Subjects in the experimental group were given five individual cut-out

cards with figures drawn in them, for example: 

One of the cards was used as a stimulus card to teach subjects how to find opposites to the stimulus card. Once they had learnt the concept of opposites on cut-out cards, they were given the same training exercise on a paper showing rows of different figures. Each row consisted of five figures, and the subjects were taught to find the opposite of the figure contained in the left-hand square. Criterion for successful learning was to correctly point to opposite of the stimulus figure presented on a paper (see Appendix C).

Subjects in the control group spent the time in carrying out activities other than training, e.g. story-telling, colouring pictures, playing card games, etc. Thus, exposure to the experimenter was similar for both the groups.

Results

The total score on the Figure-Ground Reversal Sub-test of the CFT was recorded at pre-test (Trial 1) and re-test (Trial 2). Figures 12.1, 12.2, 12.3, and 12.4 illustrate the experimental subjects' performances at two trial points.

A two-way ANOVA, with repeated measures on one factor (Trials), was computed, and the results are summarised in Table 13. A significant inter-action between Groups x Trials was present ($F=28.67$, $df\ 1/28$, $P < .001$), which indicates that the experimental subjects' performances in Figure-Ground Reversals improved significantly after training.

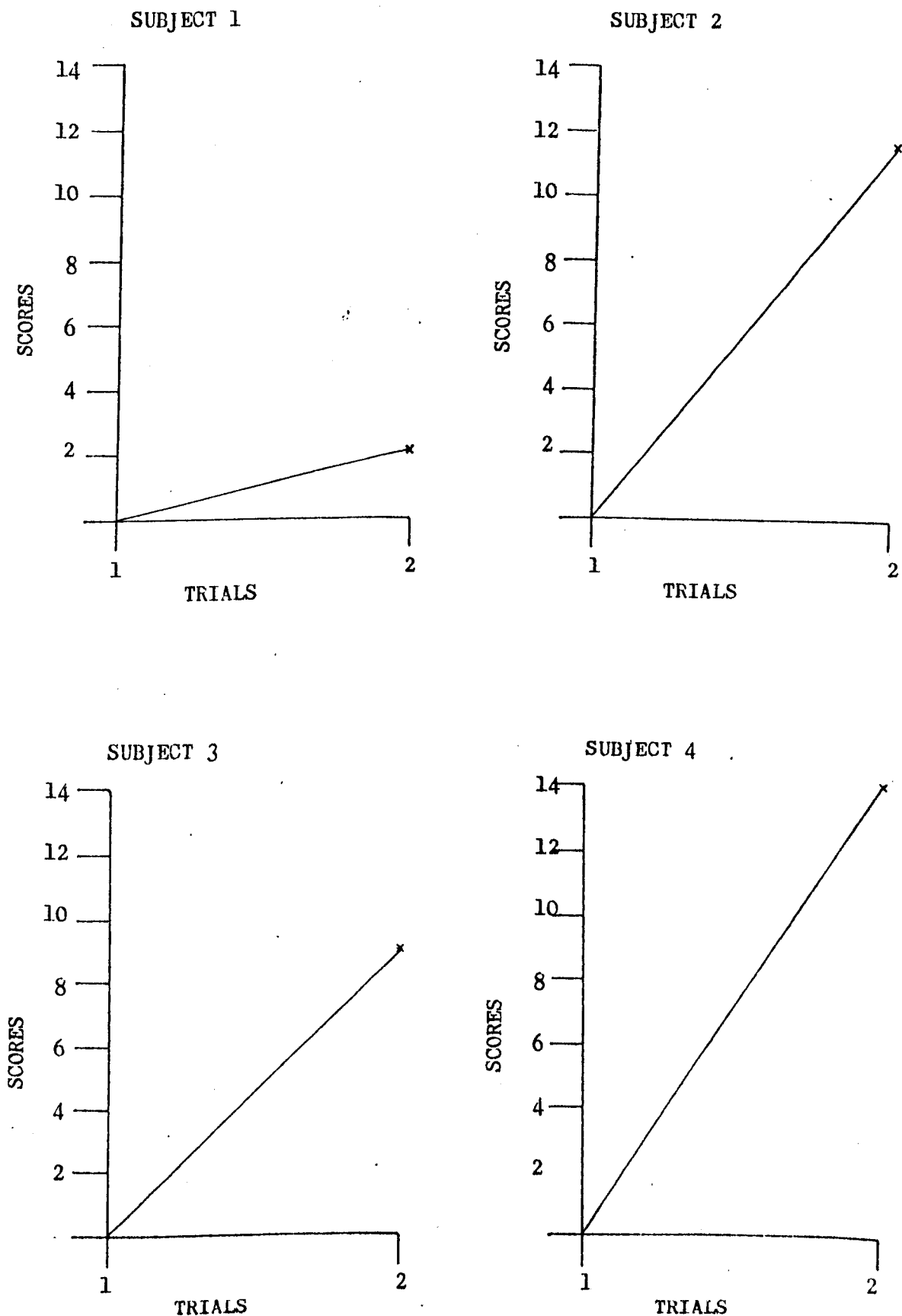
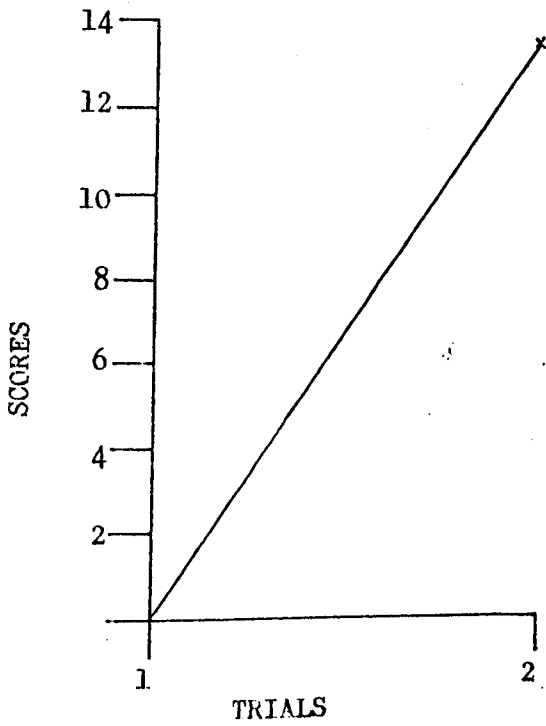
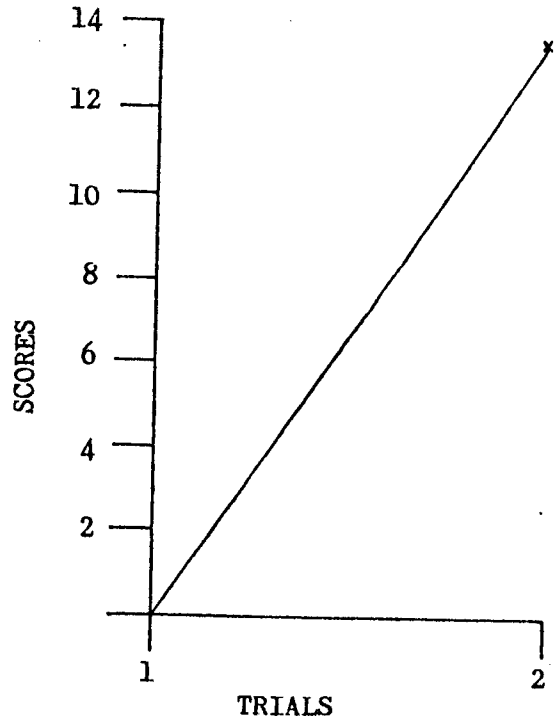


Figure 12.1 Experimental Subjects' Performances at Two Trial Points (Pre-test and Re-test) on the Figure-Ground Reversal Sub-test

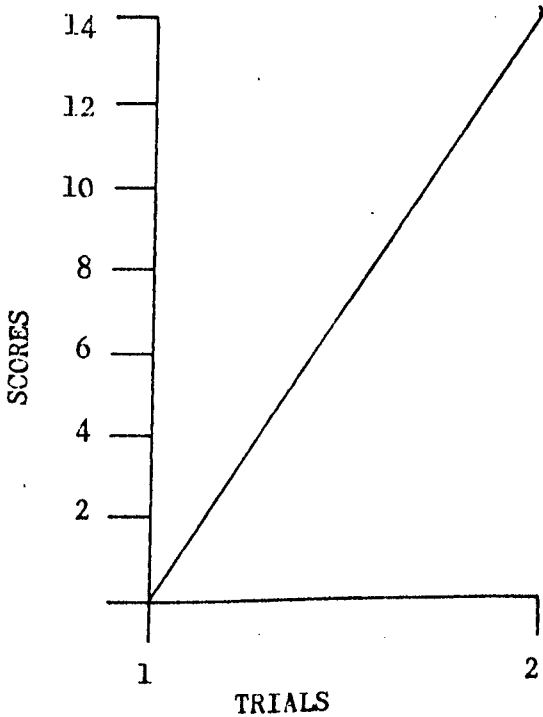
SUBJECT 5



SUBJECT 6



SUBJECT 7



SUBJECT 8

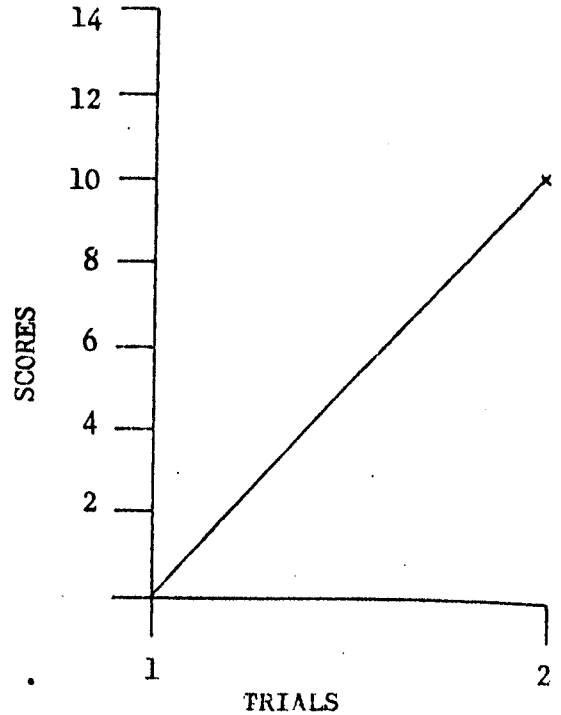
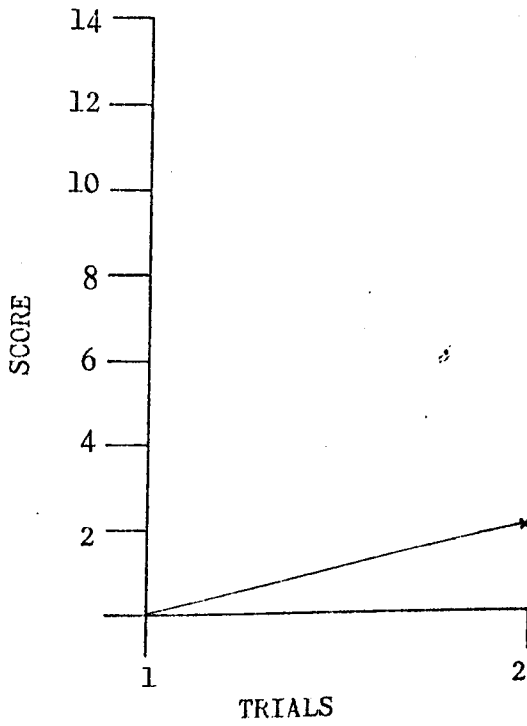
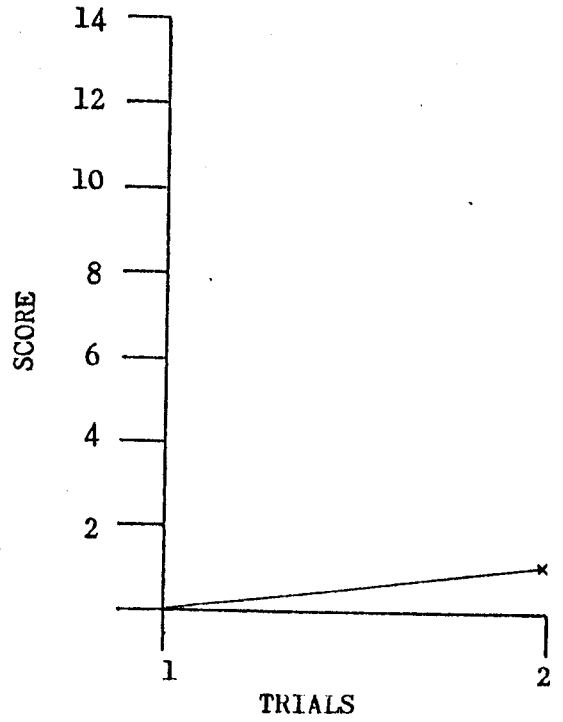


Figure 12.2 Experimental Subjects' Performances at Two Trial Points (Pre-test and Re-test) on the Figure-Ground Reversal Sub-test

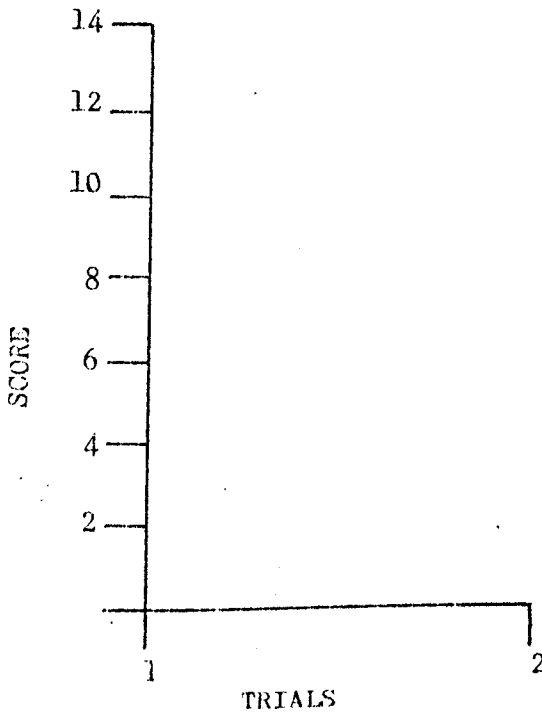
SUBJECT 9



SUBJECT 10



SUBJECT 11



SUBJECT 12

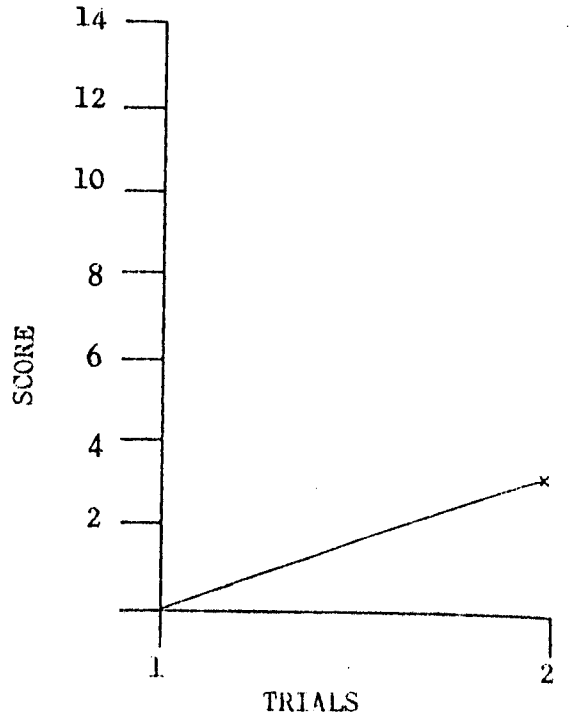
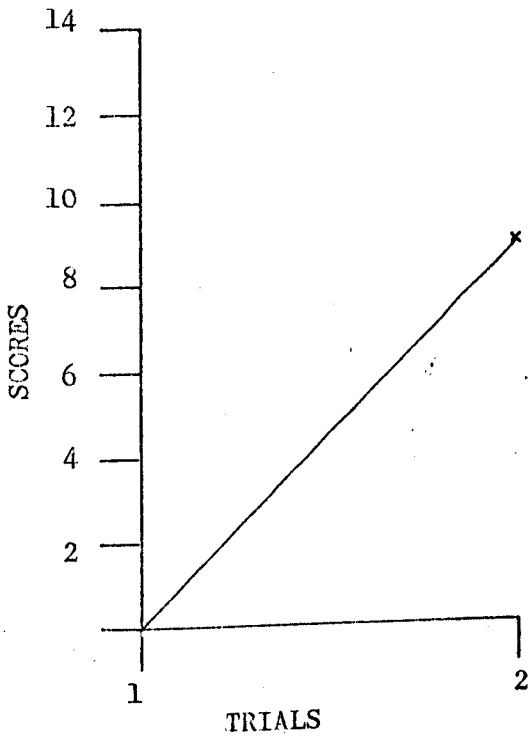
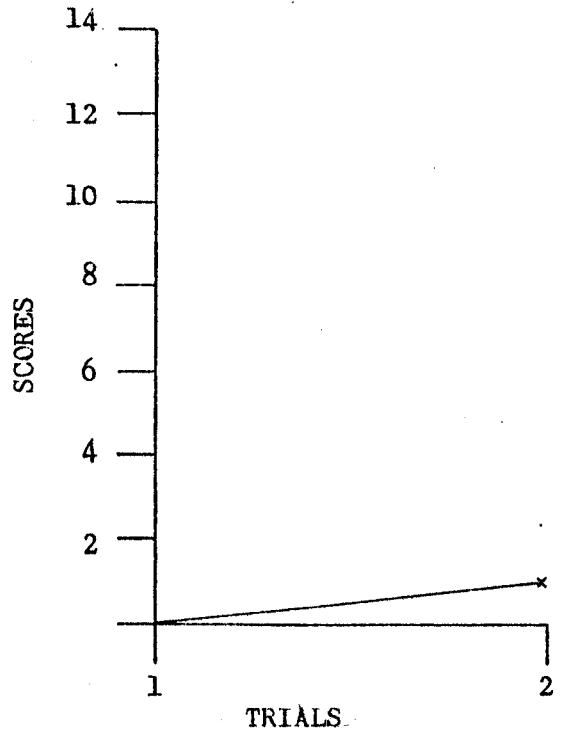


Figure 12.3 Experimental Subjects' Performance at Two Trial Points (Pre-test and Re-test) on the Figure-Ground Reversal Sub-test

SUBJECT 13



SUBJECT 14



SUBJECT 15

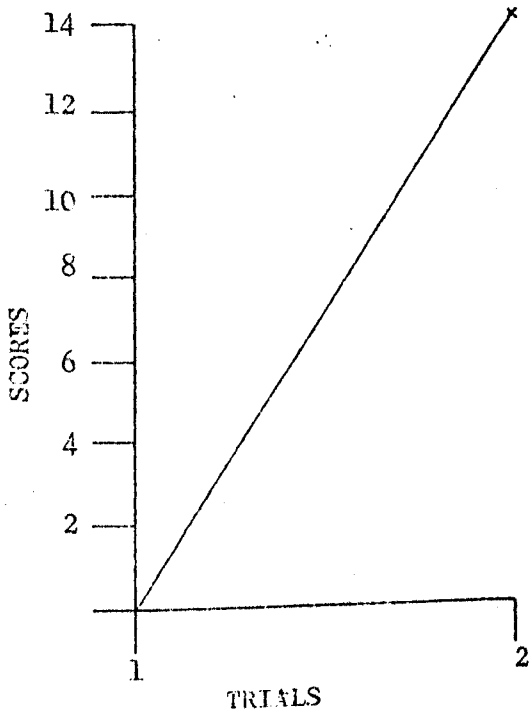


Figure 12.4 Experimental Subjects' Performances at Two Trial Points (Pre-test and Re-test) on the Figure-Ground Reversal Sub-test

Table 13

Two-Way Analysis of Variance with Repeated Measures
on Trials

Source	Sums of Squares	df	MS	F	P
Betw Subjs	466.483	29			
A	236.016	1	236.016	28.67	<.001
Subj W Gps	230.466	28	8.230		
Within Subj	702.500	30			
B	236.016	1	236.016	28.67	<.001
A x B	236.016	1	236.016	28.67	<.001
B SWG	230.466	28	8.230		

One-way Analysis of Variance at Each Level

A at B ₁	0.000	1	0.000	0.00	
A at B ₂	472.033	1	472.033	57.34	<.001
Error	460.933	56	8.230		
B at A ₁	472.033	1	472.033	57.34	<.001
B at A ₂	0.000	1	0.000	0.00	
Error	230.466	28	8.230		

Discussion

Botwinick (1973) has emphasised that poor discrimination may lead to rigidity. Developmental psychologists have indicated that the orientation dimension poses, perhaps, the most difficult discrimination. It is common observation that mentally handicapped persons will look at pictures either right-side-up or upside-down, and this does not seem to make any difference in their understanding. Moreover, they tend to confuse letters which are mirror-image reversals of each other, such as 'p' and 'q', and 'b' and 'd'. One might conclude that mentally retarded people disregard orientation in their perceptions.

The present study has shown that even the severely and moderately handicapped subjects can learn, from such training, the most difficult perceptual concepts such as Figure-Ground Reversals. The view that retarded persons have difficulty in attending or detecting spatial orientation and reversals may be because they do not regard these as critical in object differentiation. According to Gibson (1967), when one is dealing with objects, reversals:

"indicate, not a different object, but a change in the position of the same object. They must be tolerated in order for size and shape constancy to be possible."

It is indicated in this investigation, that with training, the retarded comes to regard spatial orientation of objects as a relevant dimension. This advance is due to further experience in which dimensions of upright and upside-down are relevant, and also, in part, to comprehend labels such as right, left, up, down, and therefore attending to these directions.

Careful programming in small steps, designed and re-designed in terms of the behaviour of an individual subject with immediate feedback are, of course, some of the important characteristics of such training programmes.

The emphasis on maintaining correct performance, starting with easy discrimination in the beginning and then gradually moving towards a more difficult one, is also an important factor in training the severely retarded subjects. The procedure in the present study could be interpreted in terms of the importance of relationship between attentional factors and distinctive features of a stimulus display. Further support for such training variables is reported by Samuels (1971).

The importance of a variety of cognitive abilities, including verbal and numerical skills, has been clearly recognised in research with retarded persons. However, relatively little research with this population has been focused on the importance of visual-spatial ability, i.e. the ability to understand and manipulate relations of a visual or spatial nature. The perception of orientation by the mentally handicapped should receive attention, since Hartlage (1971) and Jackson (1973) have suggested that visual-spatial skills are strongly related to the employment success of retarded persons.

CHAPTER 9

EXPERIMENT 4

CHAPTER 9

Introduction

Psychologists and educationalists have long been concerned with the cognitive functioning of mentally retarded children and adults (Allen, 1973; Robinson and Robinson, 1976). Conceptual problems incurred by this population have been interpreted in many ways. One of the most basic and recurring problems concerns the ability of handicapped children and adults to perceive, represent, and deal symbolically with various aspects of their environment. Budoff and Hamilton (1976) have stated that a learning potential approach to assessment of abilities of institutionalised moderately and severely retarded persons provides a fairer estimate of their capabilities.

The three previous experiments reported in this thesis investigated Cognitive Flexibility Training, as operationally defined by Corter and McKinney (1968) with the severely and moderately handicapped children and adults. The results of these investigations have indicated that, after receiving intensive flexibility training, these people are able to make cognitive shifts. However, much of this research can be viewed as intelligence training.

The experimenter has observed the negative attitudes of staff dealing with mentally handicapped adults in social and industrial training centres. The individuals in these centres have been allowed to stay on one particular task month after month, because the staff feel that they are very happy to stay on one particular job, and dislike having to change or learn different tasks.

Clarke and Clarke (1974b) have undertaken an extensive review on experimental work concerning training and transfer of learning in the retarded. Although they did not deal explicitly with the concept of

flexibility/rigidity in the mentally handicapped, their research on transfer in this area can be viewed in the same context. The reason being, that, if retarded persons are inherently rigid, then training on a variety of tasks would not, of itself, be able to assist them in better transfer, because these people would find it difficult to shift from one task to another. The rigid behaviour can be seen as a result of fewer activities and low demand.

At this point, it is useful to reflect on the diverse definitions of rigidity reviewed in Chapter 3. One definition, in particular, by Chown (1959), is worth noting:-

"Rigidity: a lack of change of behaviour where a change is necessary for success at task, and where the subject knows that a change is likely to be demanded."

This concept is tested in the context of variety of training in the moderately and severely handicapped adults. The rationale being, that if mentally handicapped persons are intrinsically rigid, and show lack of change of behaviour where a change is necessary for success at the task, then, by giving them a series of tasks in a session, this should produce deleterious effects on subsequent tasks presented during the session. Therefore, the aim of the present study is to investigate this concept of rigidity by comparing learning performances of one group on a few tasks in each session, with the second group carrying out several tasks in each session.

Design

Four tasks devised by the author were used as criteria or transfer tasks. These tasks were; a cancelling task, naming objects in pictures, sorting shapes, and packing cocktail sticks in a container. Two groups of fifteen subjects each were matched on the four transfer tasks (Trial 1) and then randomly allocated to one of the two groups.

The first group was required to carry out four transfer tasks (Trials 2-18) in addition to eight other tasks, each day, for a period of seventeen days. For a similar period, the second group was given four transfer tasks only, but the remainder of the time was spent listening to stories by the experimenter. On average, the time spent with the tester by the two groups was similar.

After carrying out various activities for seventeen days, on the following day both groups were re-tested on four transfer tasks (Trial 19). This experiment was designed so that any observed differences between the two groups can then be ascribed to intervening activities and is illustrated in Figure 13.

Subjects

For this investigation, fifty-five subjects were tested on the four transfer tasks, namely, a cancelling task, naming picture objects, sorting shapes, and packing cocktail sticks in containers. Two matched groups of fifteen subjects each were formed. They were then matched in pairs on the four transfer tasks and other relevant variables, such as IQs and chronological age. IQs on the Stanford-Binet test were taken from the assessment reports of the subjects, which were not more than three years old at the time of this investigation. The matching data on all the variables is shown in Table 14. It is noted that mean differences between the groups on all matched variables but one, are not significant. The two groups differed significantly in their performance on the cancelling task, with Group II, on average, performing better on this task than Group I.

Transfer Tasks

- A - Cancelling Task
- B - Naming Picture Objects
- C - Sorting Shapes
- D - Packing Cocktail Sticks

Figure 13 Design for Experiment 4 - using Four Transfer Tasks

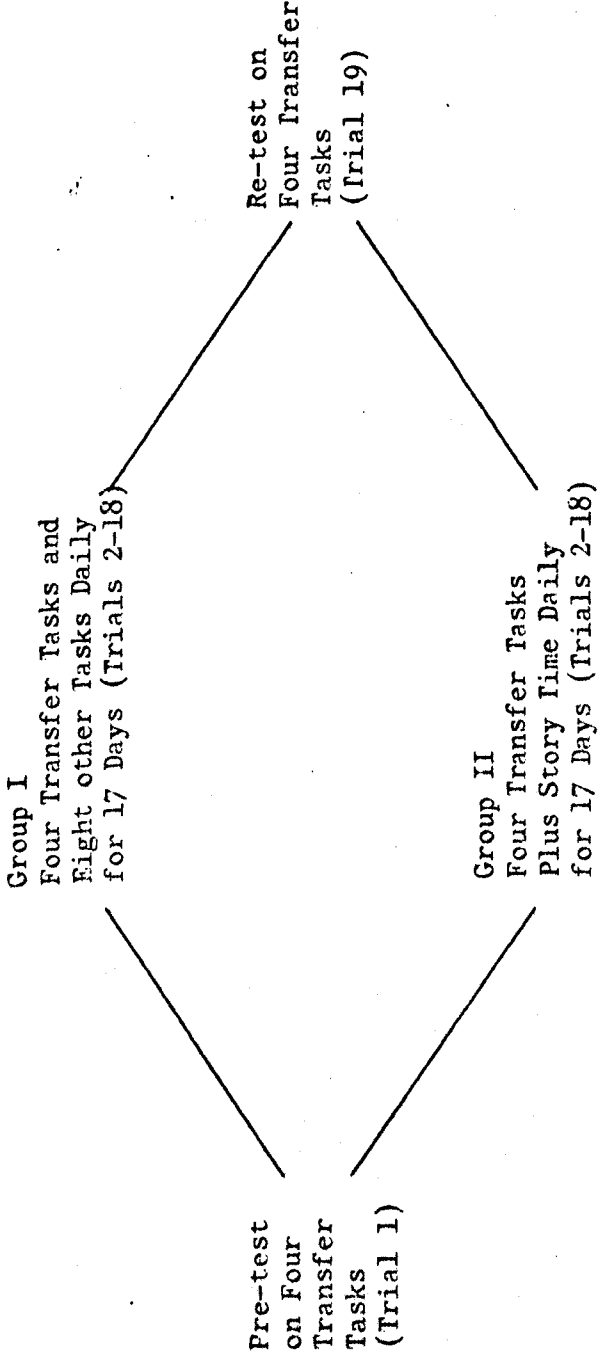


Table 14

Matching Data for the Groups

Groups	Score on Cancelling Task	Score on Naming Picture Objects	Score on Sorting Shapes	Score on Packing Cocktail Sticks	IQ's on Stanford- Binet	Chronological Age (Years)
I (N = 15)	M = 18.6 R = 7-32	M = 10.46 R = 7-16	M = 7.0 R = 1-17	M = 16.33 R = 8-32	M = 32.6 R = 30-45	M = 27.26 R = 22-44
II (N = 15)	M = 20.93 R = 9-39	M = 10.86 R = 6-16	M = 8.8 R = 1-24	M = 17.60 R = 9-34	M = 37.6 R = 28-51	M = 31.86 R = 20-47
	t = 3.09 .01	t = 0.58 N.S.	t = 2.02 N.S.	t = 1.11 N.S.	t = 1.07 N.S.	t = 1.71 N.S.

Materials

Transfer Tasks

For this experiment, the following four tasks were devised by the experimenter and used as transfer tasks:-

- (a) Cancelling Task An equal number of capital letters; A, B, C and D, were printed in a random order on a sheet of paper so that it had one hundred and twenty letters in all. The subjects were required to cancel a specified alphabet, e.g. "A". The score was taken to be the number of correct letters cancelled in one minute.
- (b) Naming Objects in Pictures Pictures of objects in everyday use were drawn on cards. Each card showed one object, and thirty-five objects in all were used for this task. The residents were shown one card at a time in a specific sequence. The score was related to the number of pictures correctly named in one minute.
- (c) Sorting Shapes Various geometrical shapes were cut out from a piece of cardboard and painted with different colours. The subjects were then presented with these geometrical shapes, together with nine different stimulus shapes, and were required to place shapes on top of the appropriate stimulus shape. The score is related to the number of shapes correctly placed in one minute.
- (d) Packing Cocktail Sticks Subjects were given cocktail sticks, containers, and one wooden jig which had fifteen holes. They were required to place one cocktail stick in each of the holes in the wooden jig, and then to transfer them into the containers. The score was taken to be the number of cocktail sticks correctly placed in containers in one minute.

The details of materials and procedure are described in Appendix D₁.

Training Tasks

With the exception of Manual Dexterity and Finger Dexterity tasks, the following tasks were devised by the experimenter, and used as training tasks.

- (a) Matching Coloured Pegs on a Board Six pegs of different colours were placed in a row on a plastic board. The residents were given a number of coloured pegs, and were required to match the pattern formed by the experimenter. The score was taken to be the number of pegs correctly placed in rows in one minute.
- (b) Sorting Colours Materials used in this task were similar to the ones used in sorting shapes, described earlier in the transfer task. The learners were given nine different stimulus colours and were required to match the stimulus colour. The score is related to the number of colours correctly placed in one minute.
- (c) Picture Classification Printed cards with pictures of various types of food and articles of wear were shown to the subjects. They were required to classify these pictures into the two groups described above. The score was taken to be the number of pictures correctly classified in one minute.
- (d) Coin-Sorting Coins of various denominations were given to the individuals, together with $\frac{1}{2}$ p, 1p, 2p, 5p, 10p, and 50p denominations as stimulus coins. The subjects were required to place the coins on top of the appropriate stimulus coin. The score was related to the number of coins correctly placed in one minute.
- (e) General Aptitude Test Battery - Manual Dexterity Task (Dvorak, 1956)
The task consisted of a pegboard with rows of holes and coloured pegs, each peg being half-red and half-white. The subjects were required to insert the red-half of the pegs into the holes, followed by the white-half. Score was related to the number of pegs correctly inserted in one minute.
- (f) General Aptitude Test Battery - Finger Dexterity Task (Dvorak, 1956)
The task consisted of a board with fifty holes, rivets, and washers. The learners were required to fit a rivet with a washer into each hole. The score was taken to be the number of rivets and washers fitted in one minute.
- (g) Coding Task Subjects were given a stimulus consisting of a red vertical line

and a green horizontal line. They were required to mark these lines in rows, alternating with red vertical and green horizontal lines. The score was related to the number of lines correctly marked in one minute.

- (h) Paper Folding Task The task consisted of folding a square paper in half. The score was related to the number of folds correctly completed in one minute.

The details of materials and procedure are described in Appendix D₂.

Procedure

All subjects were seen individually on transfer and training tasks. No corrective feedback was given to any individual when tested at pre-test and re-test on transfer tasks.

After pre-test, the residents from Group I were first given training tasks followed by transfer tasks. Each task was of a one-minute duration. Therefore, subjects received twelve tasks daily for a period of seventeen days. Most of the tasks were within the individual's capabilities. During training, when subjects made mistakes the experimenter gave immediate feedback, and they were shown the correct method of completing the given task. The order of the twelve tasks was as follows:-

1. Matching coloured pegs on a board
2. Sorting Colours
3. Picture Classification
4. Coin-Sorting
5. General Aptitude Test Battery - Manual Dexterity Task
6. General Aptitude Test Battery - Finger Dexterity Task
7. Coding Task
8. Paper-Folding Task
9. Cancelling Task
10. Naming Picture Objects
11. Sorting Shapes
12. Packing Cocktail Sticks

Subjects in Group II received attention from the experimenter in terms

of story-telling for eight minutes each day, followed by four transfer tasks. Thus, daily exposure to the experimenter for both groups was similar.

Verbal reinforcements, in terms of "well done" or "good boy or girl" were given liberally to all subjects during the training periods. Emphasis was placed on shifting from one task to another. All residents participated willingly in this investigation.

Results

Total scores on the four transfer tasks were recorded at pre-test (Trial 1) and re-test, after seventeen days training period (Trial 19). Figures 14.1 to 14.15 illustrate the performance of matched pairs on the four transfer tasks at Trials 1 and 19.

The difference score between pre- and re-tests of the two groups was analysed by two-way analysis of variance, with repeated measures on one factor task. The results are summarised in Table 15. Significant main effects for Groups ($F = 28.80$, $1/112$ df, $P < .001$) were found, indicating that the performance on re-test was better for Group I after training.

A three-way analysis of variance was computed on two tasks, namely sorting colours and shapes. Here, the repeated measures on two factors (Tasks and Trials) were taken from a single group of subjects (Group I). This analysis was performed to see if learning on one task, e.g. sorting colours during the same training sessions would interfere with learning another task, e.g. sorting shapes. The results are summarised in Table 16. It is noted that the Subject x Task and Subject x Trial interactions are significant which indicate that the subjects responded differently to the two tasks and improved on both.

PAIR 1

— Expt. Subject
- - - Cont. Subject

Figure 14.1 Paired Subjects' Performances on the Four Transfer Tasks at Trials 1 and 19

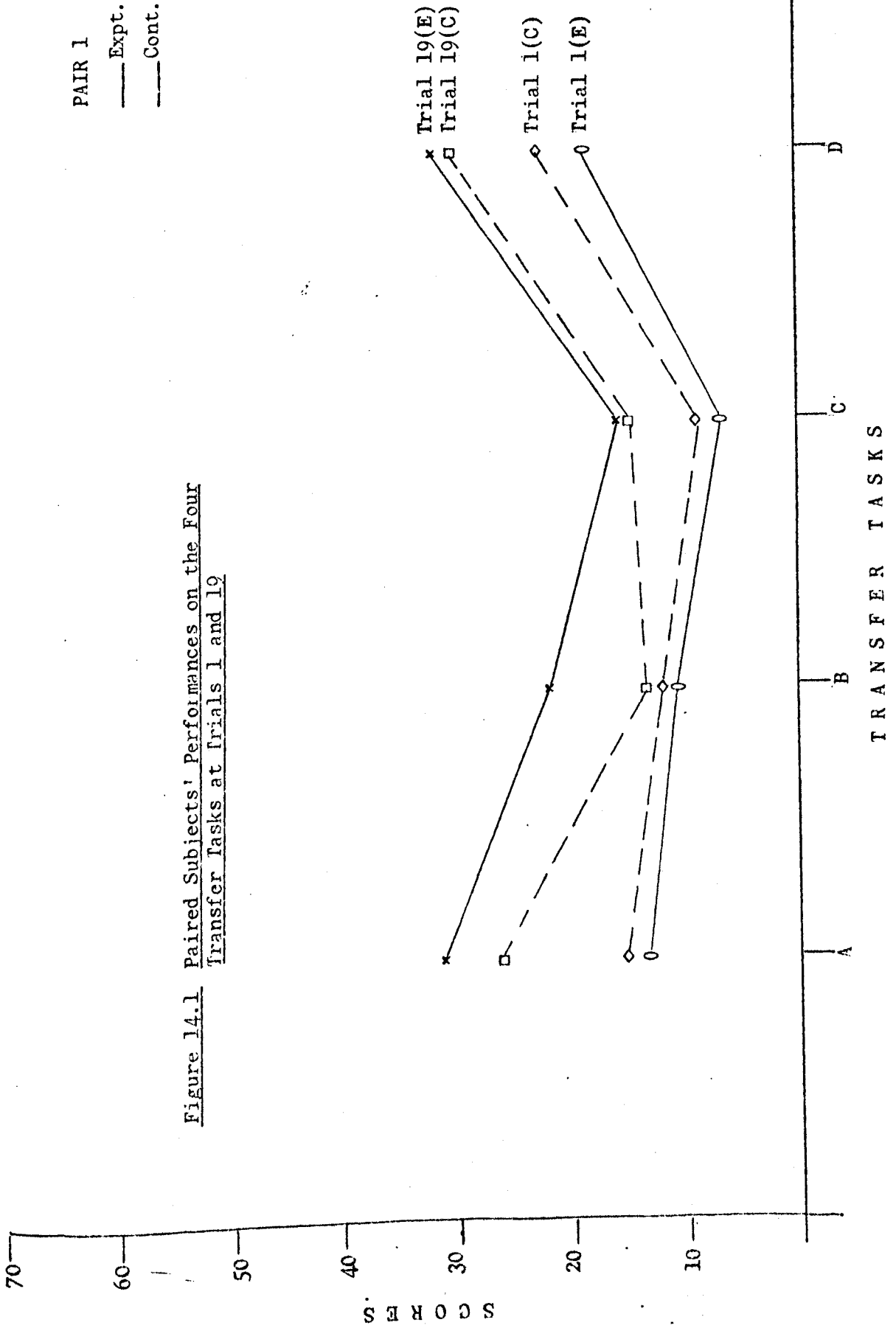
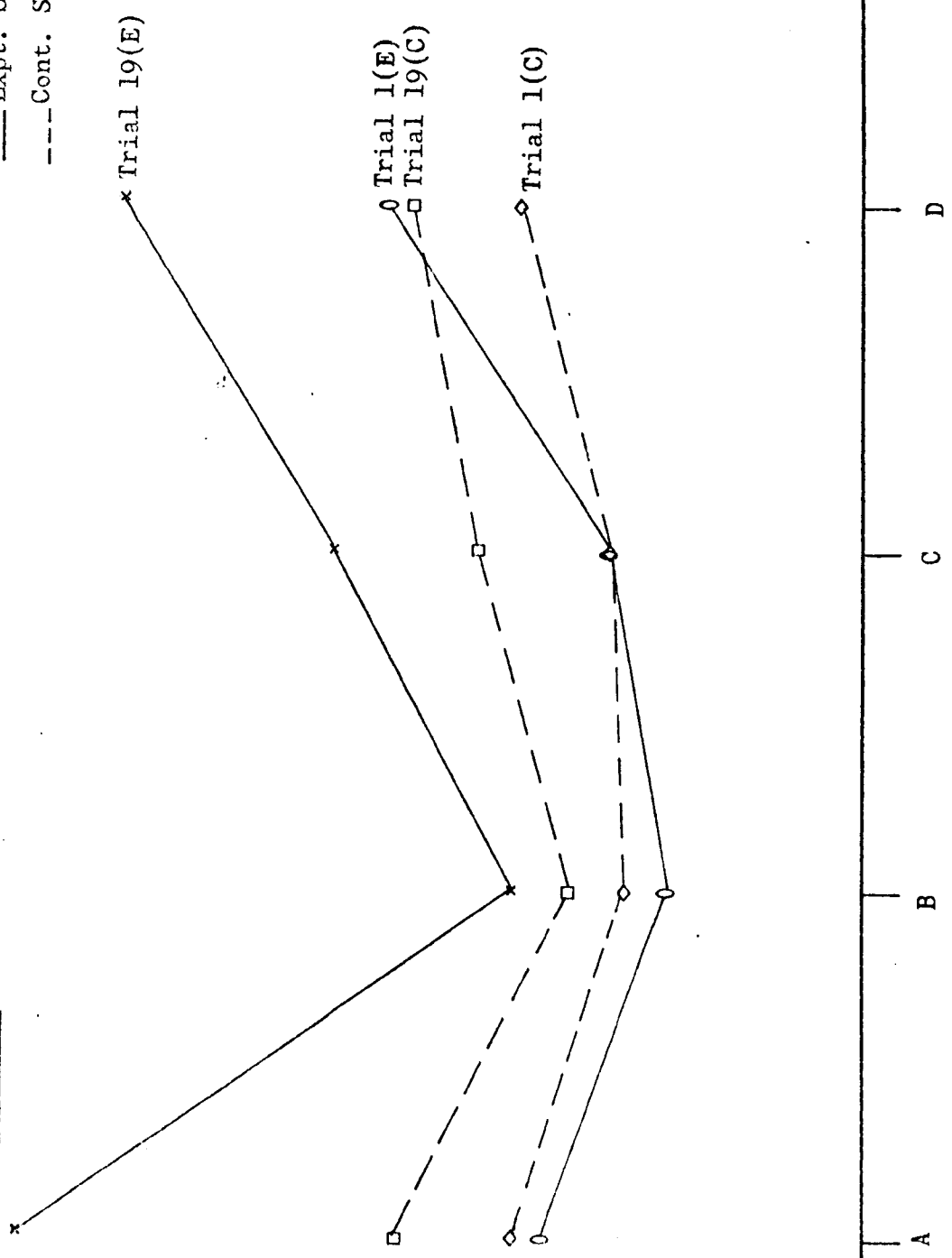


Figure 14.2

Paired Subjects' Performances on the Four Transfer Tasks at Trials 1 and 19

PAIR 2

— Expt. Subject
--- Cont. Subject

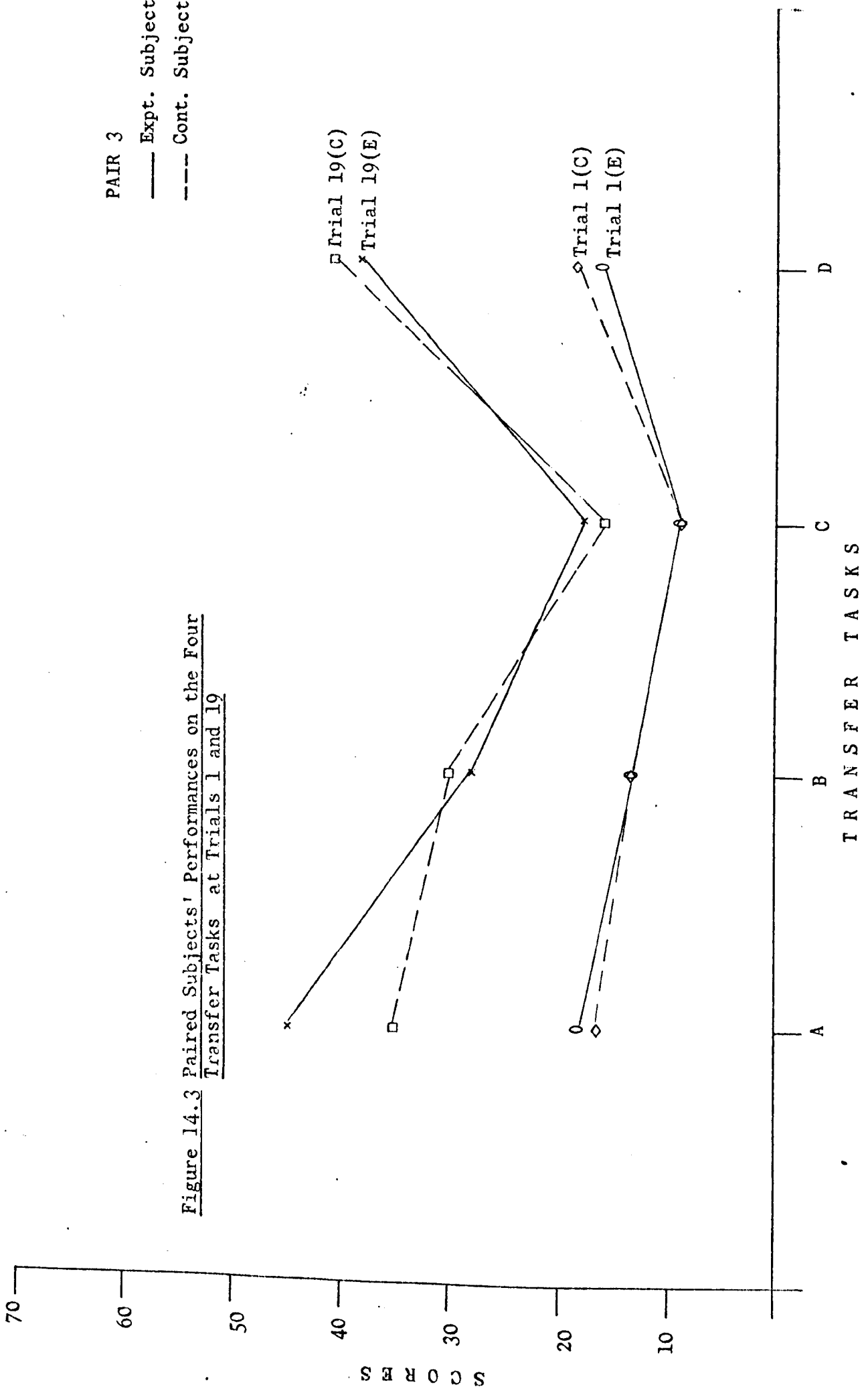


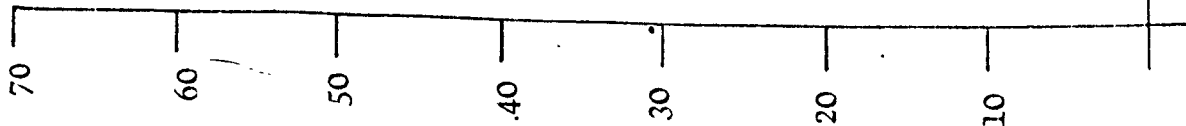
TRANSFER TASKS

PAIR 3

— Expt. Subject
- - - Cont. Subject

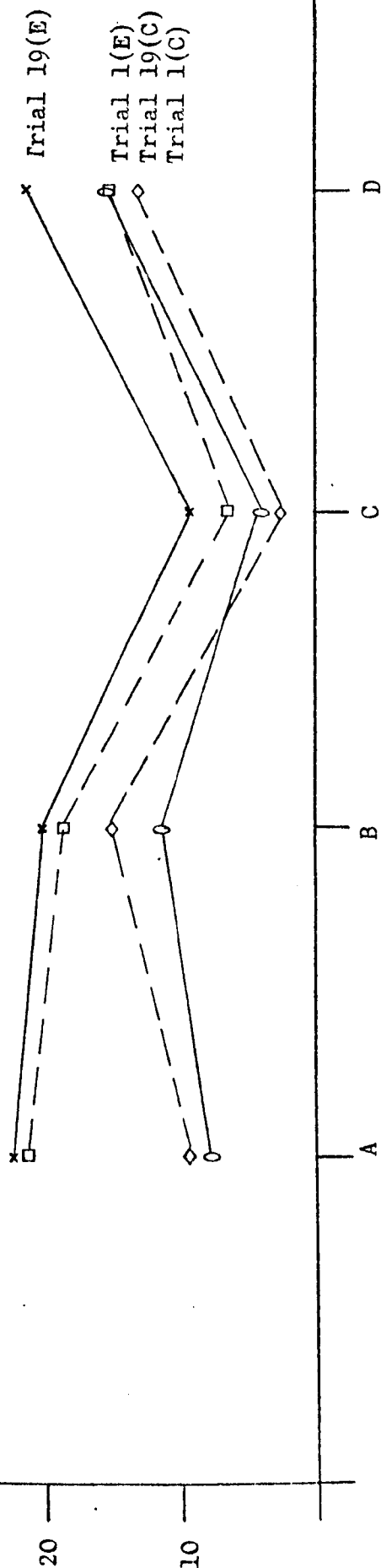
Figure 14.3 Paired Subjects' Performances on the Four Transfer Tasks at Trials 1 and 19





PAIR 4
— Expt. Subject
- - - Cont. Subject

Figure 14.4 Paired Subjects' Performances on the Four Transfer Tasks at Trials 1 and 19

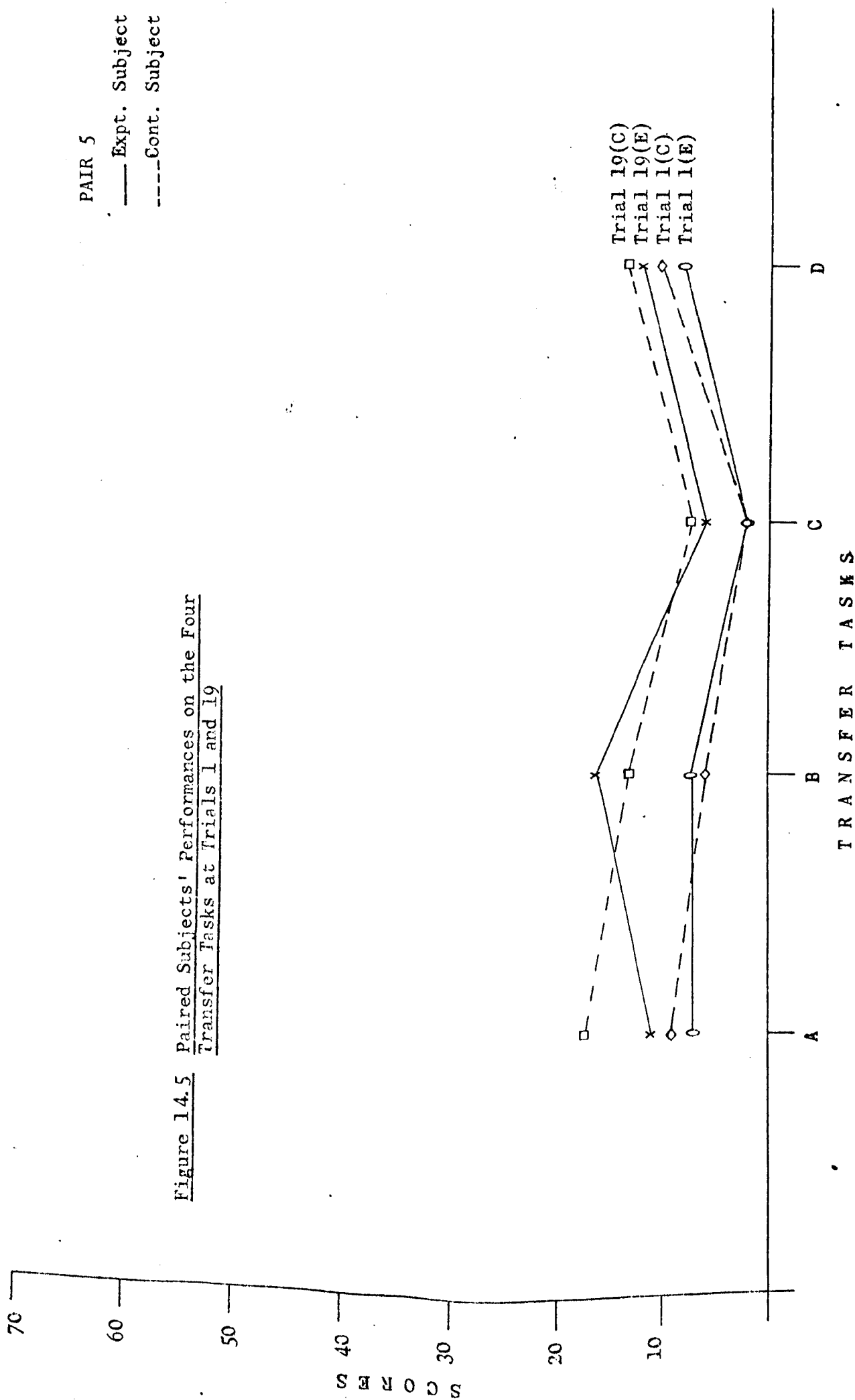


TRANSFER TASKS

PAIR 5

— Expt. Subject
 ---- Cont. Subject

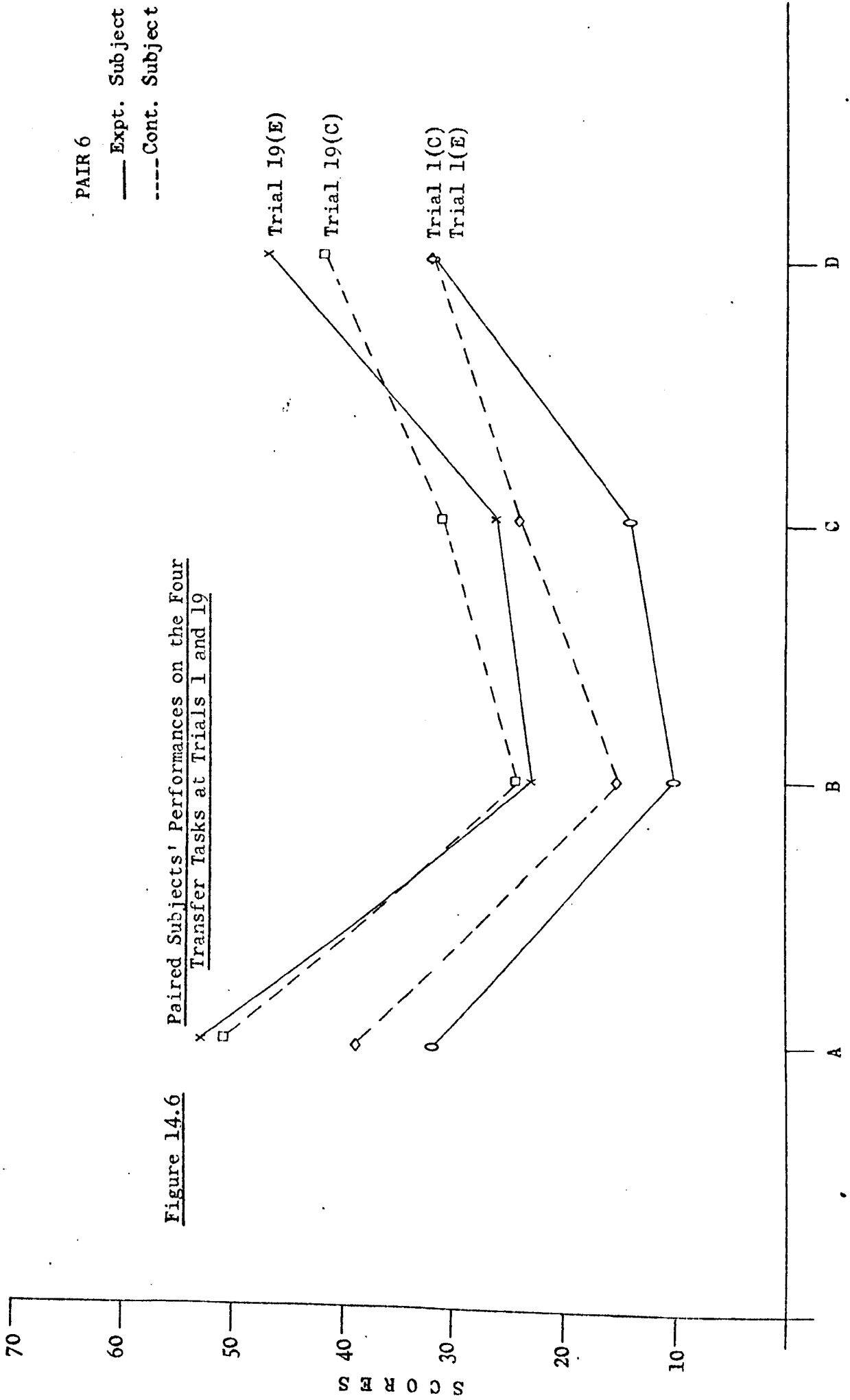
Figure 14.5 Paired Subjects' Performances on the Four Transfer Tasks at Trials 1 and 19



PAIR 6

— Expt. Subject
- - - Cont. Subject

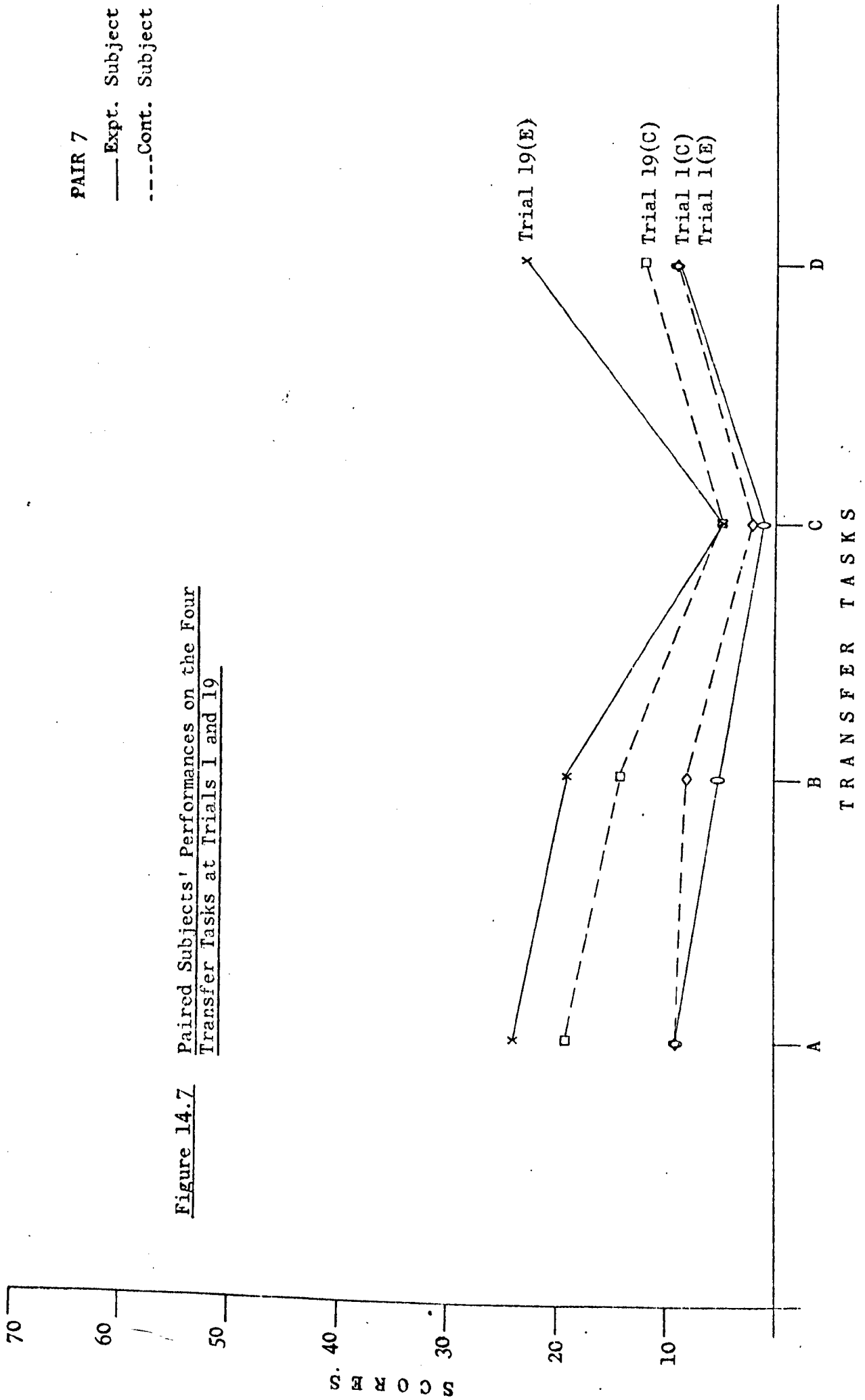
Figure 14.6 Paired Subjects' Performances on the Four Transfer Tasks at Trials 1 and 19



PAIR 7

— Expt. Subject
- - - Cont. Subject

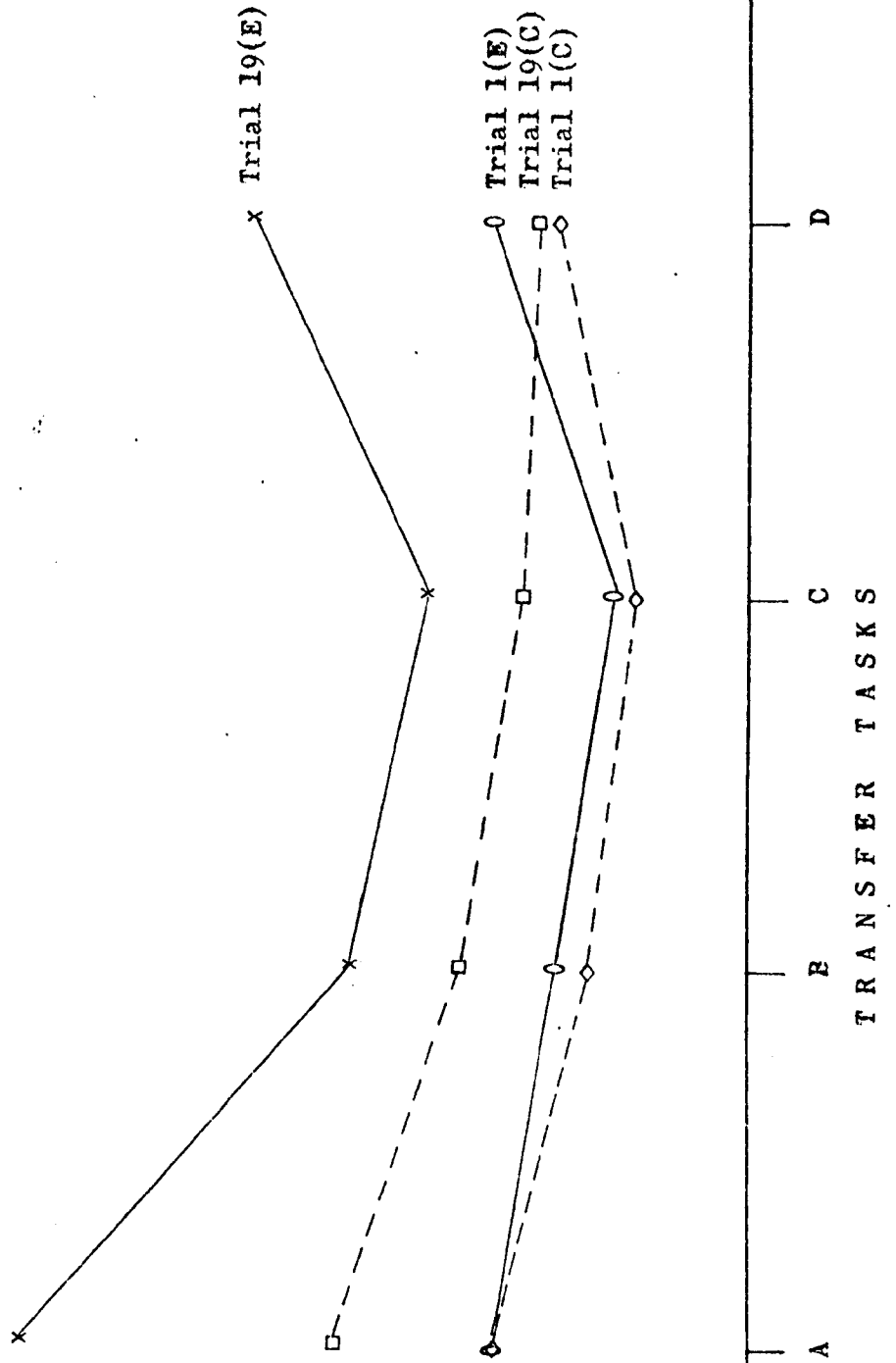
Figure 14.7 Paired Subjects' Performances on the Four Transfer Tasks at Trials 1 and 19



70
60
50
40
30
20
10
S C O R E S

PAIR 8
— Expt. Subject
- - - Cont. Subject

Figure 14.8
Paired Subjects' Performances on the Four
Transfer Tasks at Trials 1 and 19

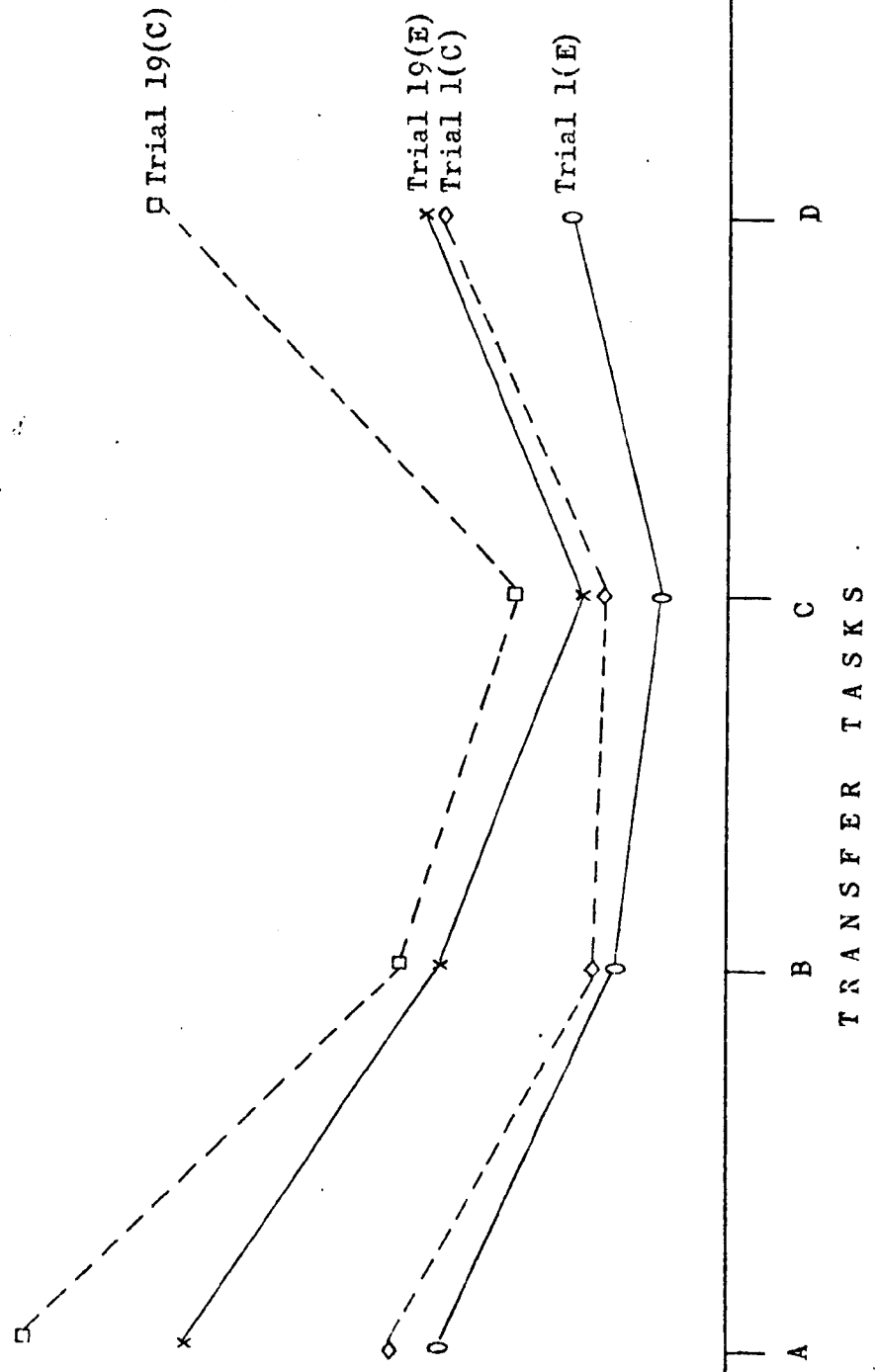


70
60
50
40
30
20
10
S C O R E S

PAIR 9

— Expt. Subject
- - - Cont. Subject

Figure 14.9
Paired Subjects' Performances on the Four
Transfer Tasks at Trials 1 and 19



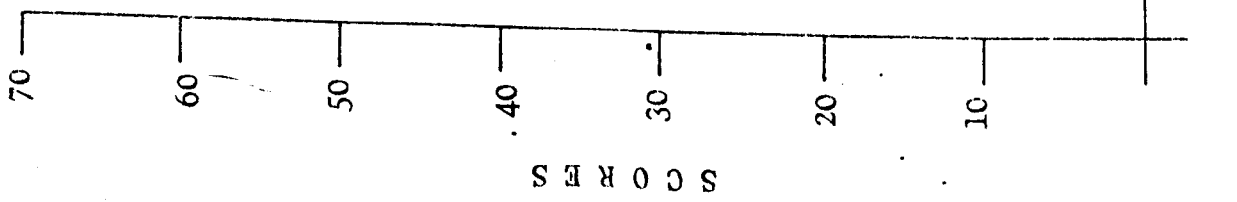


Figure 14.10 Paired Subjects' Performances
on the Four Transfer Tasks
at Trials 1 and 19

PAIR 10
 ——— Expt. Subject
 - - - - Cont. Subject

Figure 14.10

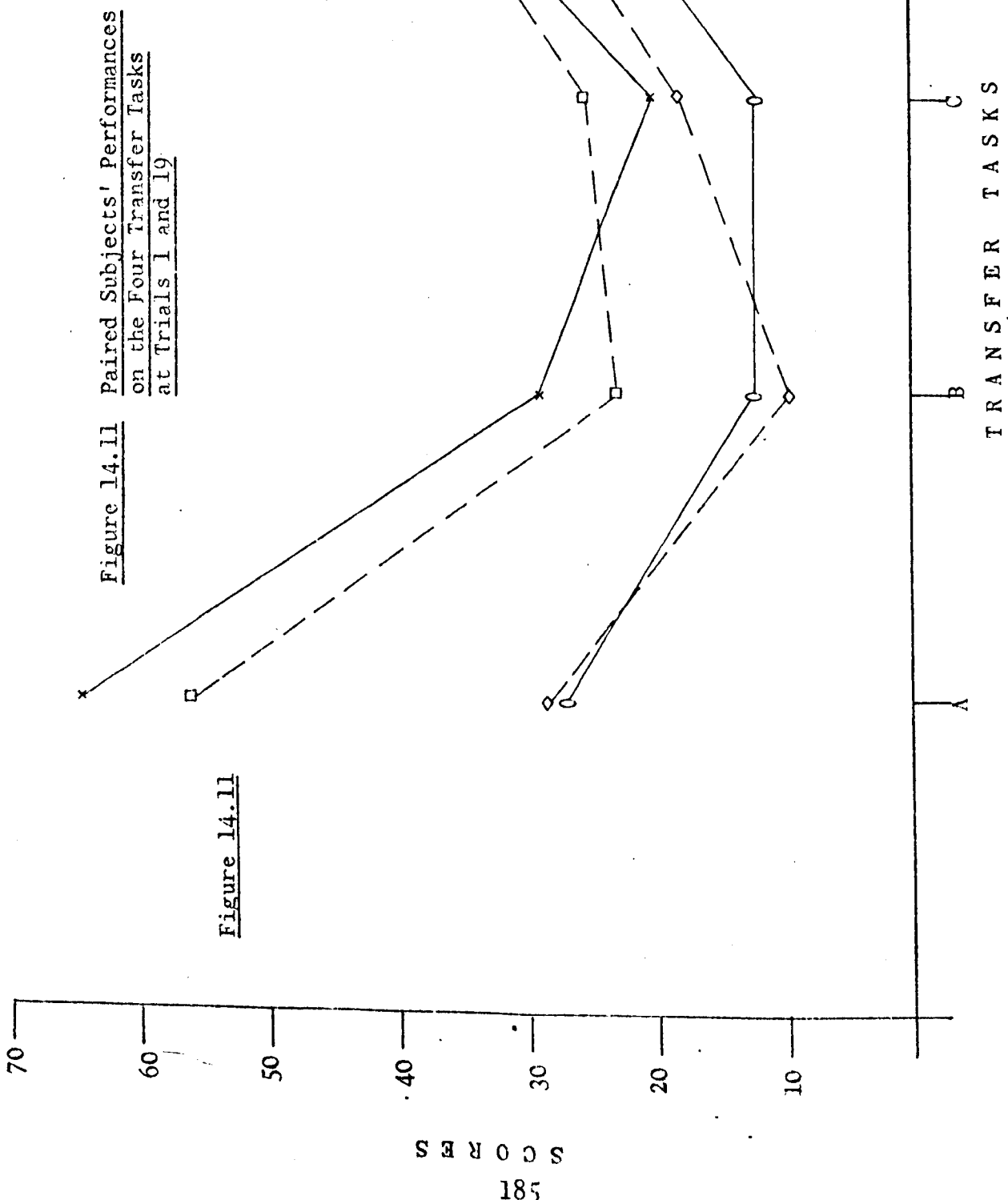


Figure 14.11 Paired Subjects' Performances on the Four Transfer Tasks at Trials 1 and 19

PAIR 11
 — Expt. Subject
 - - - Cont. Subject

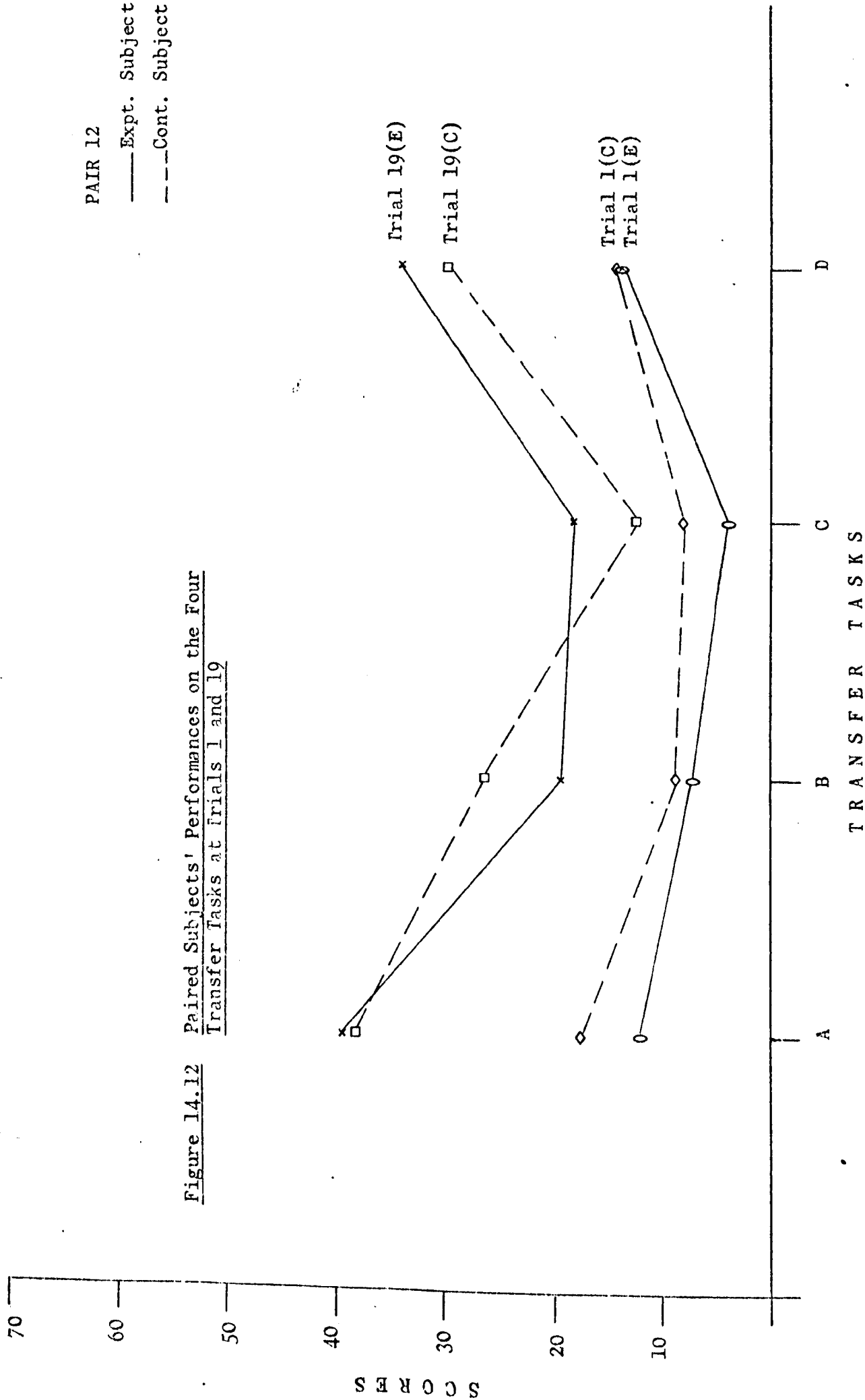
Figure 14.11

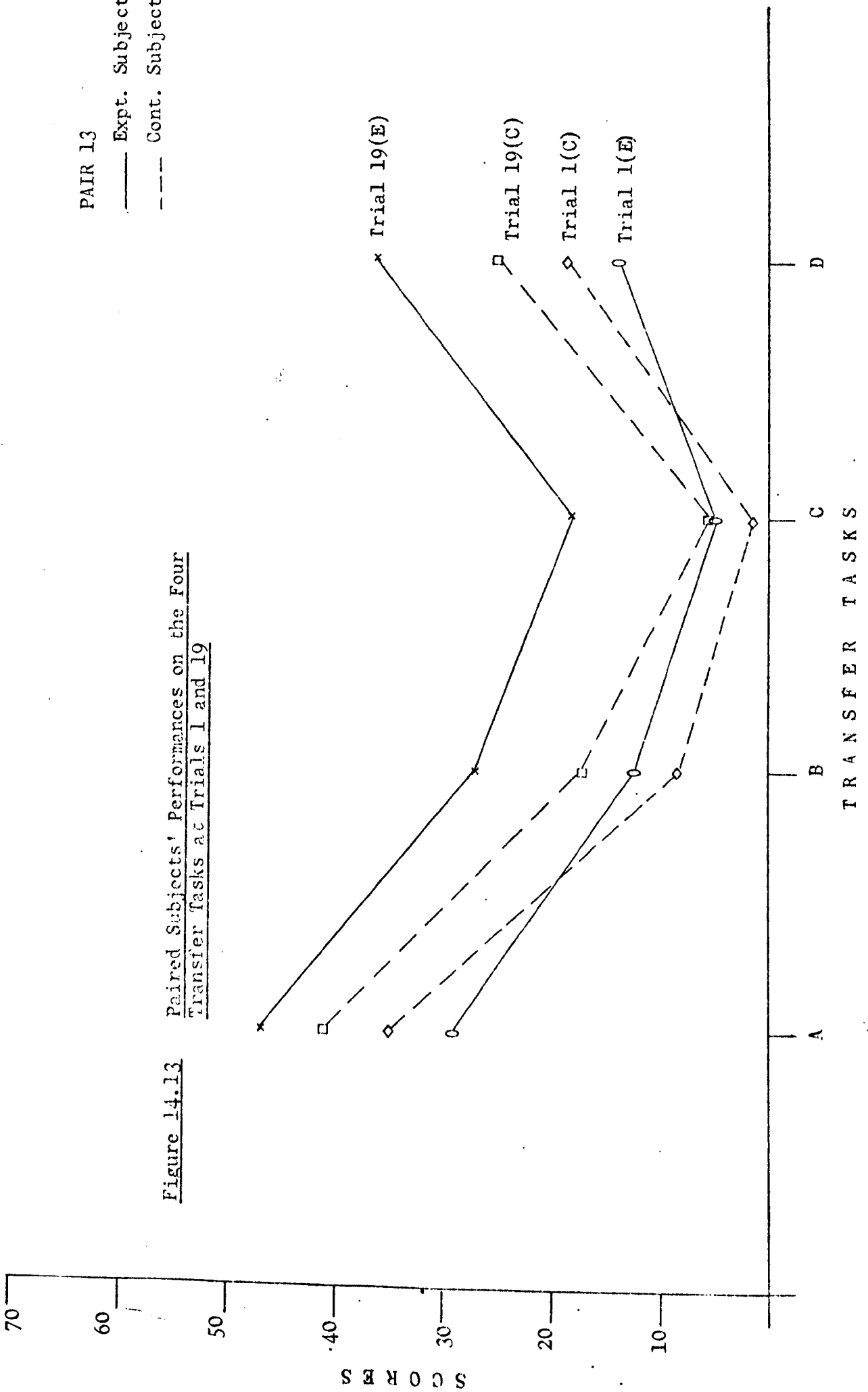
PAIR 12

— Expt. Subject

- - - Cont. Subject

Figure 14.12 Paired Subjects' Performances on the Four Transfer Tasks at Trials 1 and 19

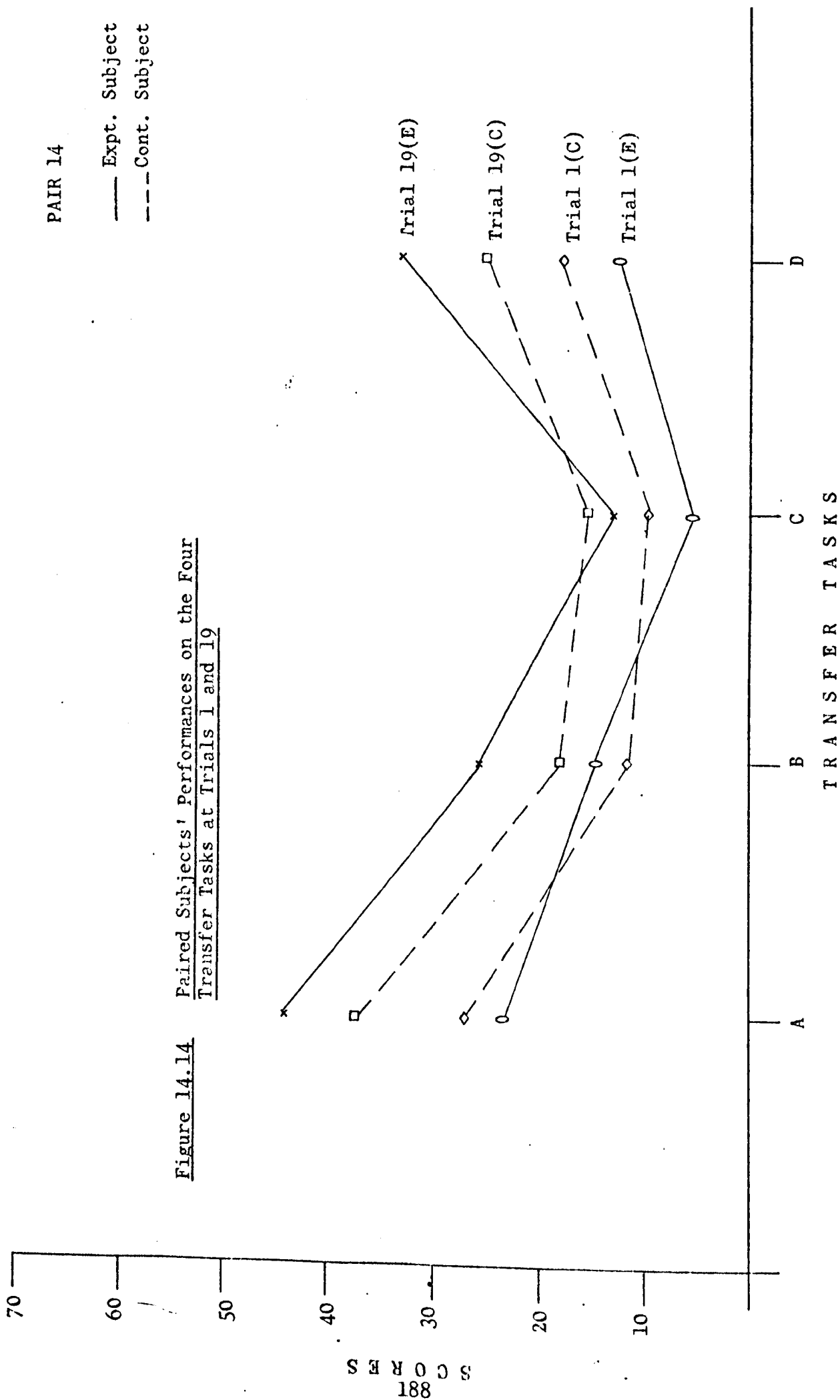


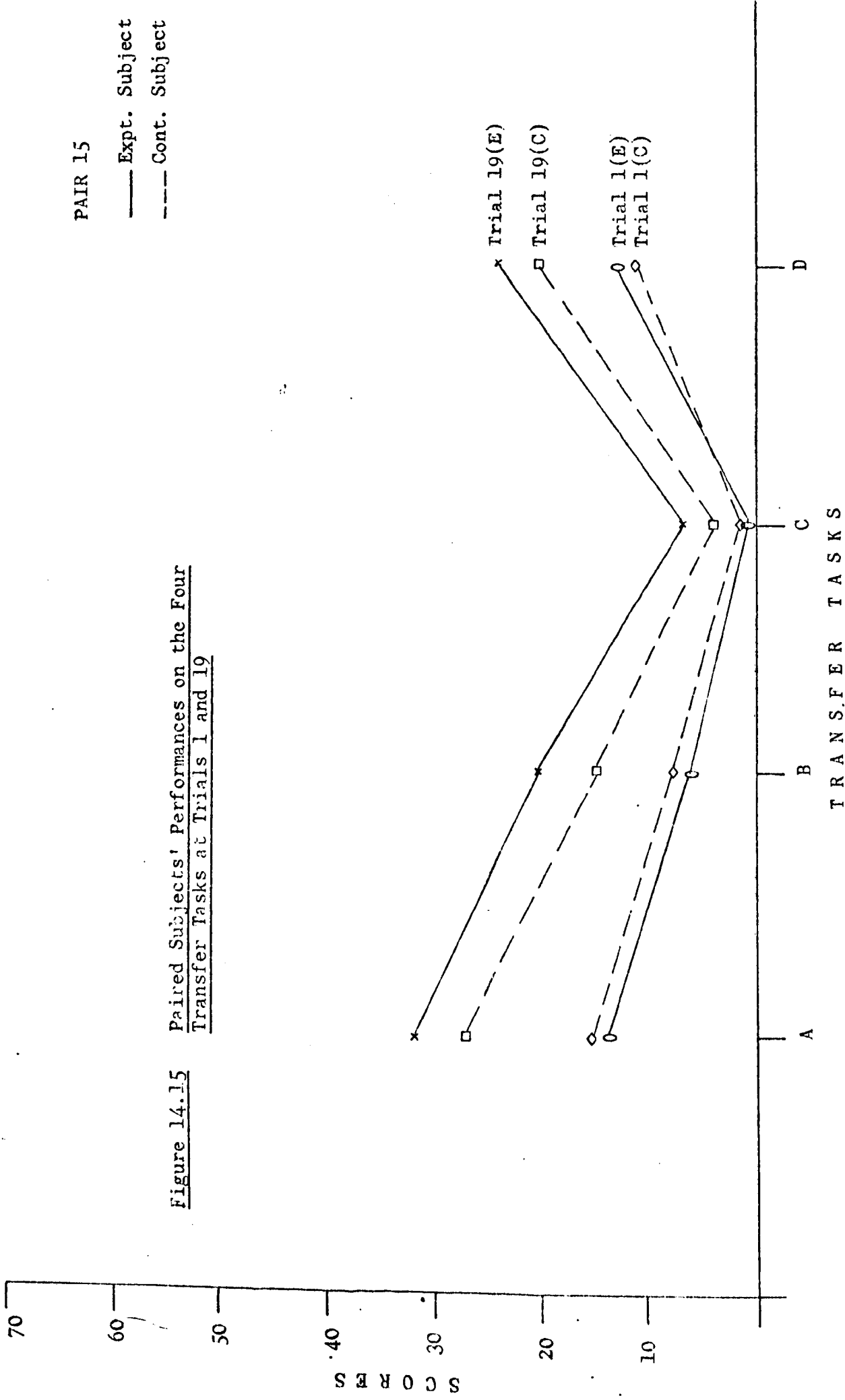


PAIR 14

— Expt. Subject
- - - Cont. Subject

Figure 14.14 Paired Subjects' Performances on the Four Transfer Tasks at Trials 1 and 19





PAIR 15

— Expt. Subject
 - - - Cont. Subject

Figure 14.15 Paired Subjects' Performances on the Four Transfer Tasks at Trials 1 and 19

TRANSFER TASKS

A further three-way analysis of variance was computed on twelve tasks, with repeated measures on Task and Trials taken from a single group of subjects (Group I). This analysis was performed to see if subjects in Group I were in fact showing increases in performance on all twelve tasks. The results are summarised in Table 17. Significant interactions between Subject x Tasks and Subject x Trials indicate that the subjects in Group I responded differently to the twelve tasks and showed improvement on all these tasks.

Table 15

Two-way Analysis of Variance with
Repeated Measures on Tasks

Source	Sum of Squares	df	MS	F	P
Groups (A)	1110.208	1	1110.208	28.80	<.001
Tasks (B)	1903.092	3	634.363	16.45	<.001
A x B	128.158	3	42.719	1.10	NS
Within Cell	4317.467	112	38.548		
Total	7458.925	119			

One-way Analysis of Variance at Each Level

A at B ₁	607.500	1	607.500	15.75	<.001
A at B ₂	124.033	1	124.033	3.21	NS
A at B ₃	132.300	1	132.300	3.43	NS
A at B ₄	374.533	1	374.533	9.71	<.01
Error	4317.467	112	38.548		
B at A ₁	1476.267	3	492.088	12.76	<.001
B at A ₂	554.983	3	184.994	4.79	<.01
Error	4317.467	112	38.548		

Table 16

Three-way Factor Analysis of Variance, where Repeated Measures on Two Factors (Tasks and Trials) are taken from a Single Group of Subjects

Source	Sum of Squares	df	MS	F	P
Blocks (Tasks)	60.000	1	60.000	5.21	< .05
Columns (Trials)	1643.267	1	1643.267	60.74	< .001
Subjects	2319.733	14	165.695		
B x C	26.667	1	26.667	7.88	< .05
B x S	161.000	14	11.500	3.40	< .05
C x S	378.733	14	27.052	8.00	< .001
B x C x S	47.333	14	3.381		
TOTAL	4636.733	59			

Table 17

Three-way Factor Analysis of Variance, where Repeated Measures on Two Factors (Tasks and Trials) are taken from a Single Group of Subjects

Source	Sum of Squares	df	MS	F	P
Blocks	13189.003	1	13189.003	138.80	< .001
Columns	12726.742	11	1156.977	31.15	< .001
Subjects	12648.017	14	903.430		
B x C	1528.164	11	138.924	13.38	< .001
B x S	1330.205	14	95.015	9.16	< .001
C x S	5720.717	154	37.148	3.58	< .001
B x C x S	1598.128	154	10.377		
TOTAL	48740.975	359			

Discussion

The present investigation re-examines the concept of rigidity in the light of the experimenter's experience with staff working with mentally handicapped in training centres administered by Social Services and the National Health Service. Staff in these centres state that severely-handicapped people like to stay on one particular task, rather than change or learn different jobs. The assumption being that these people are inherently rigid, hence the lack of provision in providing variety of jobs.

The results of the present study have shown that subjects receiving training on a variety of tasks performed better than individuals receiving training on a few. Hence rigidity in this population may be viewed on the whole as a result of low demand and fewer activities and hence poor outcome. Further evidence for the beneficial effects of varied training in the severely handicapped is provided by Sedlak (1976). Budoff and Hamilton's Study (1976) demonstrated the validity of a learning-potential assessment procedure with institutionalised moderately and severely retarded adolescents and adults.

In the present study, no comparisons of normal and retarded people were attempted, as research methodologies covered in Chapter 1 indicate the problems fraught in carrying out such comparisons. However, this investigation raises certain issues which require further research.

The present data were also analysed on two tasks for Group I, which was required to sort colours and shapes during the same session. The results indicate significant main effects for tasks and inter-action between tasks x trials, which show that, after training, the experimental subjects' performance improved on both the tasks. This is contrary to the findings of Lewin and Kounin's theory of rigidity in mental retardation.

Kounin (1941a) carried out a similar experiment on concept-switching in which the child was given a deck of cards that could be sorted out on the basis of either one principle (form) or another (colour). The subjects were asked to sort the cards in two different ways. The older retarded found difficulty in shifting from one sorting principle to another. Thus, in those instances where the individual must, on his own, move from one region to another, Kounin's formulation predicts that such cognitive movement would be more difficult for the retarded than for the normal individual. The differences obtained by Kounin on his concept-switching task resulted from the comparison of retarded with middle-class children who valued the tangible reward of being correct much more than did the retarded. Zigler (1972) provided evidence to suggest that, not only retarded, but lower-class children in general, would be inferior to middle-class children, when such a reinforcer is employed.

Lewin (1936) presented a considerable amount of observational and anecdotal material, as well as the findings of one experiment, to support his theoretical position concerning the rigidity of the retarded. Lewin's experimental procedure consisted of having groups of normal and retarded children of differing CAs draw moon faces until they were satiated on this activity. The persistence i.e. longer satiation time displayed by the ten-year-old retarded children, as compared to the ten-year-old normals, was used by Lewin as evidence of the greater rigidity of the retarded.

However, in the present investigation, if the experimenter had allowed the subjects in Group I to stay on one task, they would have obliged and persisted on the same task. However, further analysis of the data on twelve tasks, which were carried out by the subjects in the

experimental group, shows a significant inter-action between tasks x trials, indicating simultaneous improvement in performance on all tasks during the training period. Thus, the learning curves on all tasks were accelerating during this period. If severely-handicapped people were inherently rigid, then they would show a lack of change in their behaviour when carrying out several tasks in the same session. This, obviously, is not the case in this study, as the subjects did not show any decrease in their performances on twelve tasks.

In addition, Zigler (1963) suggested that the co-satiation score (i.e. perseveration on a task) mirrors a particular set of motivational determinants. He demonstrated that institutionalised children, of both normal and retarded intellects, were found to play a socially-reinforced satiation-type task longer than did groups of non-institutionalised normals and retarded of the same MA. Thus, the author suggested that co-satiation effects are the product of the relative strength of certain motivational tendencies. These tendencies, and their relative strengths, seem to be the product of particular environmental experiences, and, apparently, are open to manipulation and modification.

The present study also raises the question of whether severely handicapped people learn better by massed- or spaced-practices. However, the time spent on the tasks by the experimental subjects (twelve minutes per session per day) does not permit a satisfactory answer to this question.

CHAPTER 10

DISCUSSION AND CONCLUSIONS

CHAPTER 10

Discussion and Conclusions

The more important points which have been raised in this thesis are now discussed under the following headings:-

- (a) Do current approaches adequately explain the rigid behaviour of mentally handicapped persons?
- (b) Can a transfer of learning paradigm provide a better understanding of their adaptive behaviour?
- (c) If a transfer of learning formulation is relevant to investigations such as are reported in this thesis, then what conditions of learning will yield efficient strategies to enable mentally-handicapped people to be more flexible?
- (d) Does the present study have relevance for enhancing the quality of life of such persons?
- (e) Concluding comments.

Different Approaches in Explaining the Rigid Behaviour of the Retarded

Various definitions of the concept of rigidity have been detailed in Chapter 3 (pp 52- 53). It is obvious from these that rigidity is regarded as a manifestation of an individual's behaviour, observable in the cognitive and social fields as well as in perception. There is general disagreement in dealing adequately with both definitional and methodological demands of the formulation. It seems, therefore, fruitless to argue whether a definition is true or false. The more appropriate point of contention is, whether one definition is more useful than another in organising our thinking, bringing clarity to areas of confusion, and more usefully giving directions to our empirical efforts.

Just as there is diversity in the kinds of definitions applied to the concept of rigidity, there is a diversity of opinions as to the factors making up the rigid behaviour. In the present study, rigidity/flexibility

is regarded as continuum. Rigidity is seen as an inability to shift ideas in conceptual, perceptual, and spontaneous areas of functioning, whereas flexibility is defined as an ability to modify on-going behaviour. In the four lengthy investigations reported in Chapters 6, 7, 8 and 9, the rigidity/flexibility continuum is operationally defined in terms of transfer or criterion tasks.

An extensive review of the concept of rigidity in the mentally handicapped is described in Chapter 3. A variety of theoretical frameworks have influenced the researchers, and one common theme is often found in these studies, namely, the evaluation of the validity of developmental and different, or defect, theories of retardation (see Chapter 1 pp 7-11). These positions have caused researchers to compare the cognitive abilities of mentally retarded and non-retarded individuals (Ellis, 1979). The controversy, centres on whether the cognitive abilities of mental age-matched retarded and non-retarded individuals are quantitatively or qualitatively different. This assumption can clearly be seen in a commonly-employed research paradigm in empirical work with the retarded. Many studies directed at illuminating differences in cognitive functioning between normal and retarded subjects wrongly employ comparisons of institutionalised retarded subjects with middle-class subjects residing at home. The effects of institutionalisation on the lives of mentally handicapped people is well-documented and is described in Chapter 4 (pp 81-87).

The behaviour of the retarded, like the behaviour of any group of human beings, must reflect factors other than cognition. Cognitive processes constitute the information processing system, which mediates both inputs from the environment and responses that the individual makes in his efforts at adaptation. It is clear that the quality or nature of information-processing systems must have profound and pervasive

effects on an individual's behaviour. One assumes that rigid behaviour, from which the mentally handicapped suffer, is such a pervasive determinant of their total functioning that it makes them impervious to the effects of influence known to affect the behaviour of the non-retarded. Therefore, when comparisons are made between institutionalised retarded and non-institutionalised non-retarded individuals, the complexity of methodological issues precludes a solution to a simple question of whether institutionalised mentally retarded people are inherently rigid.

It has been proposed in this thesis that, in certain circumstances, the rigid characteristics of the retarded will reflect environmental factors. One can therefore speak of improving the performance of the retarded on a task through the manipulation of environmental factors, to the extent that variations in the performance of that exercise are influenced by the environmental variables over and above the cognitive demands of the task. The four inter-linked and lengthy experiments described in this thesis were designed to measure the effects of flexibility training with severely and moderately handicapped institutionalised children and adults. The results of these investigations indicate that severely and moderately handicapped persons are able to shift ideas in conceptual, perceptual, and spontaneous areas of their functioning. Moreover, the flexibility training provided experiences which enabled the various performance measures to reflect more accurately their cognitive capacity and competence.

Also the results of the experiments carried out by the author show that commitment to theories of rigidity proposed by Lewin (1936), Kounin (1941a, 1941b), Werner and Strauss (1942), and Heal and Johnson, (1970), is not only not advantageous but in many ways is deficient.

Their positions are based on the experiments involving comparisons between institutionalised retarded and non-institutionalised non-retarded individuals. These formulations fail to point out that particular conceptual abilities as well as levels of learning when manifested in performance, all reflect the interaction between possessed potentialities and the particular conditions of training and task demand.

However, the present investigations support the views put forward by Zigler (1972, 1973), and Clarke and Clarke (1974a, 1974b, 1977) regarding the concepts of rigid behaviours manifested by retarded individuals which are described in terms of developmental approach. Furthermore, the research design employed in the experiments reported in this thesis is determined by Assessment-intervention model which puts emphasis on the learning processes based on the concept of particular skills.

Further support for the present work comes from critical reviews presented by Bortner and Birch (1970), Berkson and Landsman-Dwyer (1977), and a review on amelioration studies, outlined in Chapter 2 (pp 19-51), with severely and moderately handicapped people. A recent study by Kamhi (1981) compared the performance of three groups of non-institutionalised children: retarded, non-retarded, and language-impaired, on non-linguistic symbolic, and conceptual cognitive tasks. The relatively similar task performances of the retarded and non-retarded groups reflect the influence of both experiential factors and overall level of cognitive functioning. Kamhi concluded that his findings clearly support the developmental theory of retardation, i.e. that children matched for MA will demonstrate similar cognitive abilities.

The dissatisfaction with the rigidity concept expressed by various researchers also stems from the way various hypotheses have been measured. Sometimes the tasks used are new to the subjects, and at other times rigidity is seen as inability to shift ideas of learned material. One can argue that tasks chosen in this thesis to measure rigidity are similar to the ones employed in intelligence tests. This criticism can perhaps be applied to the first three experiments. However, by altering the intelligence test performance, one is also improving the level of functioning. Further support is provided by Throne and Farb (1978) who have been concerned with the investigation of systematic procedures for the improvement of items corresponding to WISC categories of memory, vocabulary, and spatial relations. The important information yielded by this study is, not only that training resulted in the improvement of test performances which held over time, but that intelligence training generalized.

The overlap between intelligence and rigidity measures becomes especially crucial when dealing with the everyday social competence of the severely retarded individual. No amount of change in his environment will make it possible for him to become normal. However, rather circumscribed changes in his environment may make the difference between successful and unsuccessful employment at an occupation with cognitive demands falling within the limits of his cognitive ability. Although not terribly dramatic, such a goal is not only realistic but of the utmost social importance, in the light of the evidence that the everyday adjustment or competence of most of the retarded people residing in institutions may be as much a function of the retarded individual's environment as it is of his cognitive ability.

Transfer of Learning Paradigm to Explain Adaptive Behaviour

In the present investigations, a transfer of learning paradigm is employed, to study rigidity in institutionalised retarded people. Transfer refers to the effect of a preceding activity upon the learning of a given task. The question that at once arises is the extent to which mentally handicapped people generalise previously learned responses to new situations. The case put forward in this thesis is that if mentally handicapped people are inherently rigid, then no amount of training would enable them to perform better on subsequent tasks. However, if experience on one task does influence their performance on some other tasks, then their rigid behaviours could be seen partly due to environmental factors.

Corter and McKinney (1968) carried out a study with mildly-handicapped and bright, normal children, to provide training in making various cognitive shifts. They tested the effectiveness of their programme in increasing subjects' performance on both flexibility-type tasks and the Binet Intelligence Scale. Significant increases were reported for trained groups on flexibility variables and for Binet IQ. After further investigations with mildly retarded children, McKinney and Corter (1971) indicated significant improvement on variables measuring verbal fluency and concept formation. However, improvement was generally limited to those variables which shared content with the training exercises described in detail in Chapter 6.

Much of the research reviewed by Clarke and Clarke (1974) on transfer of training with severely and moderately retarded people has indicated that there has been an underestimation in what can be achieved with children and adults with IQ below 50. Thus, the work of Corter and McKinney (1968) and McKinney and Corter (1971) appeared to warrant further research with severer grades of mentally handicapped people.

Therefore, the major purpose of the investigations reported in this thesis was to provide training in various cognitive shifts, and to evaluate effectiveness of such training programmes on flexibility measures.

If, after training, severely and moderately handicapped people are able to modify their on-going behaviours, then it is obvious that their behaviours cannot be entirely due to their inherent rigidity.

The general design adopted for all the investigations was described in Chapter 5 (pp 89 - 90). All the subjects were tested on the transfer task or flexibility measures and then formed into matched pairs. Each pair was not only matched on the transfer task, but also on other relevant variables such as IQ, CA, sex, profiles on the individual sub-tests, etc. One member of each pair was then randomly assigned to either the experimental or the control group. The experimental group was given training in a particular area of flexibility for a set period of time, whereas, for the same length of time, the control group participated in activities other than training. Thus, exposure to the experimenter was identical for both the groups. After training, all the subjects were re-assessed on the transfer task. The rationale of the design being that, on re-test, any observed differences between the two groups could then be attributed to training.

The subjects who were involved in the four experiments were drawn from hospitals which varied in size from six hundred beds to one thousand beds. At the time of the investigations they had lived in the hospitals for eight to thirty years. The investigations were carried out in a very busy clinical setting by the author herself, and all the subjects were seen individually on transfer and training tasks. However, in the fourth experiment pre- and post-test measures on transfer tasks were obtained by two trainer staff who were assistants to the Psychology Department where this work was carried out. The results of the four

experiments, which were described earlier in detail, are summarised below.

Experiment 1 (pp 96 - 129)

In this experiment the work of Corter and McKinney (1968) was further investigated with severely and moderately handicapped children and adults with IQ 25 to 53. The Cognitive Flexibility Test which was developed by McKinney (1966) was used as a transfer task. The test consisted of six sub-tests, with two sub-tests representing each type of 'flexibility'. Perceptual Flexibility was measured by Embedded Figure and Figure-Ground Reversal sub-tests, Conceptual Flexibility by Form Classification and Picture Classification, and Spontaneous Flexibility by Classification and Tell About This sub-tests. (see Appendix A₁, pp219 -230).

The original training programme by Corter and McKinney (ibid) covered all three areas of flexibility by exposing the subject to intensive practice on relevant materials. It seemed, à priori, that a number of these exercises would prove to be too difficult for moderately and severely handicapped subjects. Hence, the easier exercises were chosen, and the contents and instructions were modified to meet the needs of the severely handicapped persons (see Appendix A₂, pp231 -254).

The results indicate that, after training, the experimental group differed very significantly from the control group on the Cognitive Flexibility Test. Differences widened during further six clearing trials on the same test. These trials were given to both the groups, to see whether this minimal exposure to practice on the Cognitive Flexibility Test would cause the induced differences to disappear. Analysis indicated that the increase in performance was differential, hence learning in the experimental group was significantly greater than in the control group. After a lapse of three months of non-practice, the difference between

the groups still remained significant. However, after a further nine months of non-practice, the differences induced by training diminished to non-significant, statistically. It is noted that most improvement occurred in Conceptual Flexibility and Spontaneous Flexibility areas. Less effect was apparent on the Perceptual Flexibility tasks. Similar effects are in evidence in the results reported by McKinney and Corter (1971). The Perceptual Flexibility area was pursued in subsequent investigations.

Experiment II (pp 130-151)

In the second experiment, flexibility training with Embedded Figures was investigated using perceptual tasks, since these tasks are frequently employed to study rigidity (Chown, 1959; and Leach, 1967). The Embedded Figure sub-test of the Cognitive Flexibility Test (McKinney, 1966) and the Children's Embedded Figure Test (Witkin et al., 1971) were used as transfer, or criterion, tasks. Subjects were matched on the two transfer tasks, and were then randomly allocated to one of the three groups. During the first part of the experiment, Groups I and III were given training exercises, devised by the experimenter (Appendix B₂ pp 258 - 262). Group I was taught by 'Placement Method', while Group III received training by 'Pointing Method'. However, Group II was given a training programme devised by Corter and McKinney (Appendix A₂ pp 231 - 254). In the second part of the experiment, a cross-over design was used, whereby Groups I and III reversed the teaching methods. This time Group I was taught by 'Pointing Method' and Group III by 'Placement Method'.

The results indicate that, after training, Group I and Group III, which were given training programme devised by the experimenter, improved significantly more than Group II, which was taught by Corter and McKinney's perceptual training programme. Furthermore, the results indicate

superiority of the 'Placement Method' over the 'Pointing Method'.

Experiment III (pp152 -165)

In this experiment, the Figure-Ground Reversal sub-test of the Cognitive Flexibility Test (McKinney, 1966) was used as a transfer task (Appendix A₁ pp219-230). A training programme was devised by the experimenter (Appendix C, pp263 to 265), which consisted of form discrimination, mirror-image discrimination, and reversing figures and backgrounds.

The results indicate that, after training, the experimental group differed significantly from the control group in their perceptual flexibility in figure-ground reversals. Hence, the results reported in Experiment 1, while correct for conditions of learning, are modifiable in a different situation. So, once again, it is clear that conditions of learning and of task demand are most important.

Experiment IV (pp 166+195)

The three investigations reported earlier related to the concepts of rigidity/flexibility as operationally defined by Corter and McKinney (1968). The fourth experiment re-examined the concept of rigidity, in the light of the experimenter's own experience with staff working with mentally handicapped people in hospitals and training centres. The tasks given to the retarded people fall mostly within their capabilities. The investigation into the concept of rigidity in the retarded becomes especially crucial when dealing with their everyday competence. Circumscribed changes in his environment may make all the difference to whether a retarded person has a rigid or flexible approach to tasks with demand falling within the limits of his cognitive abilities. This investigation is examined by providing training in a variety of tasks.

These tasks were devised by the experimenter (Appendix D₁ pp 266- 271 ; Appendix D₂, pp 272- 276), and the processes involved in carrying them out are similar to the ones commonly found in training centres. Two groups of subjects were matched on the transfer tasks. Group I was required to carry out four transfer tasks in addition to eight other tasks, a total of twelve tasks , each day for a limited period of time. For a similar period, Group II was given only four transfer tasks, but the remainder of the time was spent with activities other than training.

Results indicate that, after training, Group I performed significantly better on the transfer tasks than Group II. Analysis also indicates that, at the end of the training period Group I showed improvement in performance on all twelve tasks. Hence, the variety of relevant training affects transfer.

Another important point to note from the results is that, during the same training session, Group I which carried out two tasks, namely, sorting materials according to colour, and form, improved on both these tasks simultaneously. These findings are also consistent with the results of Experiment I, insofar as it related to sorting concepts. These results contradict the findings reported by Kounin(1941), which indicated that subnormals are unable to shift from one concept to another (dimensions), when the same material is used for both tasks.

It is important to indicate that, because of methodological problems involved, no attempt was made to carry out comparative studies involving institutionalised retarded people with a non-institutionalised population. Therefore, any generalisations from this work should be limited to institutionalised, moderately and severely retarded adults and children. Secondly, all the investigations were carried out by the

author herself with the exception of the fourth experiment, during which pre- and post-measures on the transfer task were obtained by two independent assessors who did not know the purpose of the investigations. The pre- and post-measures they obtained were consistent with the observation made in the fourth experiment by the author herself. However, the results reported in the same experiment were not quite as predicted by the experimenter.

At the onset of research, it seemed totally justified to regard, initially, low-scoring subnormals as a somewhat homogeneous population. However, it became obvious that, after intensive training, the final level bore little or no relationship with the starting level. The individual profiles of each subject for every experiment is described on pp 111-122; pp 138-144; pp 159-162; and pp 175-189. These findings are consistent with the work of Clarke and Clarke (1974b) in their review of 'Severe Subnormality - Capacity and Performance'.

It is noted that, in all the experiments, subjects were able to retain the induced learning sets over twenty-four hours. In addition to this, Experiment 1 (pp 96 - 129) demonstrated subjects' ability to retain and transfer these skills after three months. Further evidence for retention of learning sets with severely and moderately handicapped people have been provided by Clarke and Cookson (1962), Heywood and Heal (1968), Crosson (1969), Gold (1972), and Litrownik et al. (1978). Clarke and Clarke (1974), however, concluded that much more information is needed on the degree to which learning sets may be retained. Apart from the nature of the tasks, at least two powerful factors seem to be involved.

Firstly, the amount of learning and over-learning undertaken and, secondly, the degree to which the ordinary life experience of these subjects possesses relevant reinforcers or demands the direct use of

the induced sets. This conclusion is also supported by the results obtained in Experiment I (pp 108 - 126), where the differences induced by training in the instruction group diminished to a non-significant level after nine months of non-practice.

It seems that the concepts of rigidity based on the difference model has a narrow and over-simplified approach to institutionalised,retarded people. The four lengthy and inter-linked investigations reported in this thesis have demonstrated that some of these concepts in this population are modifiable. The present studies generated the conclusions that the retarded person must be viewed as an individual and is not to be understood in terms of some stereotyped views of retardation. Furthermore, these investigations disclose that the retarded are shaped by, and respond to, their environment.

The Nature of Transfer Facilitated by Flexibility Training

The learning of complex abilities and content, e.g. ideas, concepts, rules, and principles involves associations between internal processes, as well as the principles of transfer of learning and discrimination.

Gagné (1965) has proposed a cumulative learning model that attempts to account for such learning. He postulates that there are eight types of learning - hierarchically organised. In order of increasing complexity the eight types are:

Signal Learning - learning a response to a signal, as in classical conditioning;

Stimulus Response Learning - learning a connection between a response and a discriminated stimulus;

Chains - chains of two or more response connections;

Verbal Association - learning of chains that are verbal;

Multiple Discrimination - in which the individual learns to make 'n' different learning responses to as many different stimuli;

Concept Learning - the acquisition of a capability of making a common response to a class of stimuli that may differ from each other widely in physical appearance;

Principle Learning - a chain of two or more concepts;

Problem-Solving - a kind of learning that requires the internal events called thinking.

In thinking, two or more previously-acquired principles must be combined to produce a new capability.

From observations in Experiments I, II, III, and IV, it is clear that most of the learning of severely and moderately handicapped institutionalised people has gone through the various stages of the above model. A hierarchical order of skills, as Gagné (ibid) outlined with normal population, has been used by severely and moderately handicapped people, in order to learn how to shift ideas in Perceptual, Conceptual, and Spontaneous areas of functioning. The subjects learned verbal associations, multiple discrimination, concept learning, and principle learning. The nature of transfer, facilitated by flexibility training, is discussed in this section.

The perception and comprehension of information in the environment is the first process in all problem-solving sequences. Increasing differentiation in perception implies greater precision in recognising similarity and differences in physical stimuli. Encoding processes, including stimulus pre-differentiation, whole-part perception, and perception of spatial orientation have been investigated in Experiment I (pp 96 - 129), Experiment II (pp 130-151), and Experiment III (pp 152-165).

It is reported that the younger child's preference for reacting to the whole stimulus, rather than parts, interferes with his ability to notice changes in the internal parts of a stimulus. It seemed appropriate to study the principle of stimulus pre-differentiation to teach mentally handicapped people whole-part perception. The principle was investigated in Experiment II (pp 130- 151), by using 'Placement' and 'Pointing' techniques to teach subjects embedded figures. Training by the 'Placement' method involved manipulating stimulus figures, to enable the subjects to break up an organised visual field in order to see a part of it separate from that field, thus directing the subject's attention to relevant dimensions. The results detailed on pp'137 indicated the superiority of 'Placement' method over 'Pointing' technique.

Important developments in encoding processes also involved teaching verbal associations, at the expense of imagery, in the interpretation of environment, directing the subjects' attention to relevant aspects of events, and increased ability to maintain attention on a problem without being distracted. It is possible that the subjects in the investigations comprehended verbal associations to solve problems, without being able to clearly express themselves. As Clarke (1975), Personal Communication, reported by Sedlak (1976), has pointed out, that severely subnormals have no difficulty in classifying everyday objects. For example, they recognise a variety of different stimuli as chairs, and differentiate sufficiently well enough (in most cases) so as not to sit on tables. Training, therefore, must:

- (a) elicit the strategy from the subject
- and
- (b) ensure that the probability of its transfer is maximised.

A young child, although often failing to pay heed to the orientation

of objects, is capable of detecting and reacting to spatial orientation, if his attention is specifically called, and rewarded, to this dimension. It is reported, in Experiment III, (pp152 -165), that many severely and moderately handicapped people appear to have a difficulty detecting the difference between a figure and its mirror image. By using basic principles of perceptual development, namely, differentiation of stimuli, and attaching labels to specific stimuli, they were able to make these distinctions quite easily. With increasing learning, the retarded comes to regard spatial orientation of objects as a relevant dimension.

There are important developmental, as well as individual, differences in the kinds of conceptual categories the subject uses to classify information. Normally, one is concerned with the content of a concept, e.g. does the concept deal with people, animals, plants, etc? However, a second aspect of a concept pertains to its formal qualities. The formal aspect deals with the quality of the grouping, independent of its specific content. Some of the major formal dimensions proposed by Kagan, Moss and Sigel (1963) include the following:-

1. Superordinate of Categorical Concepts

When a categorical concept is used, it represents a shared attribute among the objects. The subject who groups pears, apples, or bananas together, under the label 'fruit' is using a superordinate concept. Materials learnt by subjects for Picture Classification in Experiment IV (Appendix D₂ pp 274) fall into this category.

2. Functional-Relational Concepts

In these concepts, the basis of similarity involves the relation between, or among, members of the class. Example of functional-relational concepts includes grouping a match with a pipe, because the match lights the pipe. Materials for Picture Classification in Experiment I (Appendix A₁ and A₂, pp 222, 245)fall into this category.

3. Functional-Locational

In this case the members of the class share a common location. The subject who groups all animals that live on a farm is producing a functional-locational concept. Indeed, this was the case in Picture Classification in Experiment I (Appendix A₂, pp 236-240).

4. Analytical Concept

The basis for similarity involves a manifest component that is part of each stimulus in the category. An example would be to group together all living things that had legs. Materials for classification in Experiment I (Appendix A₂, pp 238, 240) fall into this category.

There are developmental changes in the use of these four conceptual categories. As the individual grows, he is more likely to use superordinate categorical dimensions and less likely to use functional dimensions in classifying familiar materials together. However, the tendency to produce analytically-based concepts with visual stimuli (objects or pictures) tends to increase with age. It is important to realise that the individual who uses analytic or relational concepts with pictures may not do so when he is presented with words. The individual's strategy of classifying information depends to a great extent on the material being classified, Olver and Hornsby (1966).

An attempt to establish the importance of another variable, the role of task variety on the transfer of problem-solving skills, as well as shifting of concepts of already-learnt tasks (spontaneous learning) was investigated in Experiment IV (pp 166-195). The paradigm employed allowed transfer after training on four tasks to be compared with that of training on twelve tasks (varied training). The total number of training tasks was, of course, held constant. Flexibility measures obtained showed facilitation of transfer due to varied training.

Morrisett and Hovland (1959) have shown the importance of task variety

in human problem-solving. The most significant finding of their study was that training that gives the learner the opportunity to both fully learn a particular type of problem, as well as experience several types of problems, yields maximum transfer. A high degree of original learning is important, in order to strengthen the correct response tendencies, and practice with a variety of tasks provides the learner with the opportunity to discriminate between relevant and irrelevant cues.

Sedlak (1976) has also argued that, when a strategy is trained in a variety of situations, it is stored in association with many contextual cues. Therefore, when a 'new' situation is presented, there is an increasing probability of contextual similarity serving as a cue for the retrieval of that strategy. This model also incorporates the work of Clarke, Cooper and Clarke (1967) who have demonstrated that complexity of training enhanced transfer in the mentally handicapped. This variable was defined by the number of dimensions present in the material. A strategy trained on a complex task would have been stored in association with many contextual cues, and hence would be more likely to be retrieved in the transfer situation.

Another important aspect in the economy of learning is the extent to which learning of one thing helps in the learning of something else. Non-specific transfer refers to transfer not dependent upon any specific features of the task, but dependent upon more general characteristics. It seems that retarded persons' growing independence from the specific must take place through the development of certain intellectual skills built up by learning.

From observations of transfer and training tasks reported in Appendices A-D (pp 219 - 276), it appears that transfer occurring in the severely and moderately handicapped can be classified as ranging from specific to

non-specific. The acquisition of certain principles learnt by subjects in one situation were relevant to another situation. However, the wealth of learning material contained a tremendous number of components which can be seen to differ from each other. If the retarded fully used their capacity for registering the differences in objects and for responding to each event as unique, they would have been overwhelmed by the complexity of learning material. However, by forming concepts, the retarded reduced the complexity of learning material. This must have facilitated their ability to deal effectively with a different complex problem, which, if it was to be solved, also needed to be reduced in complexity. In other words, practice in one form of categorising improved their ability to undertake a different system of categorisation, as illustrated in Experiment I (pp 96 -129). Further support for non-specific transfer in the retarded is reported by Clarke, Cooper and Clarke (1967).

The rationale of the presented work lies in the belief that, if the exact nature of transfer can be determined, more efficient means of training can be devised. A beginning has been made by demonstrating that various strategies of encoding, including acquired distinctiveness of various stimuli, various forms of concept formation, and variety of training increase transfer in severely and moderately handicapped subjects.

Relevance of Present Study to the Life Style of Institutionalised Retarded Persons

The concept of rigidity has considerable impact on our conceptualisation of the retarded, as well as on the treatment and training practices devised over the years to help the retarded. Mittler (1973) has stated that much remains to be done before the functioning of hospitals, training centres, and their staff is based on a scientifically

acquired knowledge of behaviour. A recent report by National Development Group for the Mentally Handicapped (1978) indicates that fifty thousand citizens of this country have lived in hospitals for twenty years or more. Anyone who looks at mental handicap hospitals today cannot fail to be struck by the discrepancy between the quality of life of the general population, and that of mentally handicapped residents in hospitals.

The psychological study of moderately and severely retarded people provides an opportunity for assessing the behavioural effects, on the one hand, of brain damage of varying degrees and, on the other, of extremely adverse socio-cultural factors. An outcome of such research is a significantly improved prospect of diminishing the extent of individual handicap. The major contributions of the present work to the understanding of environmental variables in the development of the mentally handicapped persons are four-fold.

Firstly, it has been shown that subjects who live in a less stimulating environment, i.e. an institution, respond to flexibility training. The present results are analogous to the data reported by Clarke, Clarke and Reiman (1958), and Zigler and Balla (1977). They demonstrated that increases in IQ scores shown by mildly subnormal subjects after institutionalisation were greater for those subjects who came from the worst home backgrounds. According to Zigler and Balla, there is evidence to suggest that some institutions socialize their residents in the direction of reduced behavioural spontaneity and/or conformity. They found high levels of imitation in individuals institutionalised a relatively long period of time, and in individuals who were the recipients of institution, as opposed to, resident-orientated care practices. Thus, many of the institutionalised retarded persons appear to live in a highly predictable environment that emphasises conformity.

Such conformity may be a form of adjustment to the institution.

The imitative and conforming child distrusts spontaneous solutions to problems, and may be ill-equipped to function in a less-organised environment.

A second contribution of the work has been to identify factors which would enable mentally handicapped people to be more flexible in their approach in solving problems. The present experimental studies employed a transfer of learning paradigm which incorporated Gagné's (1965) approach to cumulative learning. The central argument is that, following Gagné's hierarchy of learning types, one might more adequately describe the nature of learning that can occur at various levels of handicap, and, thereby, more efficiently devise effective methods of training and instruction. The results demonstrated that severely and moderately handicapped people followed the same stages of learning as described by Gagné in his cumulative learning model, which he related to human intellectual development. In that conception, the retarded progresses from one 'stage' to the next, as he learns a set of capabilities that build upon one another in progressive fashion.

The most important contribution is, perhaps, the demonstration, once again, that subjects of very low IQs can be trained to perform tasks which demand fairly complex cognitive abilities. These skills have been taught in a short period of time. This reflects, not only lack of experience or inappropriateness of that experience in developing basic cognitive skills, but also alters the prognosis for these people, given that major remedial programmes are carried out. The ultimate level of functioning of severely and moderately handicapped people after training can only be guessed, but the results indicate that it is certainly far higher than has been supposed.

Lastly, Brooks and Baumeister (1977a) have pleaded for a consideration of ecological validity in the experimental psychology of mental retardation. It is their view that mental retardation, which is basically a social phenomenon, can be meaningfully understood only to the extent that ecological validity and other related issues are assigned prominence in our theories and experiments. A start has been made to put into practice some aspects of the present work in 'real-life' situations in one of the hospitals where the author works. It is also related to the theme outlined by Clarke and Clarke (1977) in their article, 'Prospects for Prevention and Amelioration of Mental Retardation: A Guest Editorial', which considers that:-

"...the practical testing and application of research findings need a much higher priority than occurs at present. We now possess powerful methodologies for evaluating the effects of both contrived and natural changes..."

Concluding Comments

The main conclusions of the present study are as follows:-

1. The formulation of the concept of rigidity based on the difference theory of mental retardation is an inadequate framework to analyse the adaptive behaviours of the severely and moderately handicapped people.
2. One approach to study the concept of rigidity is to employ a transfer of training paradigm which distinguishes between cognitive capacity and competence. This model allows the manipulation of environmental variables which may contribute towards the cognitive style adopted by the retarded subjects. The experimental studies reported in this thesis demonstrated that, after training, severely and moderately handicapped children and adults were able to shift concepts in perceptual, conceptual, and spontaneous areas of their functioning, which they were unable to do prior to the intervention.

3. The nature of transfer was analysed, which suggests that the mentally handicapped tend to perform tasks strategically, rather than as a passive receiver. The stages of learning adopted by these subjects suggest a developmental approach to the field of mental handicap.

4. One of the most significant, although not surprising, conclusions is the importance of considering individual differences in the severely and moderately handicapped persons, just like normals, when analysing and predicting their adaptive skills.

5. Retarded persons from an unstimulating environment, such as an institution, have a wider gap between their cognitive capacities and competences, and hence are able to benefit more from flexibility training.

6. It has been shown that some of the very complex skills learned by the retarded were retained over three months. However, further research in this area is needed to see the effects of relevant reinforcers and demands from ordinary life experiences, to enable the retarded the use of the induced sets.

It appears that some of the models of rigidity have a narrow and oversimplified conception of the phenomenon. The experiments have indicated that some of these concepts need modification.

A P P E N D I X A₁

TRANSFER TASKS FOR EXPERIMENT 1

APPENDIX A₁

Transfer Tasks for Experiment 1

The Cognitive Flexibility Test (CFT) was developed by McKinney (1966) to evaluate the effects of flexibility training. In his analysis, McKinney pointed out that the behaviour relevant to the measurement of Cognitive Flexibility could be divided into three general areas: Perceptual, Conceptual, and Spontaneous and these were defined by McKinney as follows:

Perceptual Flexibility is the ability to re-order a stimulus array in several ways (sub-tests: Embedded Figures and Figure-Ground Reversal);

Conceptual Flexibility is the ability to re-order or categorise concepts in several ways (sub-tests: Form Classification and Picture Classification);

Spontaneous Flexibility is the ability to shift ideas or concepts in the rapid production of information (sub-tests: Classification and Tell About This).

Specific Instructions for the Six Sub-tests

The subject is provided with a crayon and a test booklet. An example of each sub-test is illustrated on pages 225-230.

Some of the exercises in this test are presented in cut-out shapes or pictures.

Sub-Test 1: Embedded Figures Show the test booklet and point to the demonstration item 1 and say, "see this big figure on the right in the first row? This big figure is made up of several parts or smaller figures. One part has been drawn on the left-hand-side of the page

(point to the small square). The object of this game is to shade the small part that is hidden in this large figure in each row."

Where subjects have difficulty in following verbal instructions the examiner demonstrates the item by colouring in the small square which has been embedded in a more complex figure. The subject is given enough practice and demonstrations are repeated to ensure that the subject understands the instructions.

"Now, let's do the kite for practice. This triangle on the left (point to the triangle) has been hidden somewhere in the kite. See if you can find and colour the triangle."

Where necessary, the subject is corrected, and the examiner ensures that the subject knows how to respond before proceeding with the list items.

"On the next two pages there are some more problems just like these two (point to the demonstration items). In each row, colour the small part which is shown on the left side and is hidden in the larger figure on the right."

There is no time limit on this sub-test.

Score: The total score in this sub-test is seven, and one point is given for each correct answer. Leniency is allowed regarding drawing proficiency.

An item is scored right if:

(a) the part allowed is clearly indicated

and/or

(b) more colouring is inside the correct part than outside.

Some items have general correct alternatives.

Sub-Test 2: Figure-Ground Reversal "In this game we will see if you can point to the reversals. Let's look at the first row at the top on the left and four other figures beside it. One of these four figures is the reverse or opposite of the figure in the box on the left (point to the figure). See if you can tell which one it is. Very good, it is the third figure."

"Now, let's look at the next row and see if you can find the figure on the right which is the reverse of the figure on the left in the box."

Record the subject's response. If subject gets distracted by too many figures, cover rest of the items. There is no time limit on this sub-test.

Score: the total score on this sub-test is fourteen.

Sub-Test 3: Form Classification Each shape is cut out individually and shown to the subject in a group of four shapes at a time. "In this game let's see how well you can change ideas about different shapes. Here, you have a group of four shapes, a small circle, a large circle, a small square, and a large square (point to the cut out shapes). I want you to organise these four shapes into two groups that look alike."

Show to the subject how two circles can be grouped together, and demonstrate the likeness, and how two squares can be grouped together, and demonstrate their likeness.

Show the same set of four shapes. This time ask the subject to organise the groups in a different form. If the subject is not able to perform this task, he is shown how two groups can be formed in a different way. "Two sets of shapes can be formed by two different

methods. We can make one set by placing two circles and two squares together. The other set can be formed by putting two small shapes and two large shapes together."

Give subject enough practice on demonstration item in order to ensure the subject has grasped the instructions before proceeding to the test items. There is no time limit.

Score: In general, the subject receives one point for the initial classification and two additional points for shifting classifications. The two principles for classification in each item are:

1. Shape - Height
2. Colour - Position (up or down)
3. Shape - Colour
4. Letter Line - Types of lines (solid or single)
5. Shape - Context element
6. Shape - Context element
7. Shape - Number of lines
8. Size - Expression

The total score for this test is twenty-four points.

Sub-Test 4: Picture Classification The pictures in each box are cut out individually and are given to the subject in a set of four pictures. "In this game, we will do exactly the same thing as we did in the last game except that we will group pictures of different things in two different ways." There is no time limit on this sub-test.

Score: The scoring for this sub-test is the same as that for sub-test 3.

The following principles are involved in each item:

1. Sex - Age
2. Sex - Expression
3. Vehicles - Age with appropriate vehicle
4. Houses - Animal with appropriate house
5. Products - Animal with appropriate product
6. Vehicles - People with appropriate vehicles
7. Weapons - Men with appropriate weapons
8. Shoes - People with appropriate shoes

The total score on this sub-test is twenty-four points.

Sub-Test 5: Classification "In this game we see how quickly you can change and do things in different ways. Let's look at all the triangles on this page. Some of the triangles are pointing up and some are pointing down. Do you know which is a green pencil and which one is a red pencil? In the first part of this game I would like to see how quickly you can put a green mark (demonstrate the mark -) in all the triangles that are pointing up and a red mark (-) in all the triangles that are pointing down."

Correct any errors on the practice trial. Demonstrate speed by putting marks quickly in the triangles.

"Now when I say, begin, go down the page one row at a time and put a green mark in each triangle that's pointing up and a red mark in each triangle that's pointing down. Do it as many times as you can before I tell you to stop. But try not to omit any triangle. Ready? Go." The time limit on this subject is ninety seconds.

Stop the subject at the end of ninety seconds, and say, "Now when I say, begin, go down this page one row at a time and put a red mark in each triangle that is pointing up (demonstrate the mark -) and put a green mark like this (-) in each triangle that is pointing down. Do as many triangles as you can before I tell you to stop, but try not to omit any - Ready? Go!"

Score: The score on this sub-test is the total number of correct responses on both parts. The first row is not counted. Omitted items are not counted. The total score in this sub-test is eighty.

Sub-Test 6: Tell About This Point to the picture of the cup and say, "Tell me all about this". If the subject does not respond, prompt him by saying, "What is it?" "What is it made of?" "What do you use it for?"

Show each item in the same manner. Record all subject's responses. There is no time limit in this sub-test.

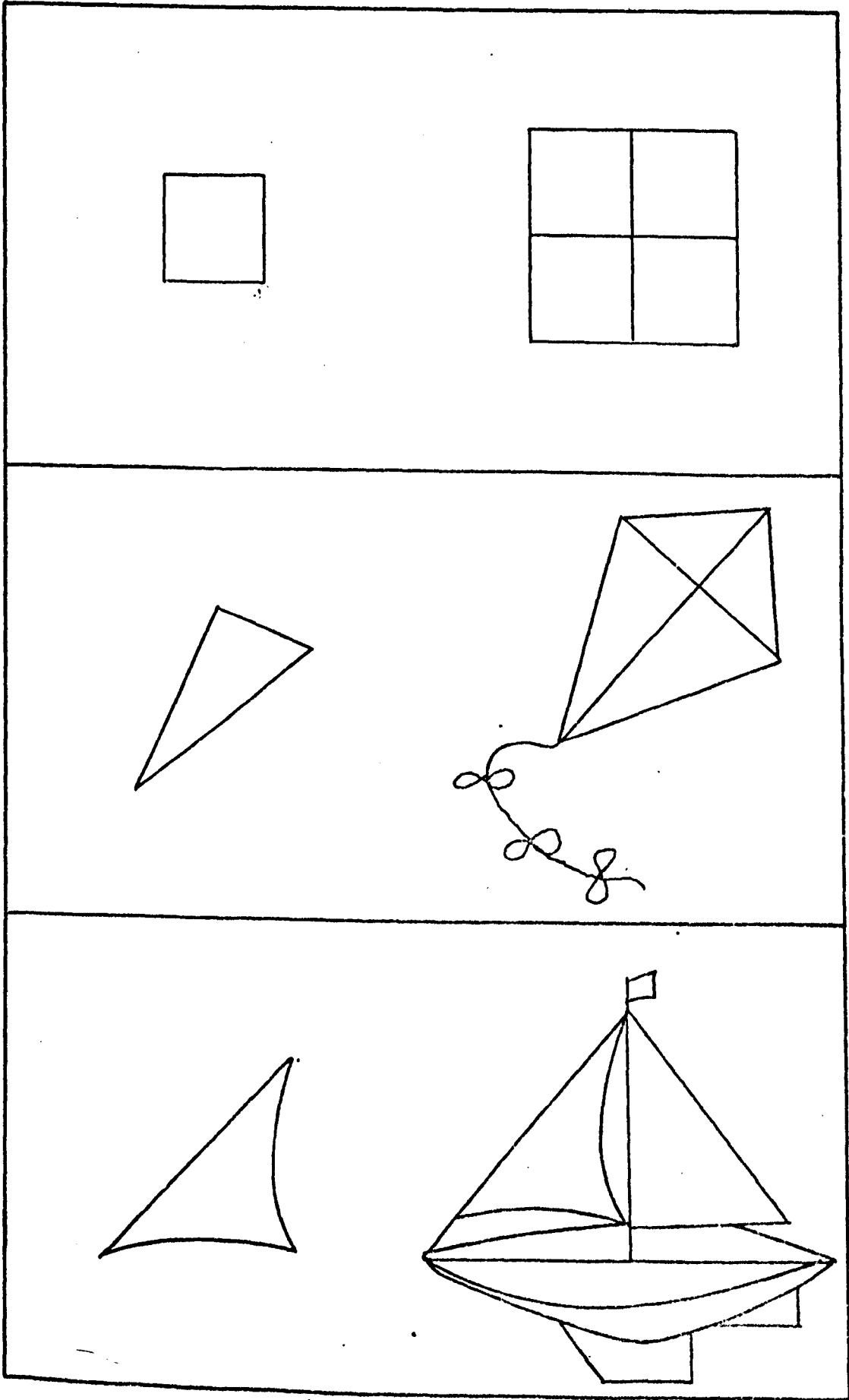
Score: The score for each item is the number of different characteristics named. Responses can be made in the categories of name, colour, shape, composition and any other relevant characteristics. Count correct number of responses.

The Use of Test Scores

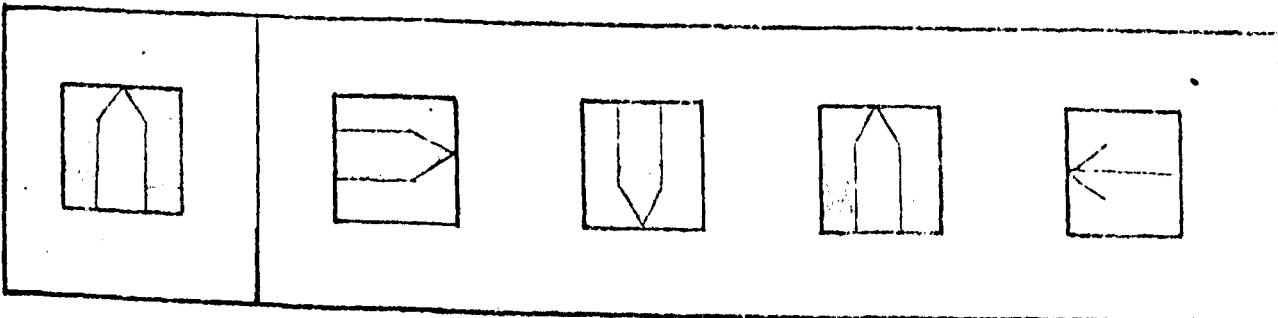
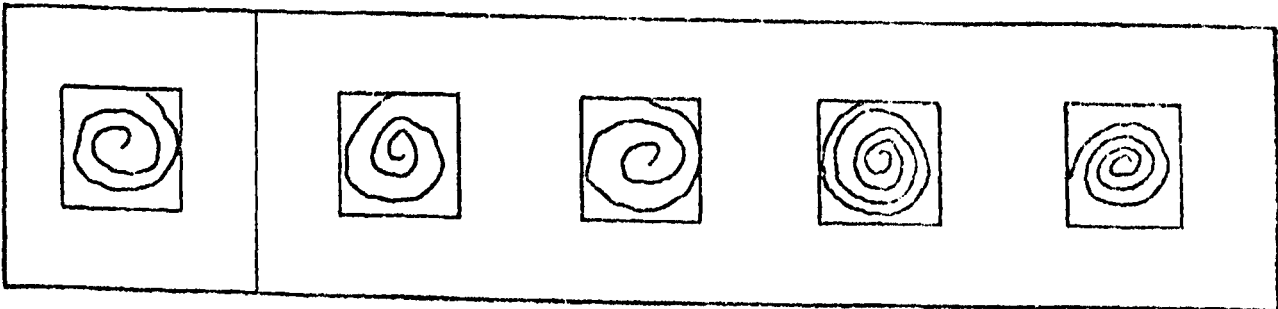
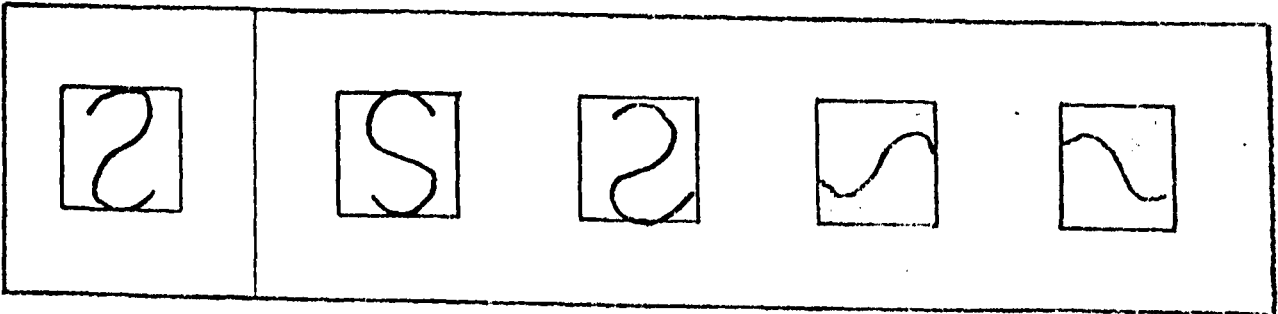
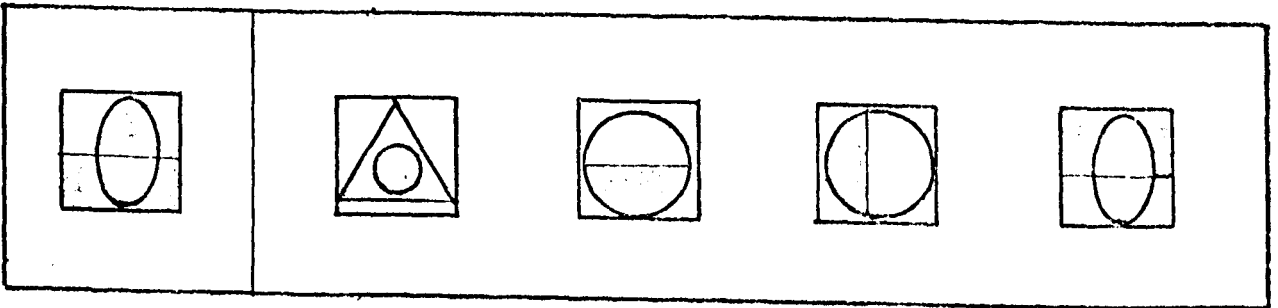
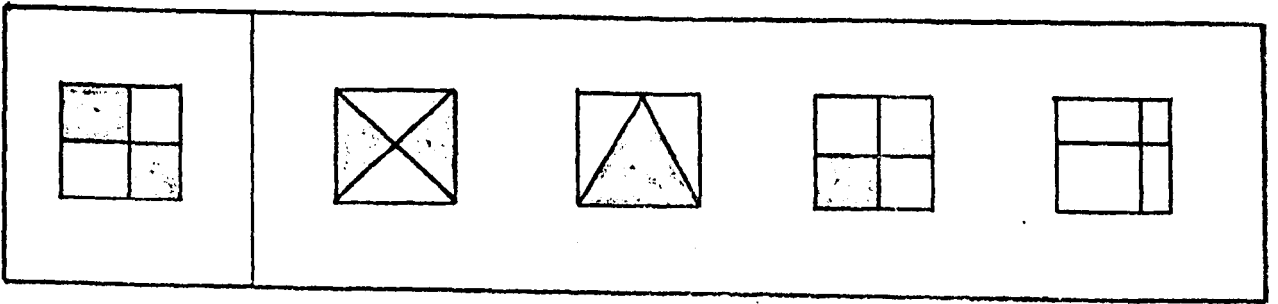
Raw scores for each sub-test are obtained and transferred to the summary table on the front page of the booklet. The Cognitive Flexibility Test as used by McKinney yields raw scores ranging from 7 to 80 for the six sub-tests. In order to equate the weighting of sub-tests, these raw scores are converted on a scale ranging from 0 to 10, with a possible total of 60, so that comparisons can more usefully be made. The total score is the sum of all converted raw scores of the six sub-tests.

For the details of the Cognitive Flexibility Test, see McKinney (1966).

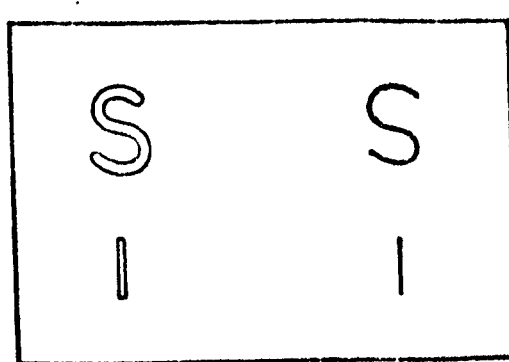
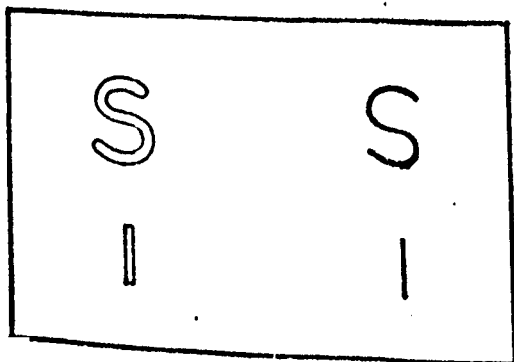
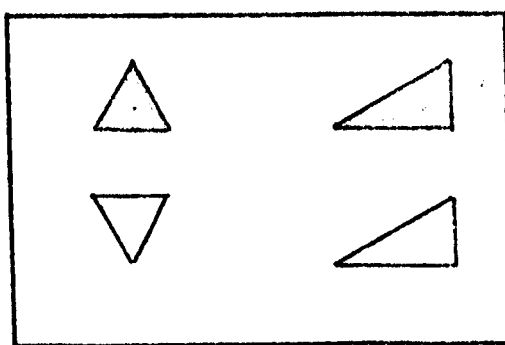
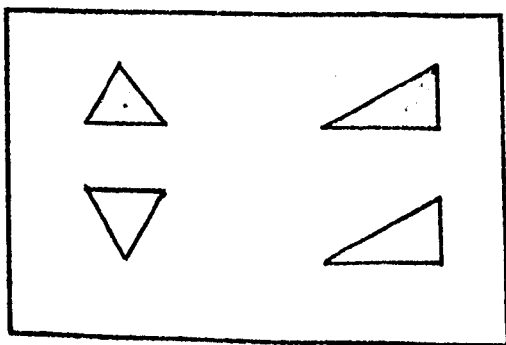
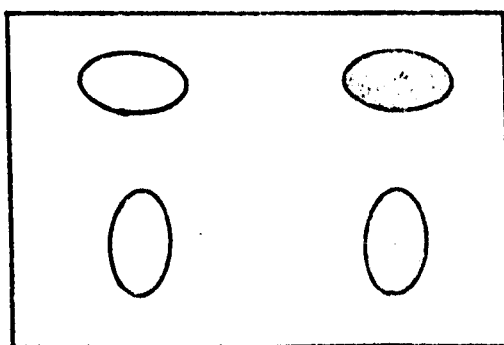
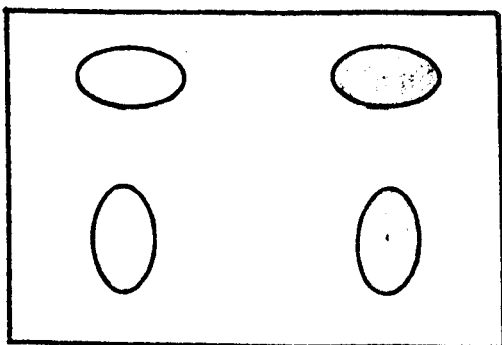
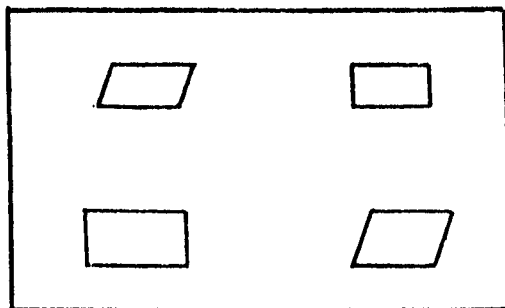
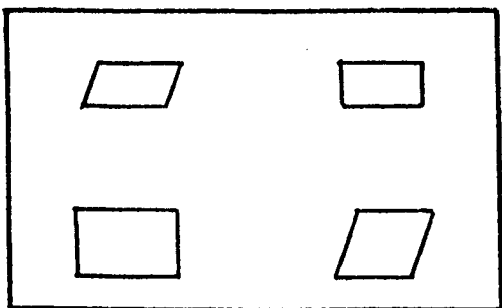
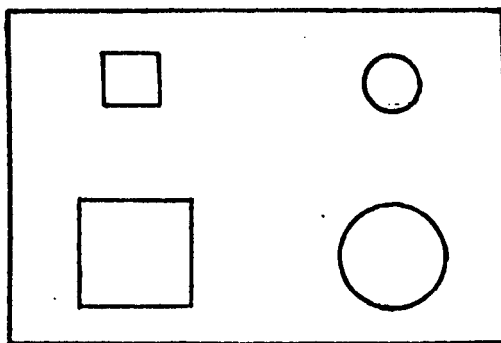
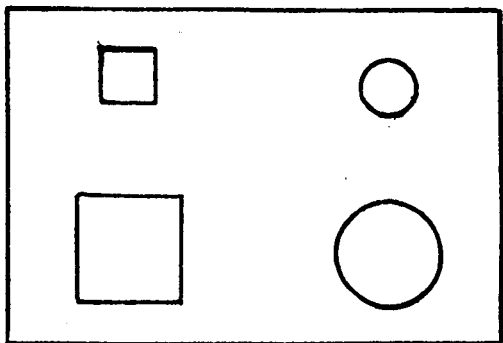
SUB-TEST 1 - EMBEDDED-FIGURES



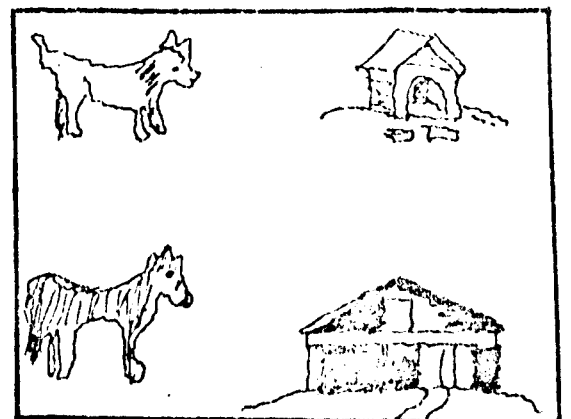
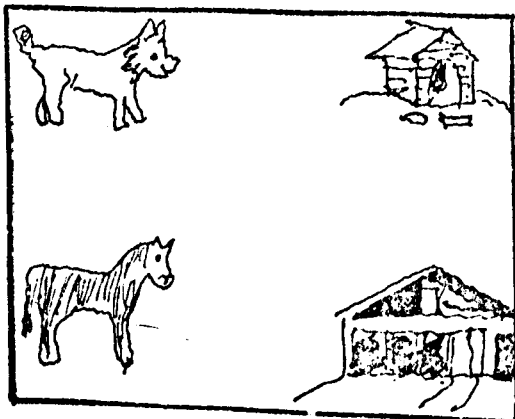
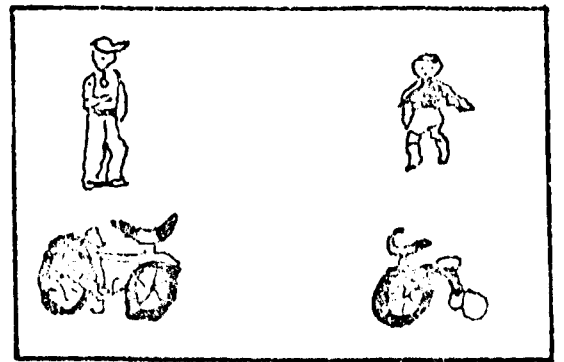
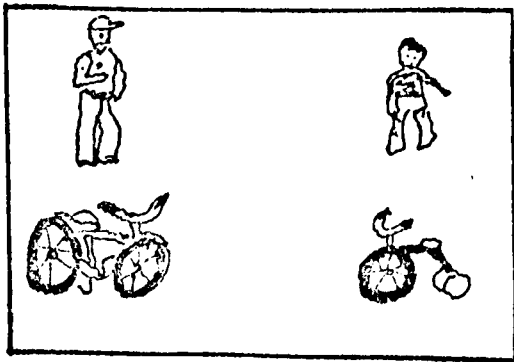
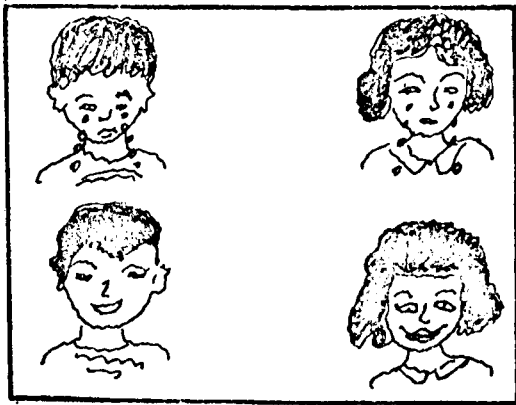
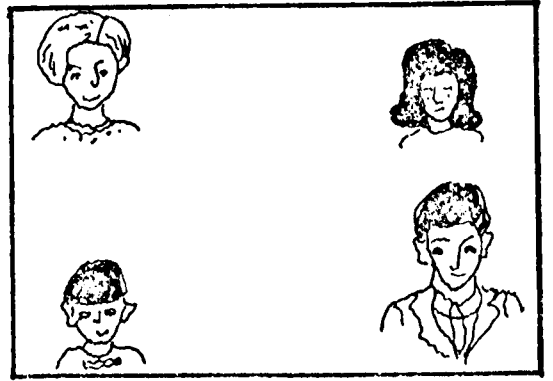
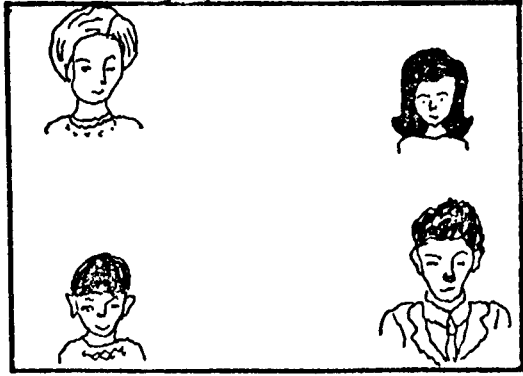
SUB-TEST 2 - FIGURE-GROUND REVERSALS



SUB-TEST 3 - FORM CLASSIFICATION

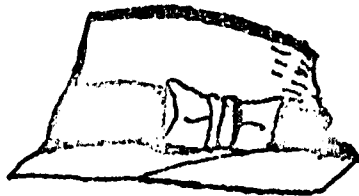
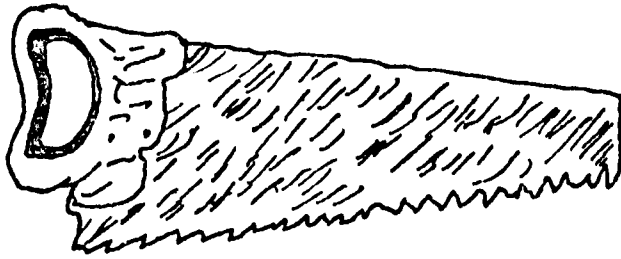


SUB-TEST 4 - PICTURE CLASSIFICATION



SUB-TEST 5 - CLASSIFICATION





A P P E N D I X A₂

TRAINING TASKS FOR EXPERIMENT 1

APPENDIX A₂

Training Tasks for Experiment 1

Corter and McKinney's (1968) training programme for educable retarded and normal children consists of forty-two exercises, fourteen for each of the three areas of flexibility - Perceptual, Conceptual, and Spontaneous. For the present investigation, their forty-two training exercises have been reduced to twenty-eight, nine for the Perceptual area, nine for the Conceptual area, and ten for the Spontaneous Flexibility area. These exercises have also been modified to meet the needs of the moderately and severely handicapped subjects.

Exercise 1: Similarities - Differences

Procedure: The examiner presents the following figures:

- (a) a red rectangle and a yellow square;
- (b) a yellow ellipse and a red circle;
- (c) a red rectangle and a red circle;
- (d) a yellow ellipse and a yellow square.

The subjects are required to tell how the above pairs are alike and how they are different. The concepts of similarities and differences are discussed.

Next, all the four figures are presented at the same time. The experimenter shows how the figures can be grouped together so that figures in each group are alike. Following this, the experimenter shows another way to group these figures together, which is different from the way it was previously done. The two principles of sorting these figures are:

- (a) two figures with four sides and two figures with round sides
- and
- (b) two red figures and two yellow figures.

After this procedure, all the concepts of similarity and difference, as well as the principles of classification and shift, are reviewed.

Exercise 2: Figure-Ground Differentiation

Materials: Two 6" x 5" stimulus cards are used. On one card the number 1, which has been cut from white paper, is pasted on a black background. On the second card the black-white configuration is reversed.

Procedure: The experimenter first discusses the concepts of "Figure" and "Background". The concepts are illustrated by first showing the dark number 1 with a white background. The concepts of figure and background are further illustrated by holding up various objects in the room in front of different backgrounds, and then encouraging the subject to tell which parts composed the figure and the background, e.g. a pencil in front of a wall.

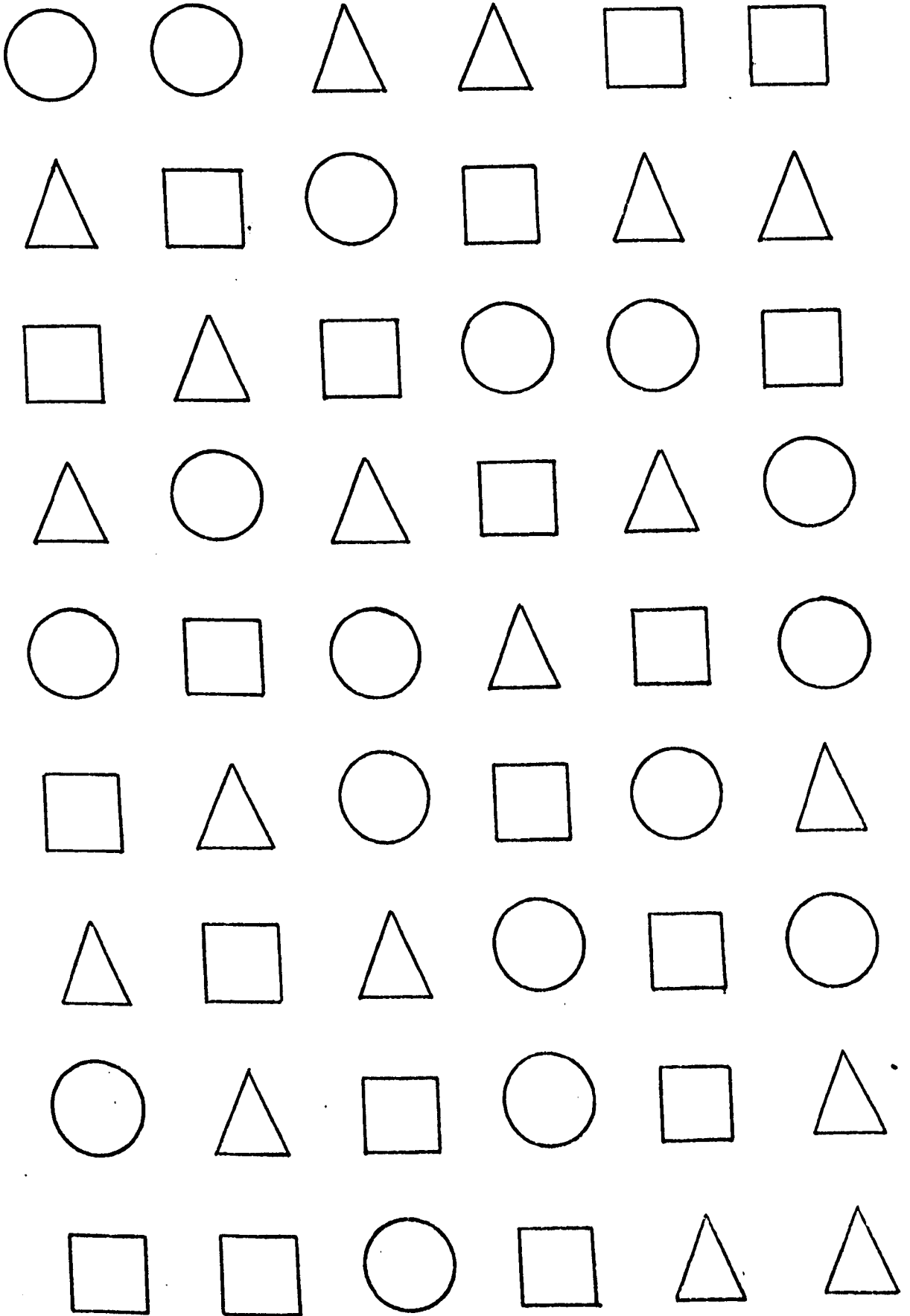
The subjects are then told that it is fun to change the figure and background, and to see what happens. Throughout the demonstrations, the concepts of figure background changing and reversing are stressed.

Exercise 3: Cancellation

Materials: A sheet of paper(A4 size)on which triangles, squares, and circles appear in random order. This is shown on page 233.

A pencil.

Procedure: Subjects are instructed to go down one row at a time, crossing out all the circles as fast as they can. Similar procedure is employed for the triangles and squares. In each case the concept of speed is stressed.



Exercise 4: Similarities - Differences

Materials: A set of four cards. On each card there is a picture of one of the following:-

A large tractor
A small tractor
A large banana
A small banana

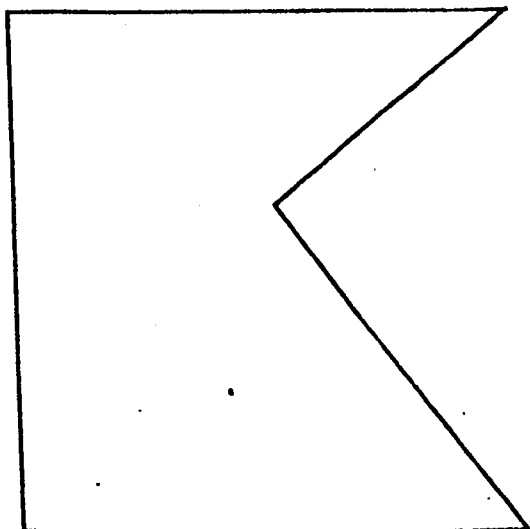
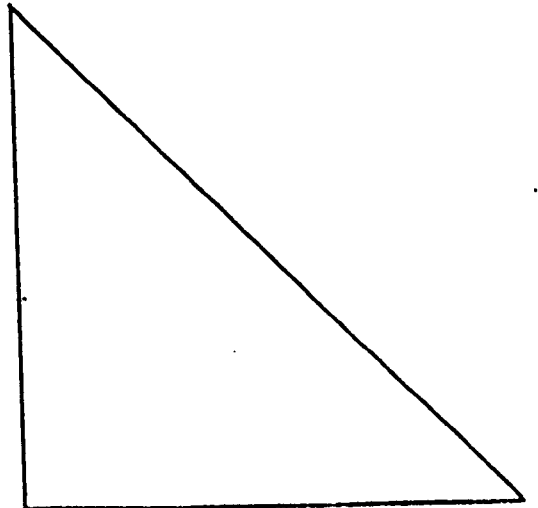
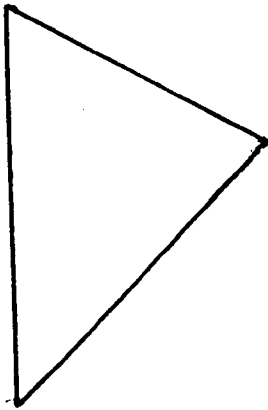
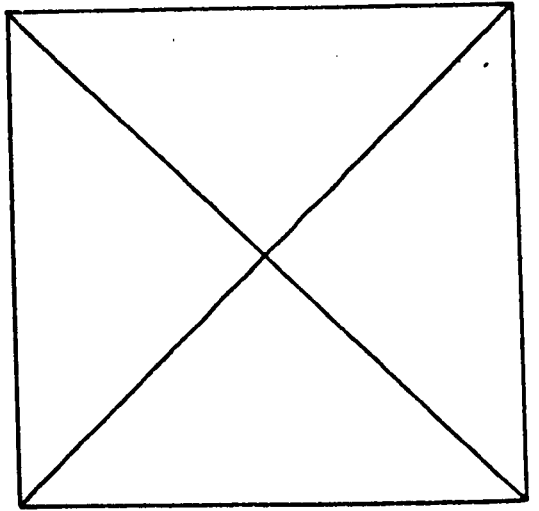
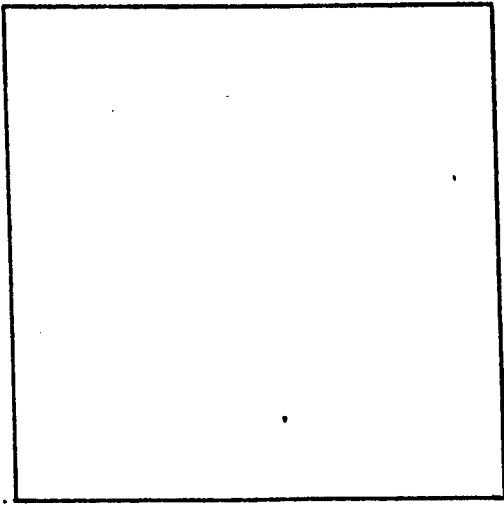
Procedure: This exercise begins with a brief review of the concepts of similarity and difference. All appropriate comparisons of objects are made by asking the subjects to show how the objects are similar, and how they differ. The principles of classification and shift are illustrated by asking the subjects to place two objects together, e.g. the tractors and the bananas. The subjects are then instructed to group them according to another principle, e.g. the two small ones and the two large ones. After subjects have successfully sorted the objects according to two principles, the concepts of similarity, difference, and shift are reviewed.

Exercise 5: Embedded Figures

Materials: This exercise consists of part-figures and when these are put together the resulting figures are a square and a cake. An example is given on page 235;

Procedure: First, "figure" and "background" concepts are reviewed by using the stimulus cards that were used in Exercise 2. In addition to the figure-ground aspects of a whole figure, the subject is shown how one can break a complex figure down into its constituent parts and how the constituent parts fit together to make a whole figure. The experimenter then holds up the stimulus card showing a constituent part of a whole figure and asks the subject to find a matching part. Next, the subject is asked to place the pieces together to form a whole figure, as illustrated on the stimulus card. All combinations of the parts and each part taken separately are then reviewed.

EXERCISE 5



Exercise 6: Word-Naming

Procedure: The subjects are told that the purpose of this exercise is to name as many words as they can in two minutes. They are encouraged to say any word that comes to their mind, e.g. "table", "pen", "chair", "paper", etc. After two minutes, the subject is then required to name as many friends as he can in two minutes. Subjects who give repetitive responses are encouraged to think of a new name.

Exercise 7: Figure-Ground Differentiation

Materials: Three designs are reproduced in duplicate on separate sheets. These are a circle, a diamond, and a four-pointed star. An example is illustrated on page 237.

A box of crayons.

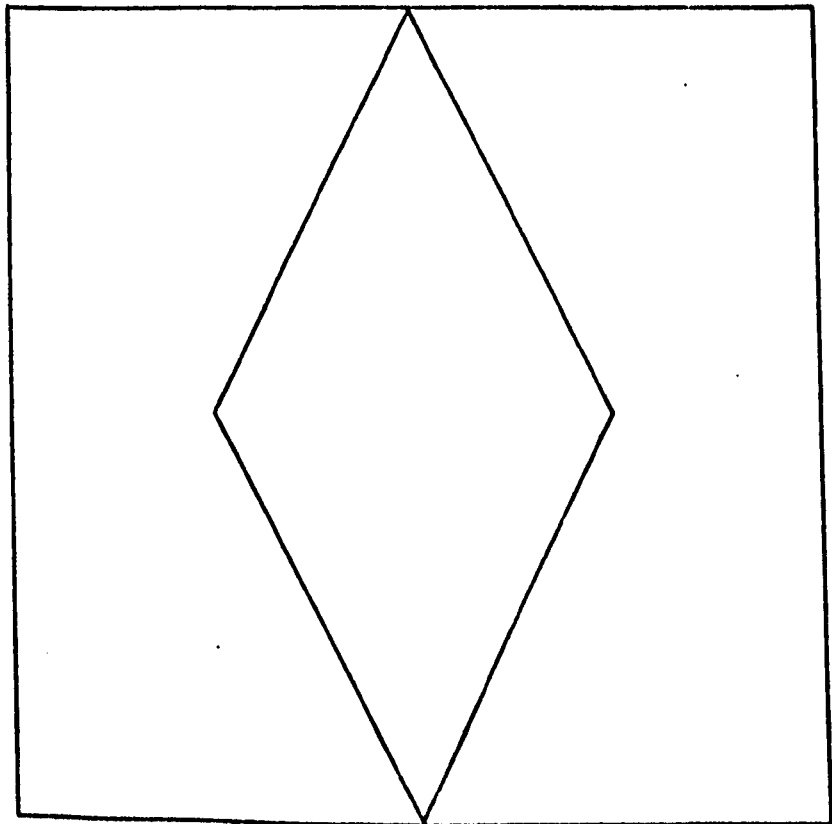
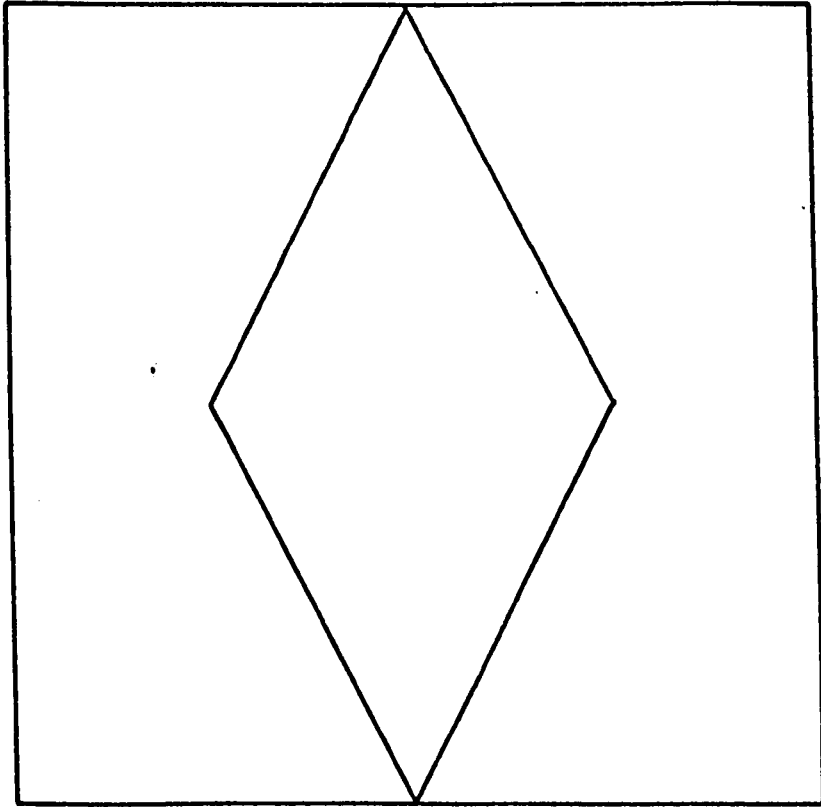
Procedure: The concepts of "figure" and "ground" are reviewed first from Exercise 2. Each subject is given a copy of the circle design and a box of crayons. Subjects are then instructed to colour the circle red and to colour the background green. After this is accomplished the experimenter asks the subjects how they can make the figure look different with the same colours. They are shown how to reverse the figure and background colours. The same procedure is followed for the other designs with different colours.

Exercise 8: Similarities - Differences

Materials: Eight sets of cards showing:

- (a) two circles - one green and one red;
- (b) two squares - one large and one small;
- (c) cat and dog;
- (d) orange and banana;
- (e) red rectangle and yellow square;
- (f) drum and trumpet;
- (g) cup and glass
- (h) blue triangle and yellow triangle.

EXERCISE 7



Procedure: Experimenter shows each set of cards and asks the subjects to point out the differences in the two pictures, and secondly, to point out the similarities in the same pictures. All appropriate similarities and differences are discussed and illustrated.

Exercise 9: Embedded Figures

Materials: Three sheets (A4 size) on which various objects are embedded within a more complex configuration. These objects are animal forms and faces, a car, and a house. An example is shown on page 239.

A box of crayons.

Procedure: Subjects are given copies of the materials and are told that several faces are hidden on the first page. Subjects are encouraged to find them by breaking the whole picture down into its parts.

Exercise 5 is repeated to remind subjects of the concepts of part, whole, and part-whole relationships. Subjects are instructed to locate and colour the faces in the picture. The same procedure is followed for the embedded pictures of animals, a car, and a house. Subjects are prompted if they have difficulty in finding the various objects. These exercises are treated as games for finding objects that are hidden in a complex figure.

Exercise 10: Class-Naming

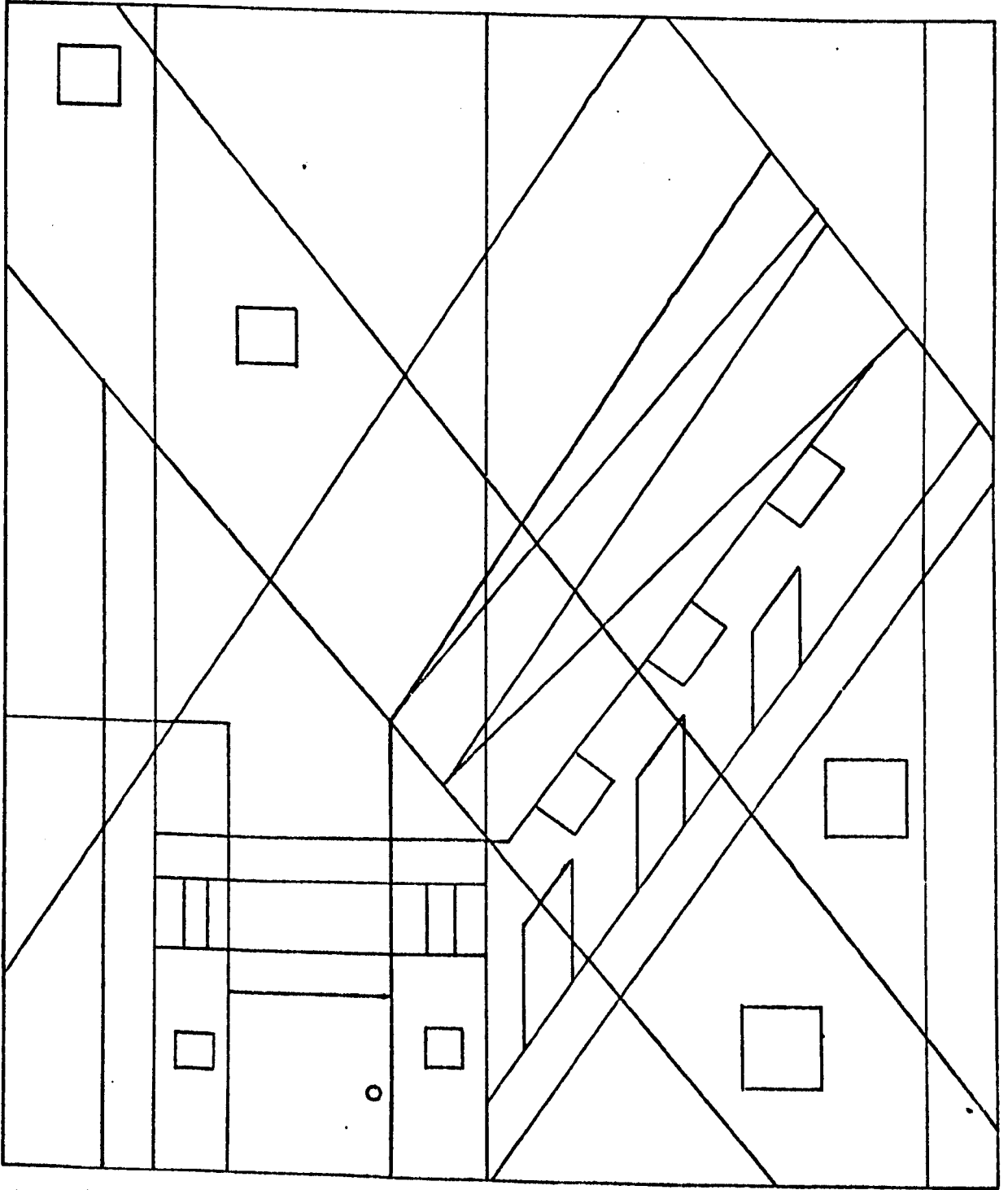
Procedure: In this exercise the subjects are instructed to name as many animals as they can think of in two minutes. In the second part subjects are asked to name in two minutes the things we eat.

Exercise 11: Classification

The following pictures are drawn on cards and presented in pairs:-

- a Pen and Pencil
- b Squirrel and Rabbit
- c Knife and Fork
- d Boat and Car

EXERCISE 9



- e Biscuits and Cakes
- f Elephant and Lion
- g Apple and Pear
- h Star and Moon
- i Sweet and Ice Cream
- j Butterfly and Bird

Procedure: The procedure for this exercise is the same as that for Exercise 8. The subjects are asked to point out the differences and similarities between the pictures. Where necessary, appropriate similarities and differences are explained.

Exercise 12: Tell About This

Materials: Three objects - a book, a ball, and an ashtray.

Procedure: The subject is given one object at a time and allowed two minutes to name as many characteristics as he can think of. He is prompted to say such characteristics as name, function, colour, etc.

Exercise 13: Classification

The following pictures of objects are drawn on cards and presented in pairs:-

- a Hat and Dress
- b Carrot and Beans
- c Ring and Lipstick
- d Pineapple and Strawberries
- e Tie and Bow
- f Flower and Leaf
- g 50p and 2p
- h Stool and Chair
- i Handbag and Glove

Procedure: The same procedure as for Exercises 8 and 11.

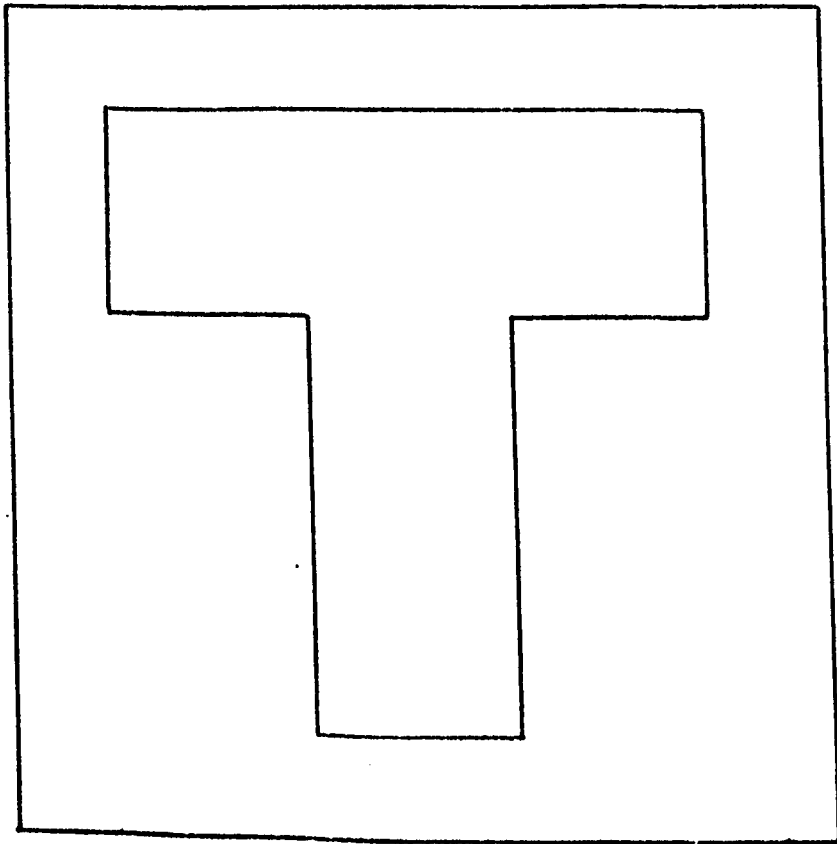
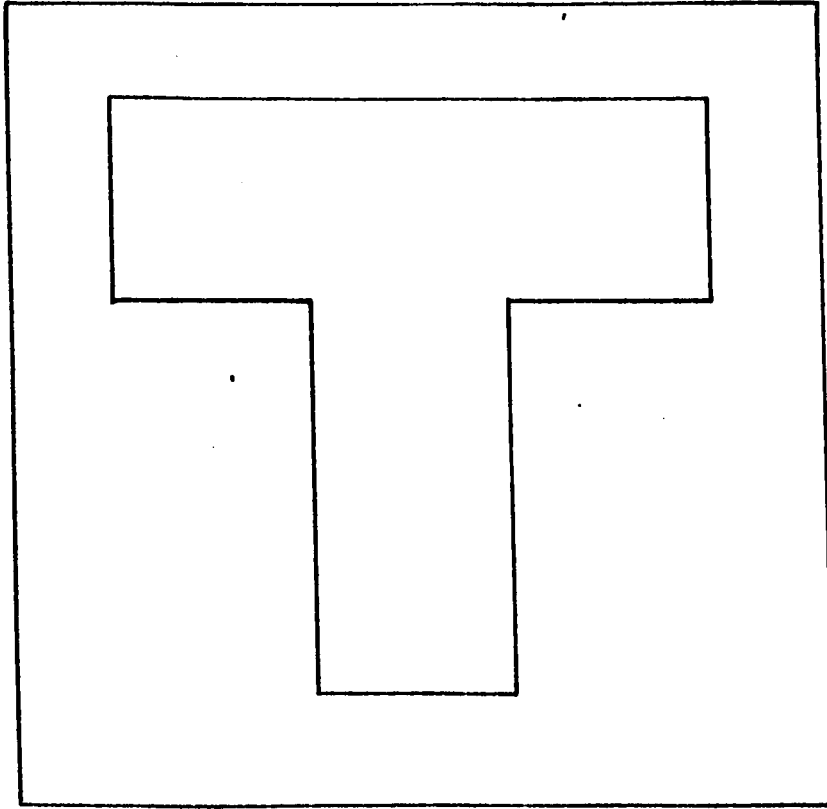
Exercise 14: Figure-Ground Reversal

Materials: Three figures: the letter T, an L-shaped configuration, and a diamond with a square in the centre are reproduced in duplicate.

An example is shown on page 241.

A box of crayons.

EXERCISE 14



Procedure: Training begins with a brief review of the concepts of figure, background, and reversals, by using previous exercises dealing with perceptual training. Procedure in this exercise is similar to Exercise 7.

Exercise 15: Coding

Materials: Two sheets of paper on which appears a matrix composed of ellipses turned either vertically or horizontally in random order. This is shown on page 243.

A box of crayons.

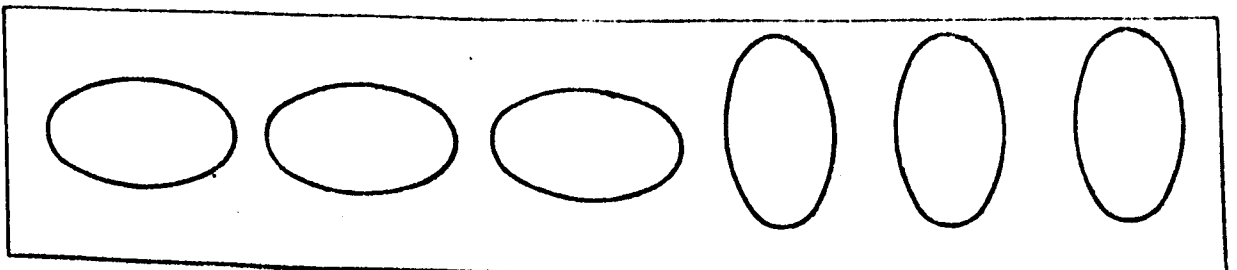
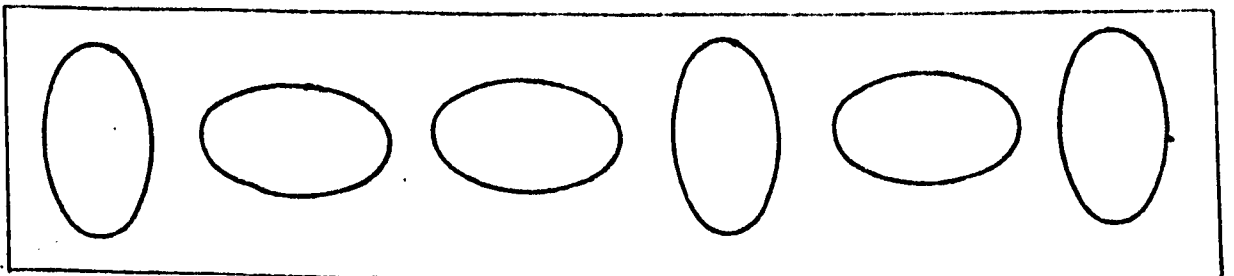
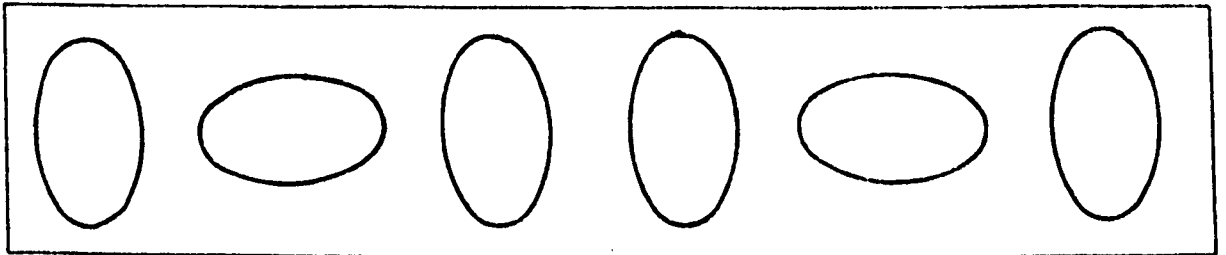
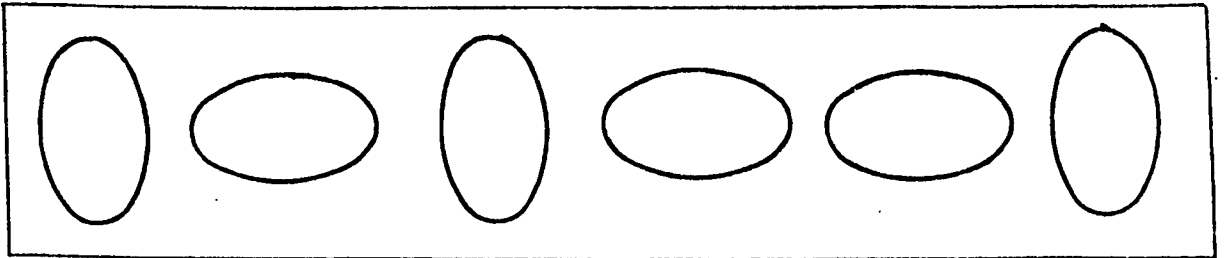
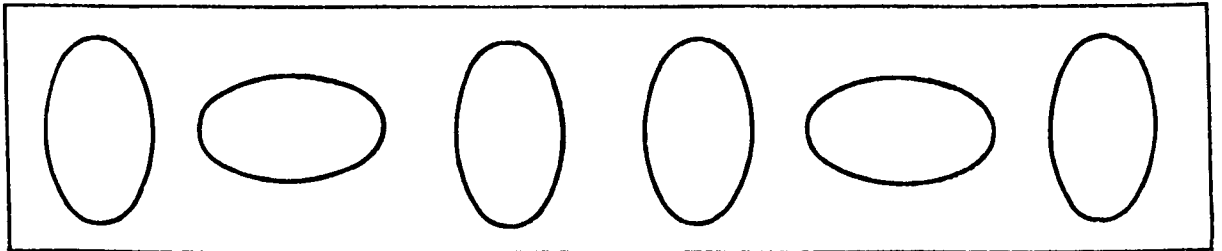
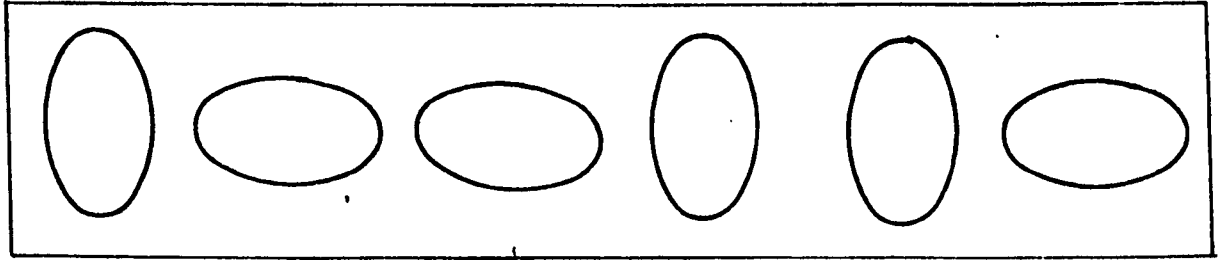
Procedure: Subjects are given a copy of the first sheet and are instructed to draw a red line through a vertical ellipse and a green line through a horizontal ellipse. The first row is completed by the experimenter as an example. Subjects are then instructed to work as fast as they can in completing the given exercises. After they have completed this task they are given a second sheet and are instructed to reverse the sequence they have just completed, namely to draw a green line through a vertical ellipse and a red line through a horizontal ellipse.

Exercise 16: Embedded Figures

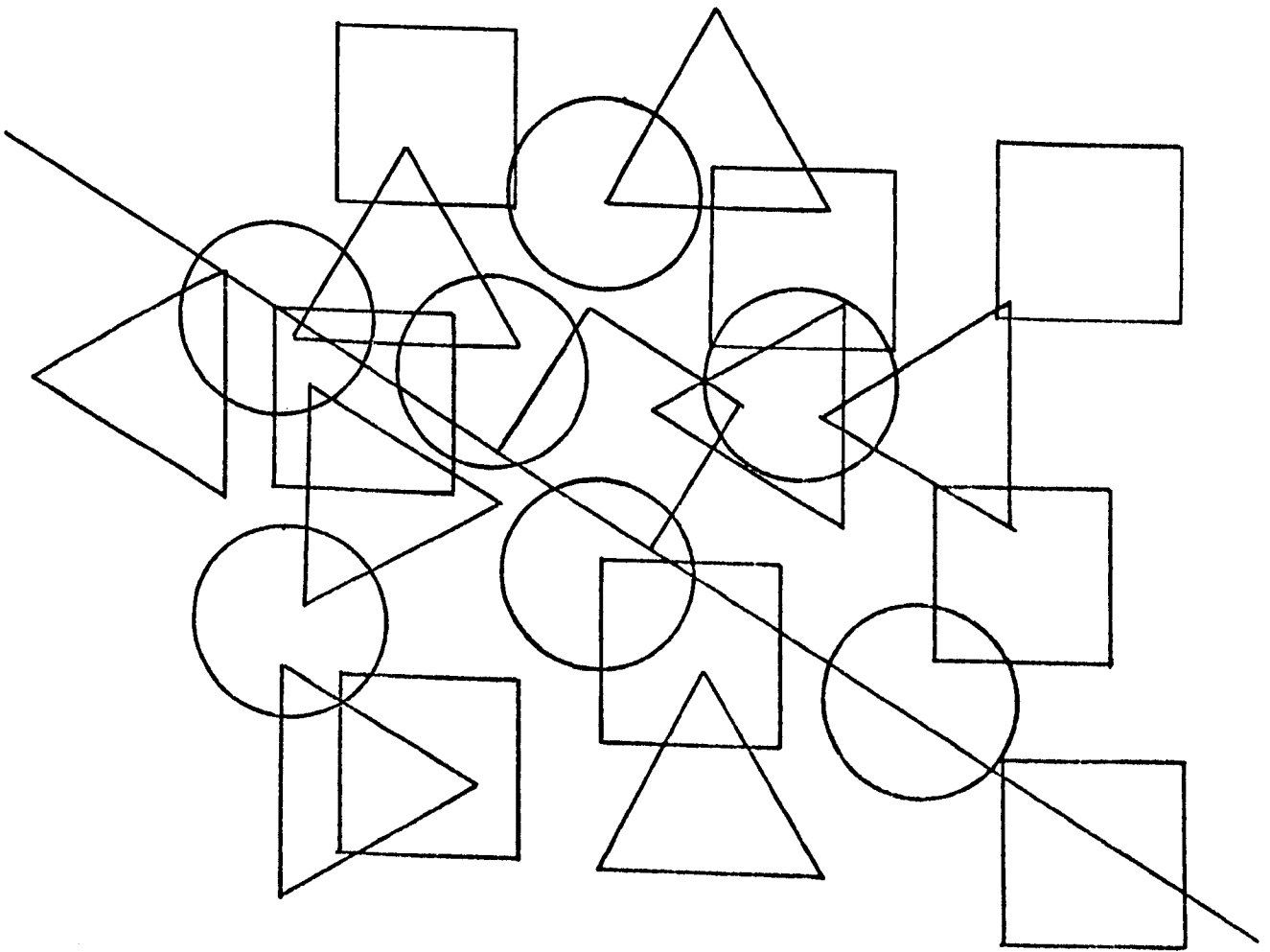
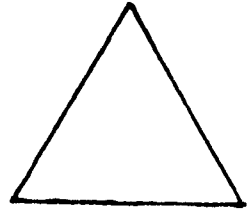
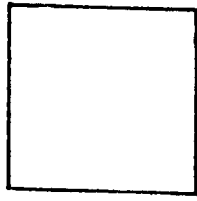
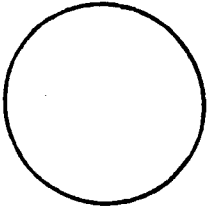
Three sheets of paper on which circles, triangles, and squares are embedded within a more complex geometrical configuration. An example is given on page 244 . A box of crayons.

Procedure: Subjects are given the first sheet and a box of crayons. They are told that the complex figure is composed of circles, triangles, and squares. Subjects are then instructed to find all of the circles and to colour them red. On the second sheet they are instructed to find triangles and to colour them green. The same procedure is used for the third sheet to find squares.

EXERCISE 15



EXERCISE 16



Exercise 17: Classification

Materials: Eight sets of pictures with four pictures per set:-

- (a) Coins and Lollipops (groups)
- (b) Adult and Baby Animals
- (c) Balls and Squares (groups)
- (d) Boots and Shoes (groups)
- (e) Letters and Numbers (groups)
- (f) Fruits and Vegetables
- (g) Stamps and Envelopes (groups)
- (h) Triangles and Squares (groups)

Procedure: The subjects are given the first set of cards and are instructed to spread them out over their desks. The experimenter then asks the subject to differentiate and point out the similarities between pictures. This procedure is followed for all appropriate combinations of the four cards. The subjects are then instructed to put cards which are alike in two groups. After subjects have successfully grouped cards together according to one principle, they are instructed to group the cards according to a second principle. The concepts of similarity and the principles of sorting are reviewed by the experimenter after the completion of each set.

Exercise 18: Figure-Ground Reversal

Materials: Three designs shaped thus:-

A symmetrical cross and two half-circles
are reproduced in duplicate.

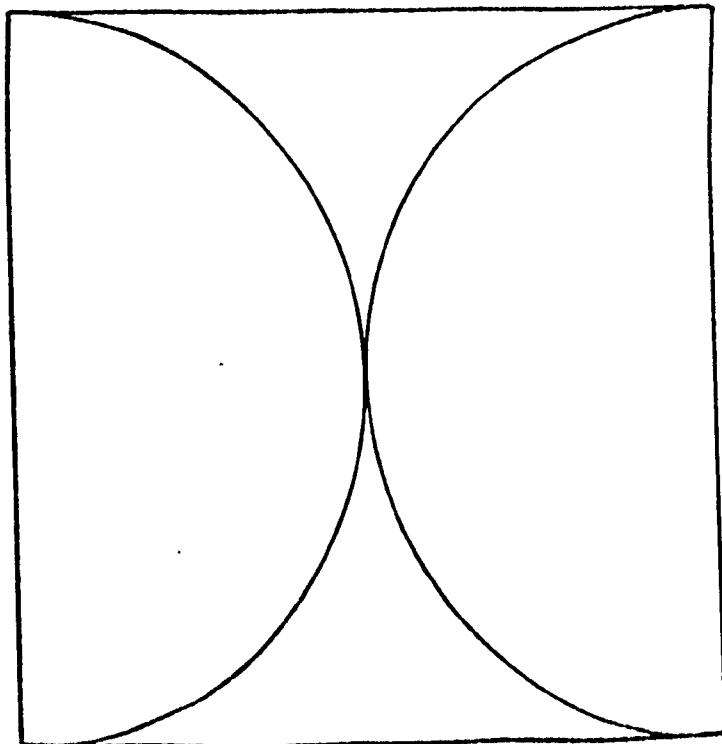
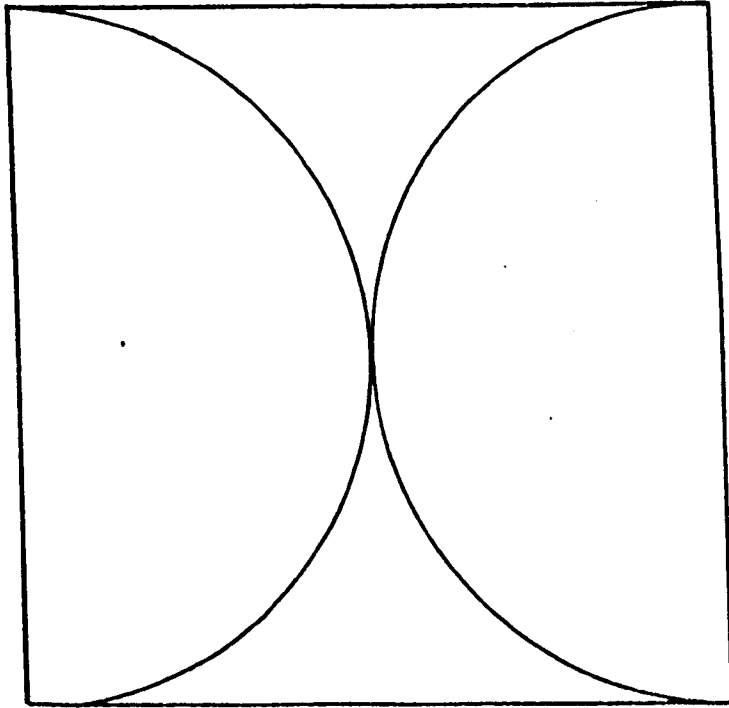
An example is illustrated on page 246. A box of crayons.

Procedure: The same procedure is followed as in other perceptual training exercises, namely exercises 7 and 14.

Exercise 19: Class-Naming

Procedure: Subjects are required to name in two minutes as many articles of clothing as they can think of. In the second part they are asked to name, in similar time, various colours they can think of.

EXERCISE 18



Exercise 20: Card-Sorting

Materials: The following objects are drawn on cards:-

- (a) Radish - Spring Onions
- (b) Candle - Lamp
- (c) Cherry - Grapes
- (d) Trouser - Skirt
- (e) Bread - Egg
- (f) Shoe - Sock
- (g) Duck - Fish
- (h) Table - Chair
- (i) Lemon - Grapefruit
- (j) Aeroplane - Bird

Procedure: Follow same procedure as for Exercises 1, 4, 8, 11, and 13.

Exercise 21: Tell About This

Materials: Five sets of geometrical figures with four figures per set:-

- (a) two circles and two half-circles - red and blue (shape and colour);
- (b) two octagons and two heptagons - yellow and blue (shape and colour);
- (c) four pentagons - all green (size and shape);
- (d) two squares and two hexagons - all red (shape and symbol);
- (e) two triangles and two quadrangles - four colours (shape and size);

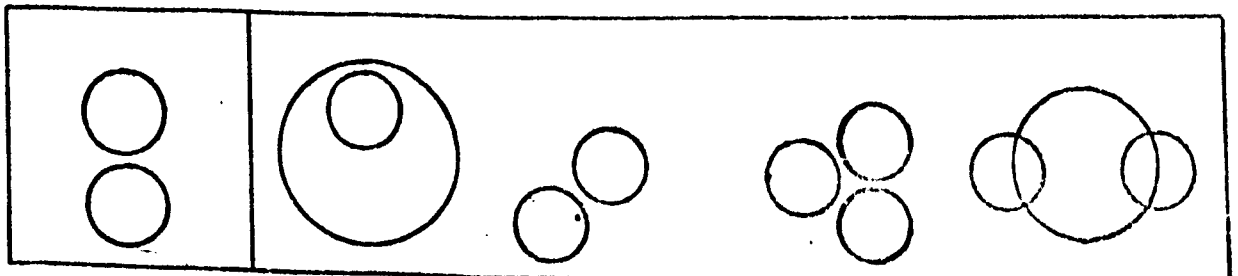
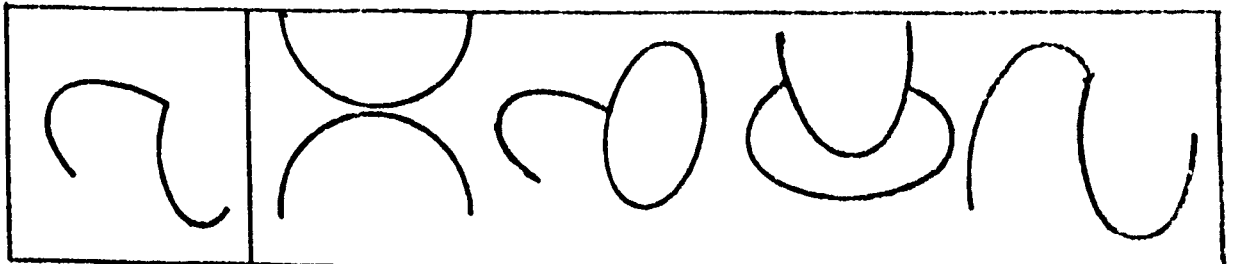
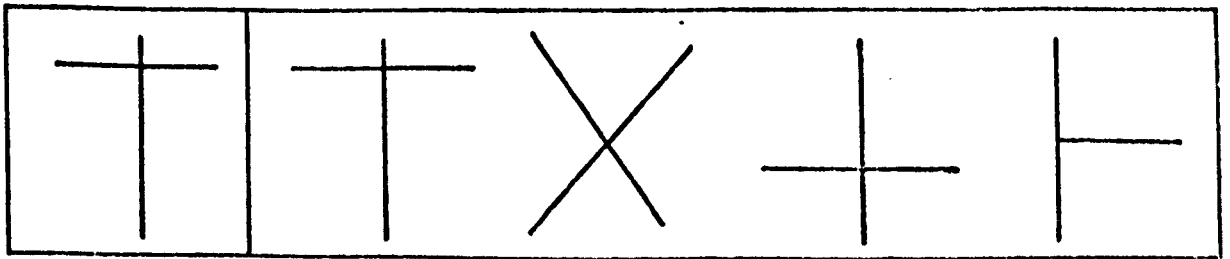
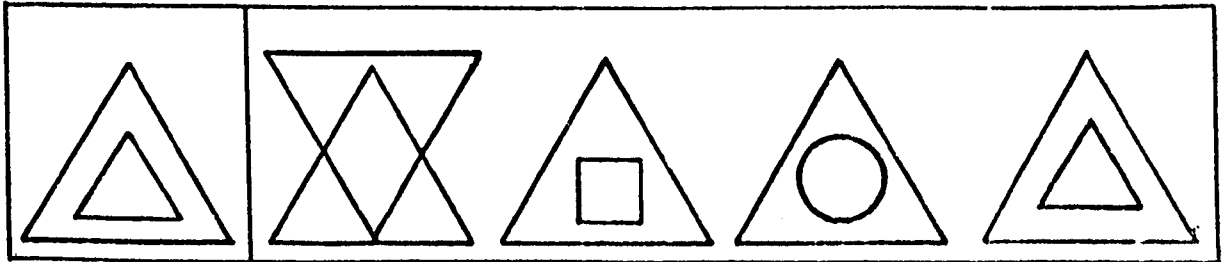
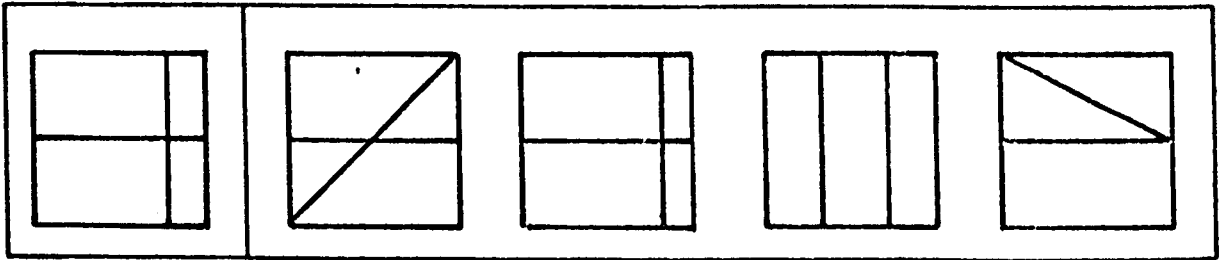
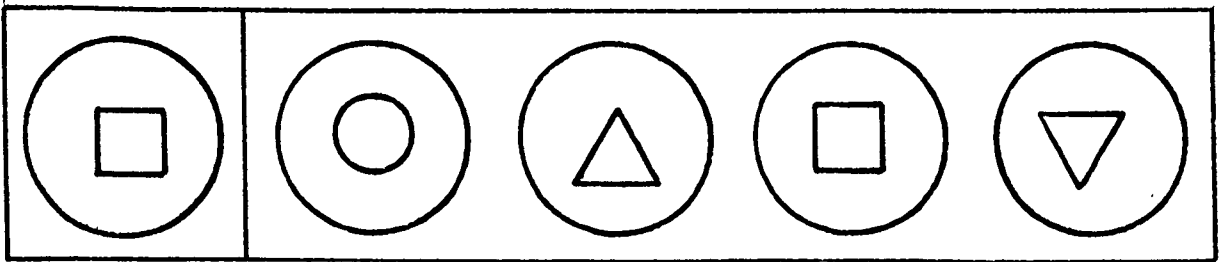
Procedure: Similar to Exercise 17. The principles of sorting are listed above.

Exercise 23: Multiple-Choice Embedded Figures

Materials: This exercise consists of twelve problems. Each problem is composed of a single figure which is shown to the left of a row of four more complex figures. The simpler figure on the left is embedded in only one of the four figures shown on the right. Examples of this exercise are shown on page 248.

Procedure: Subjects are given these problems and are required to identify the figure on the left which is embedded in more complex

EXERCISE 23



figures on the right.

Exercise 24: Coding

Materials: A matrix of circles, triangles, and squares are drawn in random order on three sheets of paper (see page 250).

A box of crayons.

Procedure: The subjects are instructed to put red lines inside all the squares, the green lines inside the circle and a blue line inside the triangles. This sequence is reversed for the second and third parts of this exercise. In general the procedure is similar to Exercise 15.

Exercise 25: Classification

Materials: Figures are drawn on two sheets of paper (A4 size). Each row contains four pictures of objects which could be classified into groups of two according to the two principles. These are illustrated on page 251.

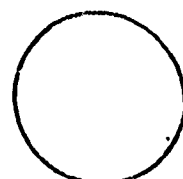
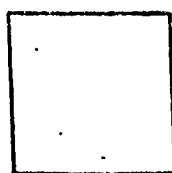
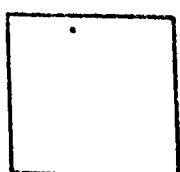
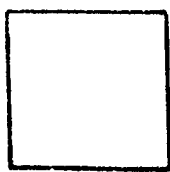
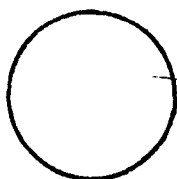
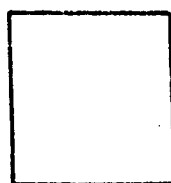
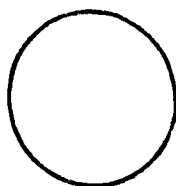
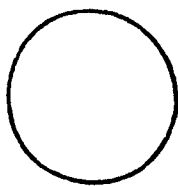
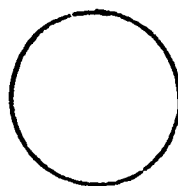
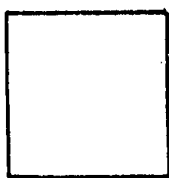
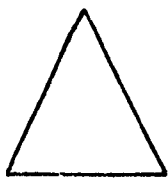
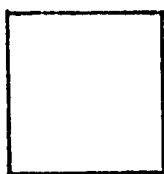
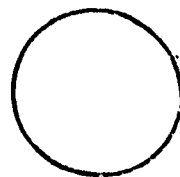
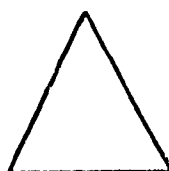
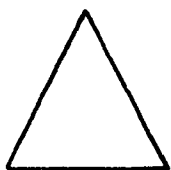
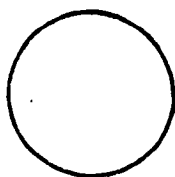
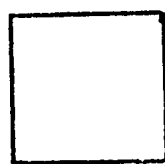
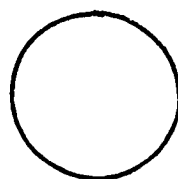
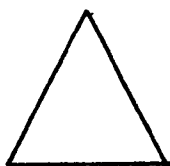
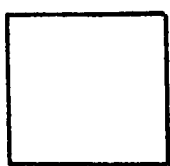
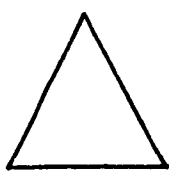
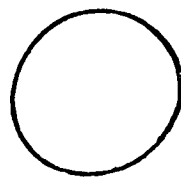
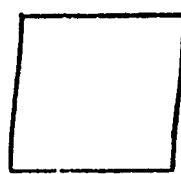
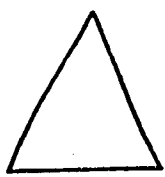
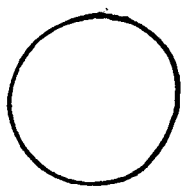
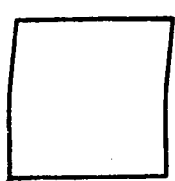
Procedure: The procedure is similar to Exercise 17.

Exercise 26: Multiple-Choice Reversible Figures

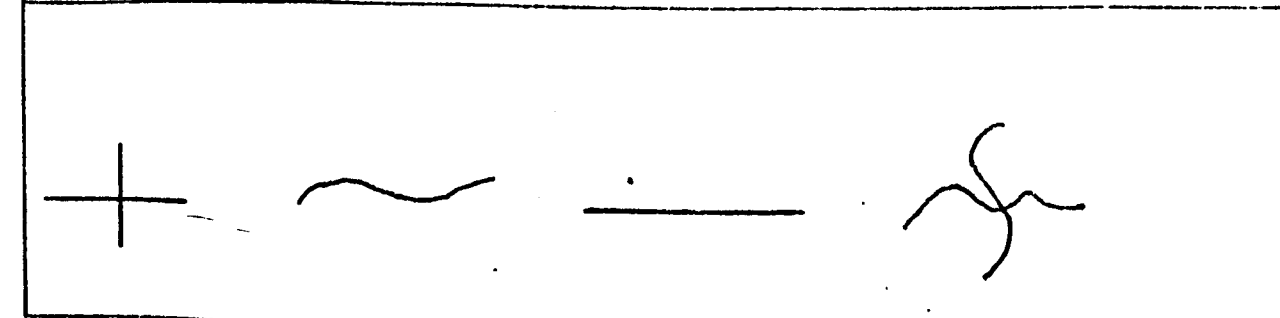
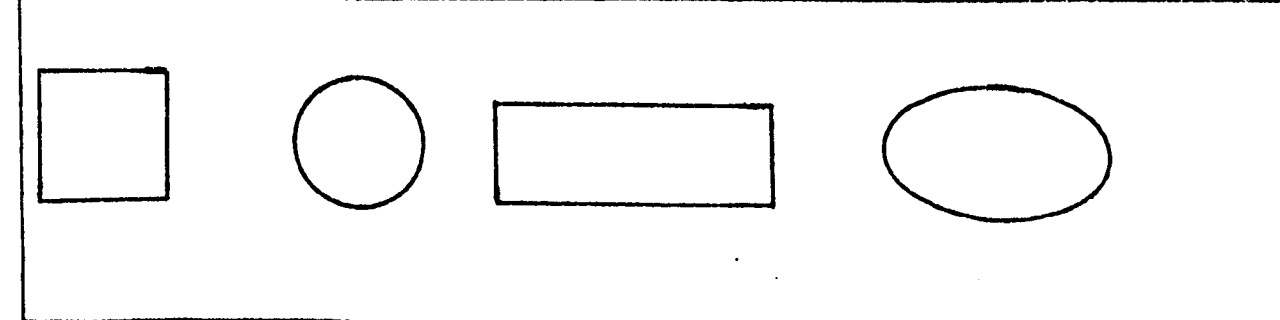
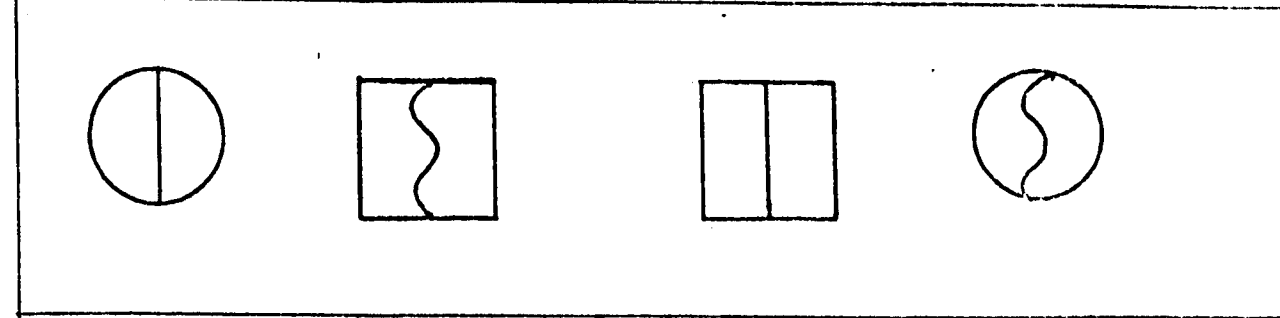
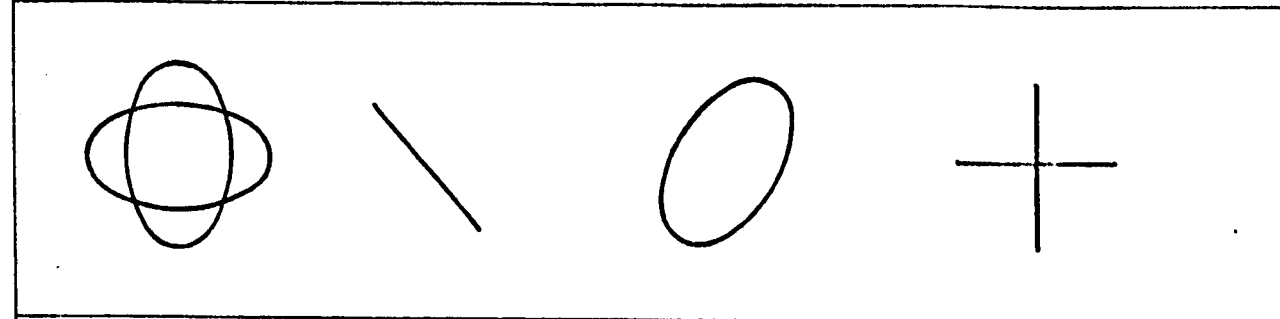
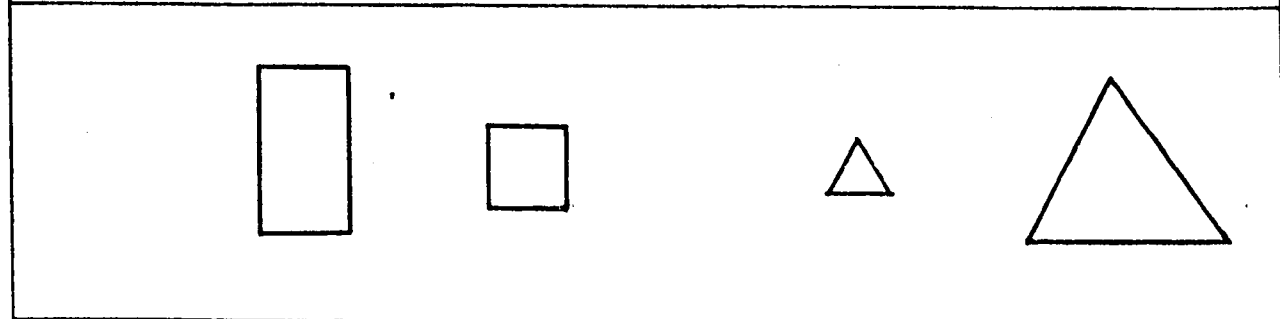
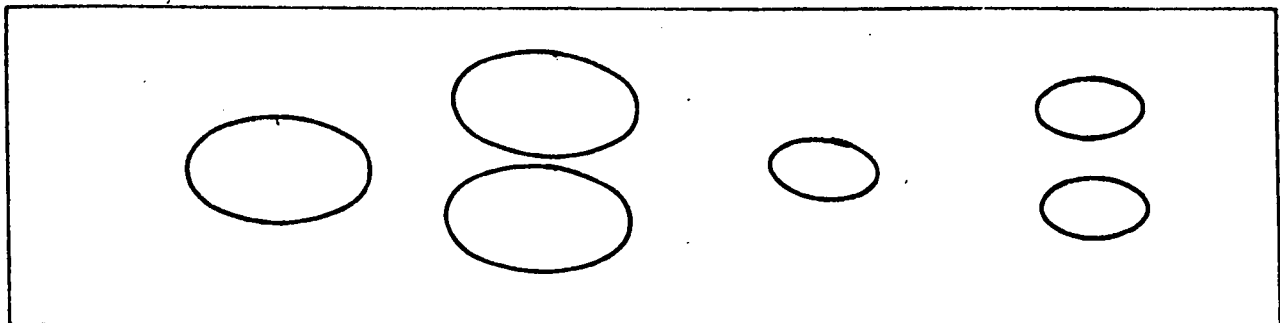
Materials: This exercise contains rows of multiple-choice problems presented on A4 size paper. Each row contains the stimulus figure which is shown on the left of four figures. One of these figures is the reverse of the stimulus figure. Some exercises are illustrated on page 252.

Procedure: The subjects are given the problems and are asked to mark the figure on the right that is the reverse of the figure on the left. The first two rows are used as examples. Corrective feedback is given immediately after each problem.

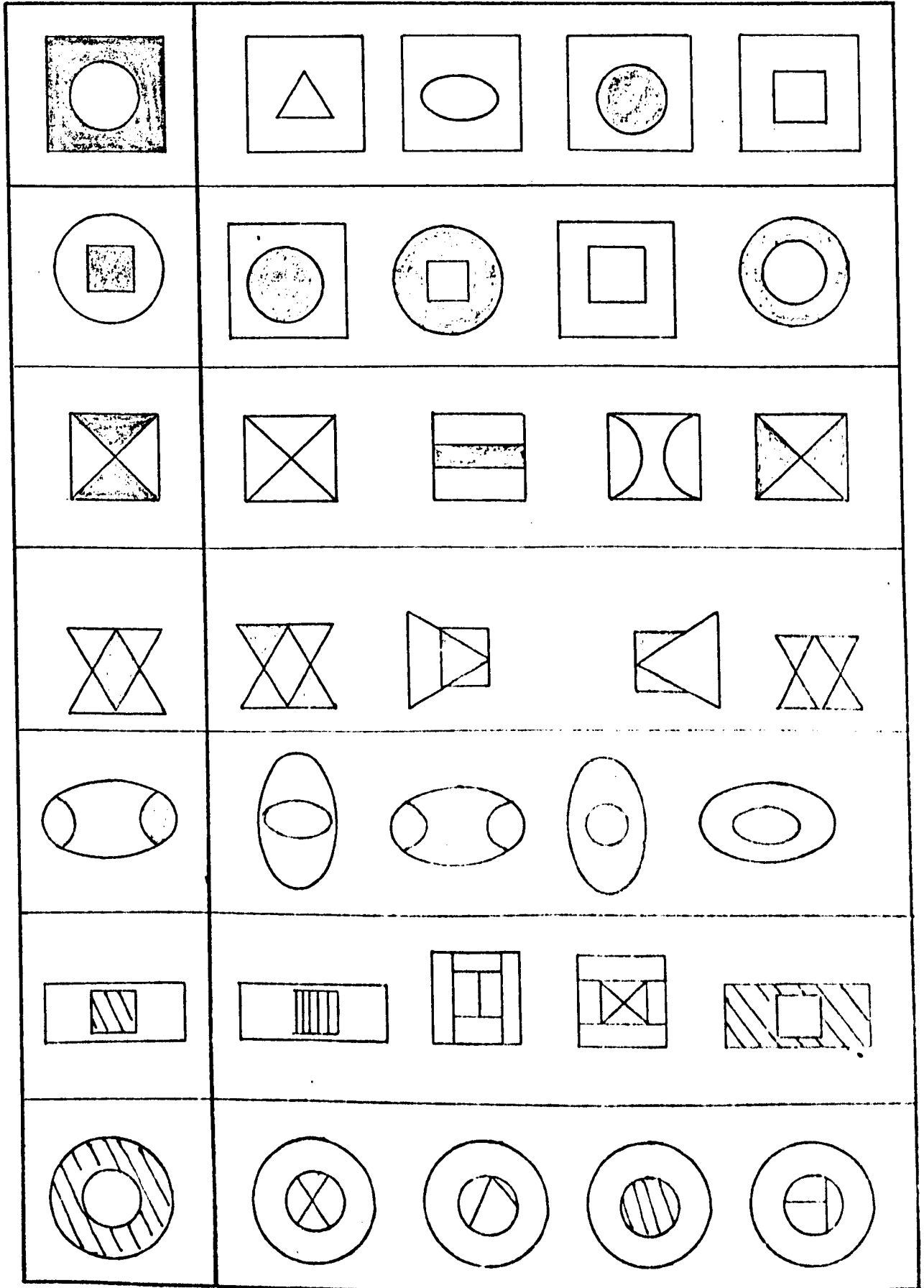
EXERCISE 24



EXERCISE 25



EXERCISE 26



Exercise 27: Tell About This

Materials: A toy, handbag, a cardboard box, and a matchbox.

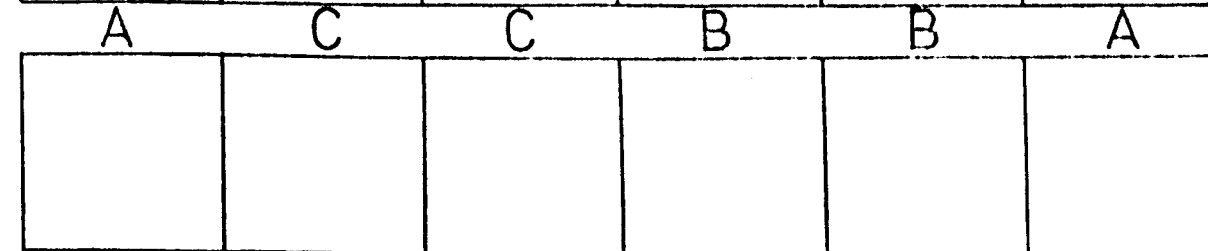
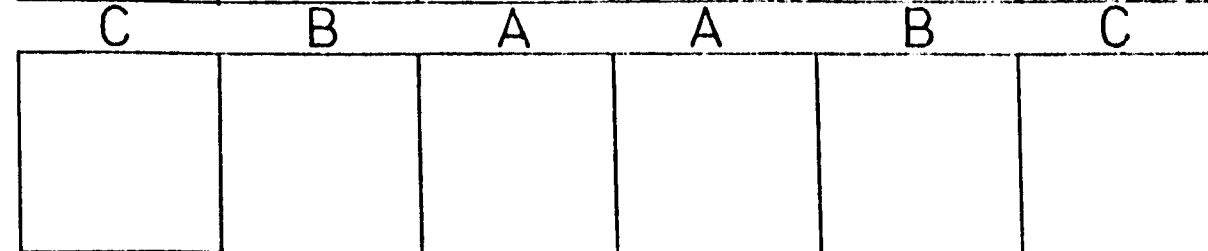
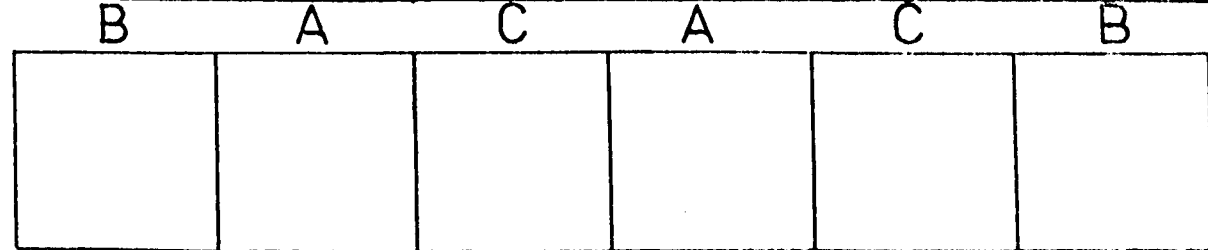
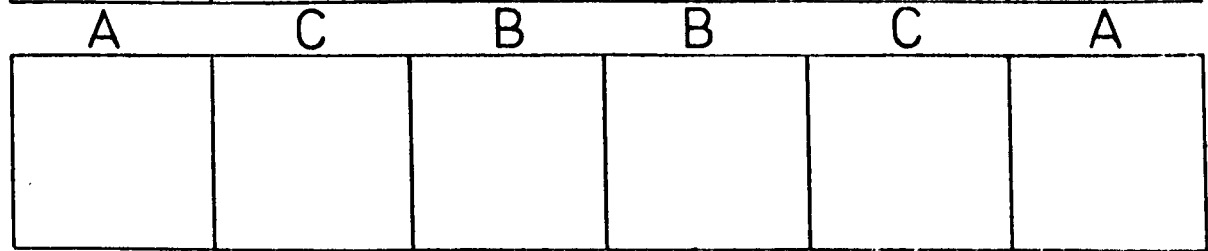
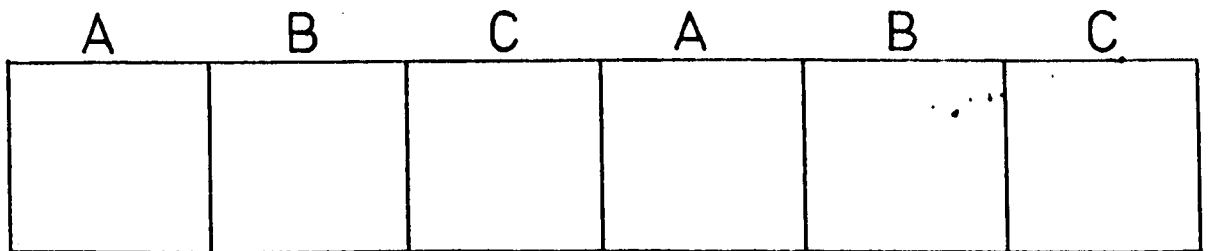
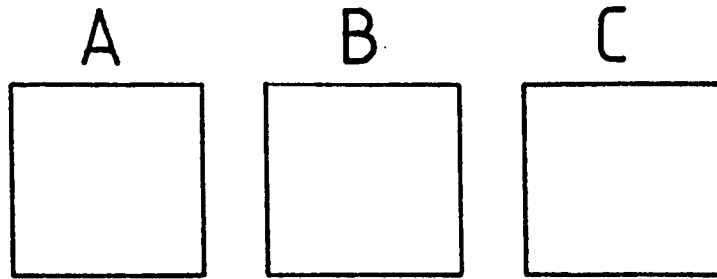
Procedure: The same procedure as for Exercise 12.

Exercise 28: Coding

Materials: Two matrices composed of squares are drawn on two A4 size sheets of paper. On the first page the letters 'A', 'B', or 'C' appear at the top of the squares, and on the second page the numbers '1', '2', or '3' appear at the top of the squares. An example is produced on page 254.
A box of crayons.

Procedure: The procedure is similar to Exercise 24. The subjects are instructed to code first the letters and then numbers.

EXERCISE 28



A P P E N D I X B₁

TRANSFER TASK FOR EXPERIMENT 2

APPENDIX B₁

Transfer Task for Experiment 2

The Children's Embedded Figure Test was developed by Witkin, Oltman, Raskin, and Karp (1971). The test series consist of twenty-five complex figures, eleven of which have the simple TENT figure embedded in them and fourteen of them have the simple HOUSE figure printed on them. An example is illustrated on page 257.

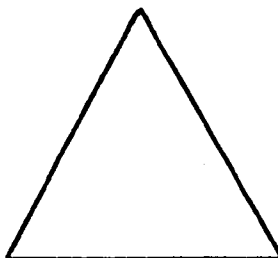
Instructions: Examiner shows the subject the first simple cut-out form (TENT) and says, "This looks something like a TENT, doesn't it? This black line at the bottom shows where our TENT rests on the ground. See if you can find another TENT that looks exactly like ours on this card." Examiner then shows the practice cards. If the subject chooses incorrect figure, examiner might help the subject by saying "You see this is not like our TENT because it is too small.", or "This one is not like our TENT because it is upside down." The concepts of correct shape, size, and orientation on the card are stressed during practice trials.

A similar procedure is adopted for HOUSE series. The test is then administered individually and has no time limit. For test series, examiner says to the subject, "See this TENT, find the TENT and show me where it is" or "See this HOUSE, see if you can find it on this card and show me where it is."

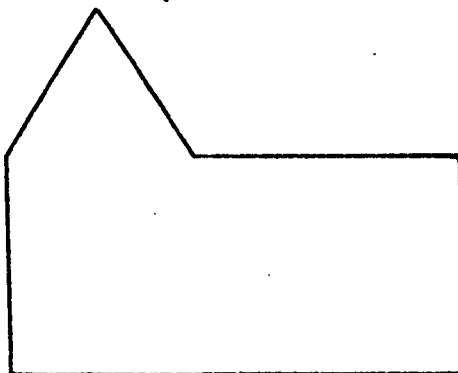
Score: Responses are scored 1 or 0. A score of 1 is given when the first choice is correct or if an incorrect choice is spontaneously corrected. The total score on both series equals the number of correct answers, 25 being the maximum score.

STIMULI FOR CHILDREN'S EMBEDDED FIGURE TEST

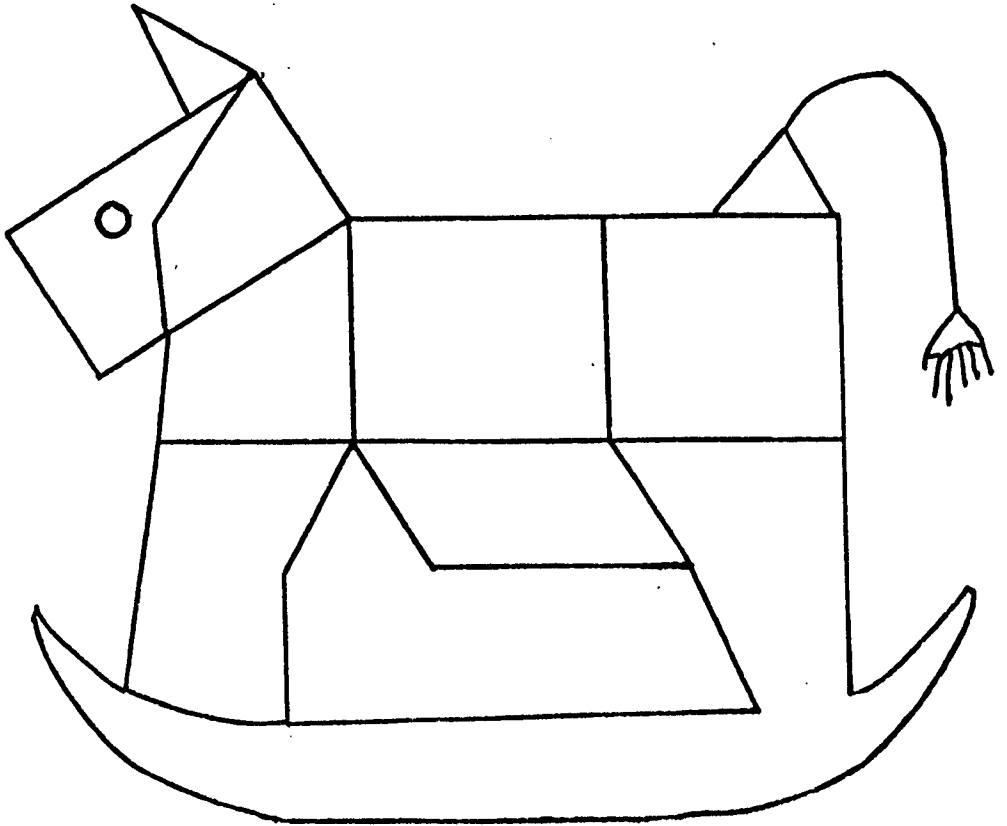
TENT



HOUSE



AN EXAMPLE OF HOUSE SERIES



A P P E N D I X B₂

TRAINING TASKS FOR EXPERIMENT 2

APPENDIX B₂

Training Tasks for Experiment 2

There are nine training exercises and the general procedure adopted is described on page in Chapter 5. The specific methods, namely, 'Placement' and 'Pointing' methods, are explained on page 136 in Chapter 7.

Exercise 1

Materials: A 'posting box' with two sides to insert nine three-dimensional shapes. These shapes are illustrated on page 259.

Procedure: The subjects taught by 'Placement' method are given one stimulus shape at a time and are asked to find the particular shape in the 'posting box'. Throughout the exercise the subjects were encouraged to pay attention to the stimulus shape and look out for a similar shape in the 'posting box'.

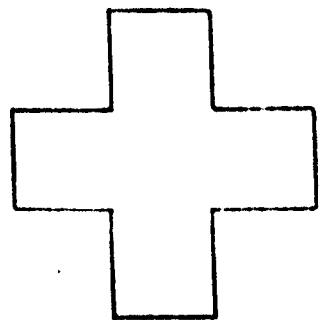
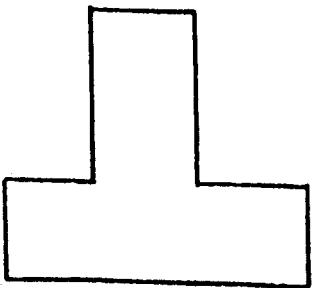
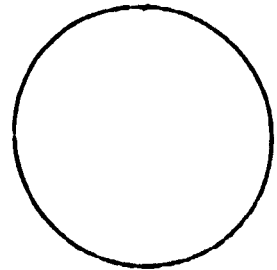
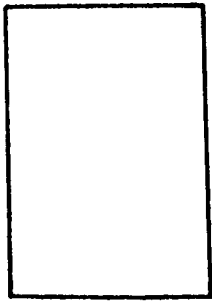
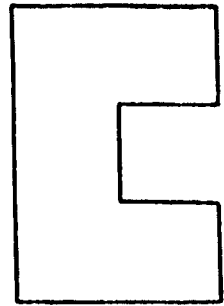
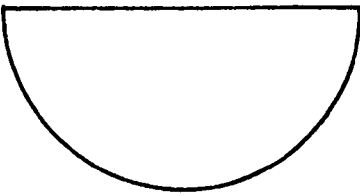
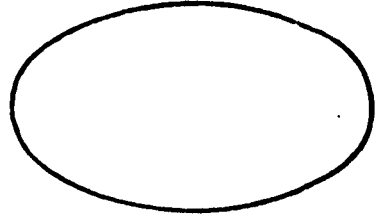
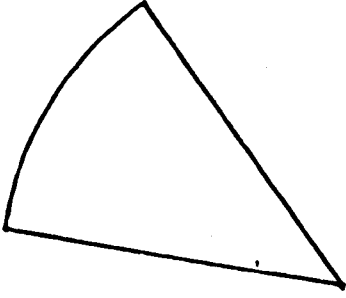
The subjects taught by 'Pointing' method were shown the stimulus shape and were required to point out to the similar cut-out shape in the 'posting box'. The subjects were not given the opportunity to handle the shapes.

Exercise 2

Materials: All nine shapes described in Exercise 1 were drawn on an A4 size sheet of paper, thus presenting Exercise 1 in two dimensions.

Procedure: One cut-out shape at a time is given to subjects who were required to locate a similar shape on the sheet of paper. The groups were trained by 'Placement' and 'Pointing' methods.

EXERCISE 1



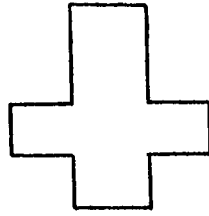
Exercises 3, 4, 5, 6, 7, 8, and 9

Materials: Various cut-out shapes illustrated on page 261 were used for the above exercises. Each stimulus shape was embedded in twenty pages of a children's painting book.

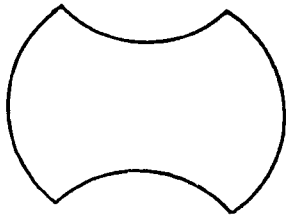
Procedure: The subject was given one stimulus shape at a time and was required to find the particular shape from twenty different pages. An example is illustrated on page 262.

Groups taught by 'Pointing' and 'Placement' methods followed the same procedure described earlier in the previous exercises.

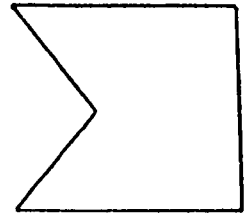
STIMULI FOR TRAINING EXERCISES 3, 4, 5, 6, 7, 8 AND 9



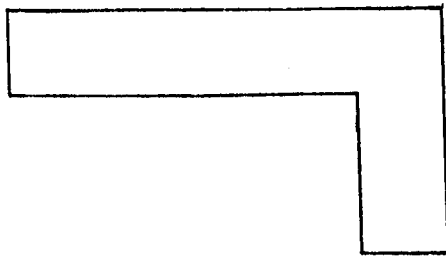
1



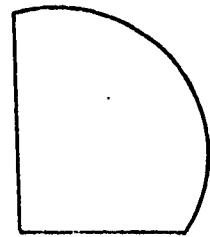
2



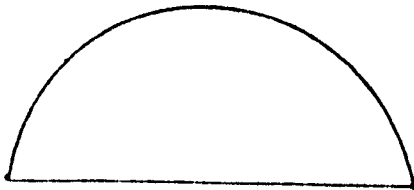
3



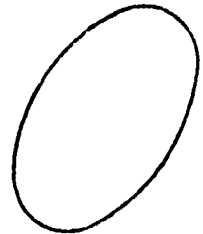
4



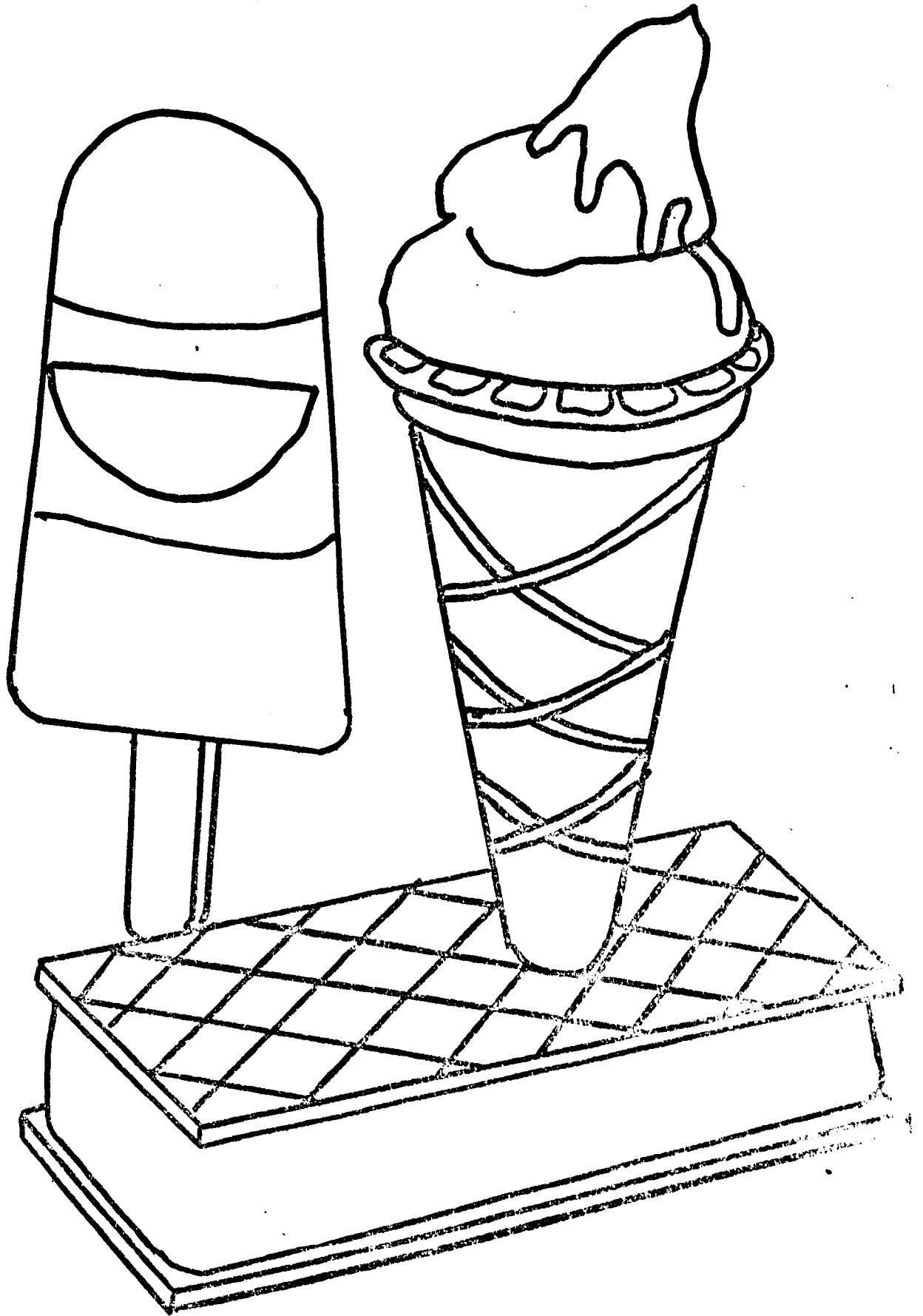
5



6



7



A P P E N D I X C

TRAINING TASKS FOR EXPERIMENT 3

APPENDIX C

Training Tasks for Experiment 3

There are twenty training exercises and these are illustrated on pages 264-265. The general procedures adopted to teach these tasks are described on page 93 in Chapter 5 and on page 157 in Chapter 8.

All twenty training tasks are presented and taught by specific sequences which are described below.

Materials: Each exercise consists of five individually-cut-out cards. One card is used as a stimulus card and the other four as training cards. These exercises are shown on paper as illustrated on pages 264-265.

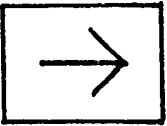
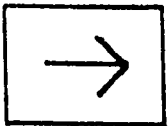
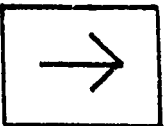
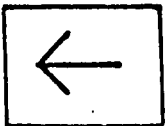
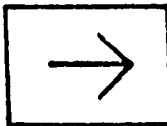

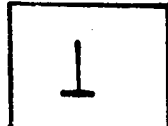


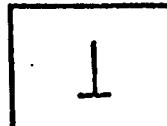


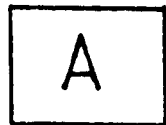
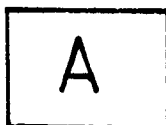





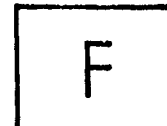
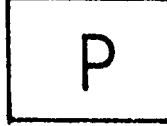




Procedure: The subject is given the stimulus card and four training cards. The experimenter introduces in a visual field the concepts of up, down, right, left, diagonal, etc. Where subjects have difficulty in understanding these concepts, the experimenter uses duplicate materials and acts as a model to teach how a particular exercise is to be done. Where necessary, the subject is physically assisted by the experimenter and then verbally encouraged to accomplish the task throughout the training period. Liberal verbal reinforcement is given in terms of "well done", "good boy or girl", etc.

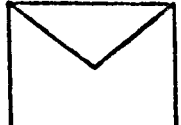
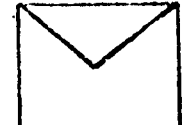
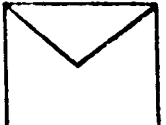


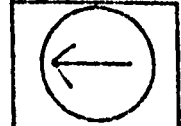
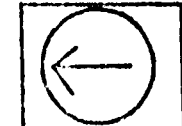
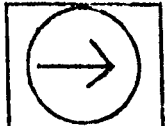
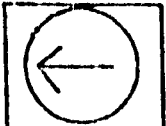
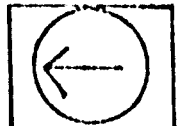




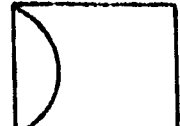
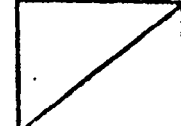
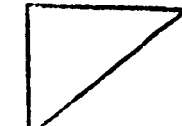
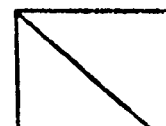
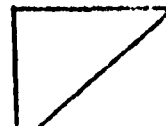
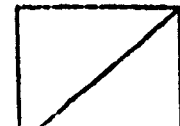





The concept of mirror-image is then introduced by teaching the opposites in visual fields, e.g. up-down, right-left, etc. Gradually the concept of figure-ground reversal is introduced. The criterion for successful learning for a particular exercise is when the subject correctly points to the opposite of a stimulus figure shown on a sheet of paper as illustrated on pages 264-265.

TRAINING TASKS FOR EXPERIMENT 3

STIMULUS CARD

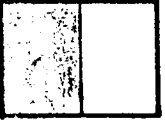










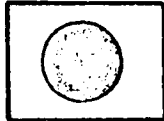
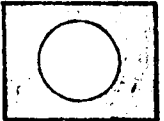

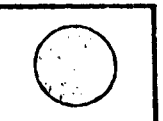




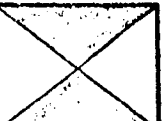





TRAINING CARDS

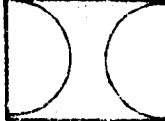
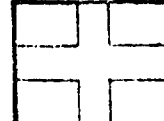
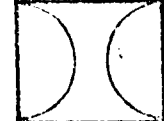








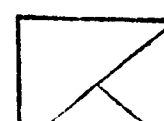
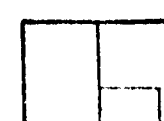

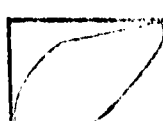





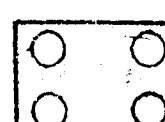


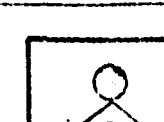
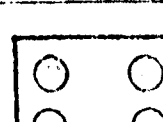
1)					
2)					
3)					
4)					
5)					

6)					
7)					
8)					
9)					
10)					

STIMULUS CARD

TRAINING CARDS

11)					
12)					
13)					
14)					
15)					

16)					
17)					
18)					
19)					
20)					

A P P E N D I X D₁

TRANSFER TASKS FOR EXPERIMENT 4

RECORD SHEET

TRANSFER TASKS FOR EXPERIMENT 4

Name
Date of Birth
Age Pre-Test
Sex Post-Test

Date of Testing

Scores

Cancelling Task
Naming Objects in Pictures
Sorting Shapes
Packing Cocktail Sticks

TOTAL

APPENDIX D₁

Transfer Tasks for Experiment 4

(1) Cancelling Task

Materials: The materials for this task are:

- (a) A4 size paper on which one hundred and twenty letters 'A', 'B', 'C', and 'D' are printed in a random order;
- (b) pencil; and
- (c) stop watch.

Procedure: Give the paper to the subject and point to the demonstration letter 'C' and say "See this letter 'C' at the top row? I would like you to put a line cross like this 'Ø'. The idea of this game is to find all the letters 'C' on this page and cancel them. Go ahead and cancel all the letters 'C' as quickly as you can." If the subject completes all letters 'C' on one sheet then he is provided with more sheets. The example is illustrated on page 268.

Time limit for this transfer task is sixty seconds.

Score: A score of 1 is given for each letter correctly cancelled.

(2) Naming Objects in Pictures

Materials: This transfer task consists of :

- (a) thirty-five cards (4" x 4") with individual pictures of objects drawn on them. Names of these objects are listed on next page;
- (b) stop watch.

Procedure: Show each card to the subject and say "Tell me what this is?" Or, "What do we call this?" Thirty-five cards are presented in a specified order as listed on the next page.

CANCELLING TASK

A B C

A C B D C B D A A B C D

C B A D B C A D D A B C

D A B C A B D C D B C A

A B C D B C A D D A B C

D A B C D A B C D A B C

C B A D C B A D B D A C

B C D A B C D A B C D A

C B A D C B A D C B A D

A C B D A B C D D B A C

B A D C B A D C C B A D

Naming Objects in Pictures

- | | |
|---------------|-----------------|
| 1. Ladder | 18. Milk Bottle |
| 2. Chicken | 19. Flower |
| 3. Hat | 20. Apple |
| 4. Duck | 21. Cup |
| 5. Torch | 22. Spoon |
| 6. Hen | 23. Feather |
| 7. Iron | 24. Envelope |
| 8. Telephone | 25. Ball |
| 9. Fish | 26. Scissors |
| 10. Egg | 27. Dog |
| 11. Coat | 28. Trumpet |
| 12. Star | 29. Cat |
| 13. Bed | 30. Drum |
| 14. Leaf | 31. Ice-cream |
| 15. Boat | 32. Butterfly |
| 16. Aeroplane | 33. Sweet |
| 17. Balloon | 34. Stool |
35. Spoon

Time limit for this task is sixty seconds.

Score: 1 point for each card correctly named.

(3) Sorting Shapes

Materials: The materials for this transfer task are:

- (a) sixty-four individual geometrical shapes cut out from a piece of card-board and painted with eight different colours: red, blue, green, yellow, pink, black, brown, and white;
- (b) stop watch.

Procedure: Present eight different stimulus shapes on the table and give the remaining mixed-up shapes to the subject and say, "Pick one shape at a time from your pile like this (experimenter demonstrates) and place this shape on top of the appropriate stimulus shape like this. See how many shapes you can find and place them correctly."

Time limit for this transfer task is sixty seconds.

Score: A score of 1 is given for each shape correctly placed.

(d) Packing Cocktail Sticks

Materials: The following items are included in this transfer task:

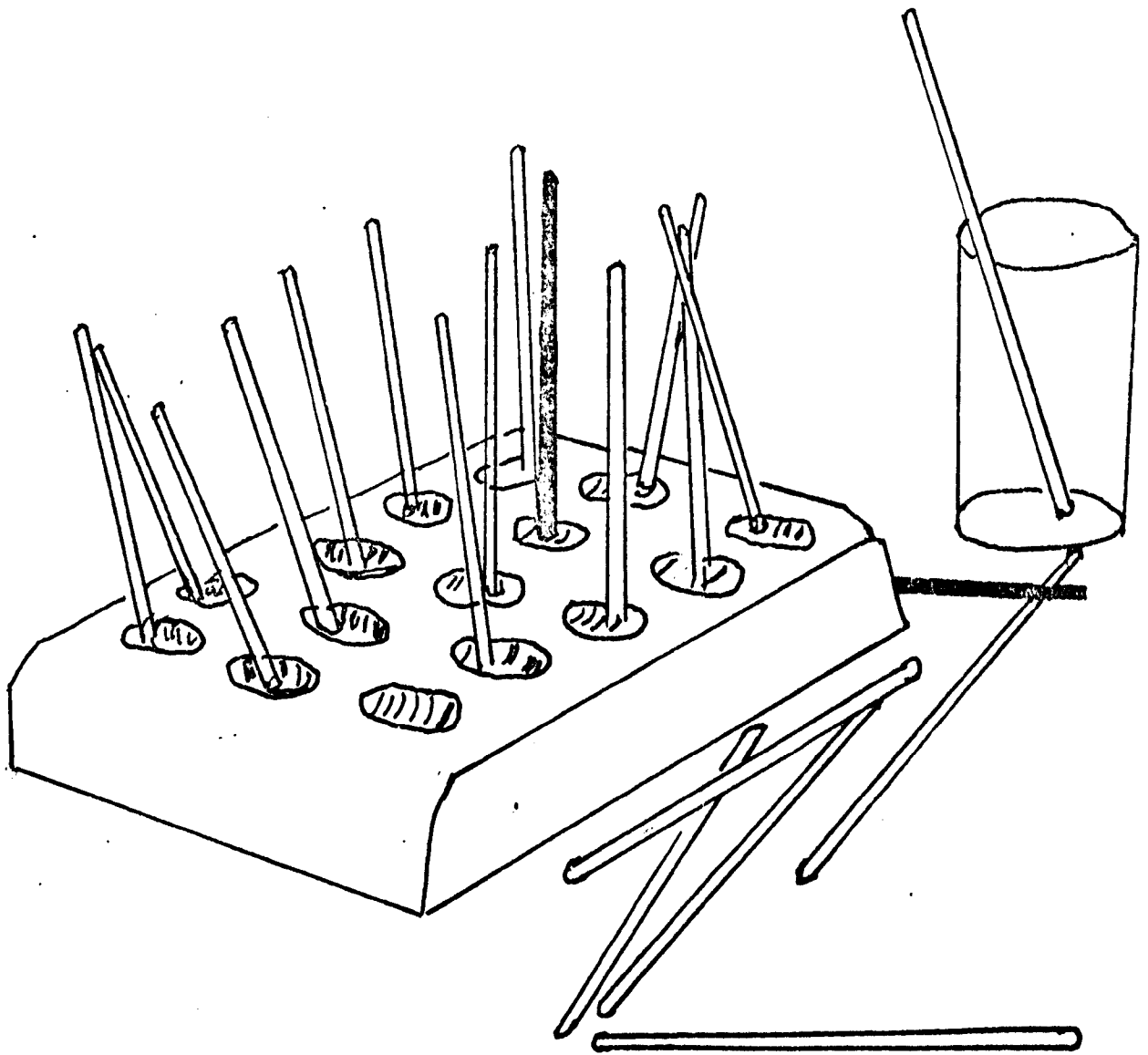
- (a) ninety cocktail sticks;
- (b) one wooden jig with fifteen holes;
- (c) six plastic containers;
- (d) a stop watch.

Procedure: Present cocktail sticks, wooden jig, and containers

(these are shown on page 271) to the subject and say, "See these cocktail sticks, I would like you to pick up these sticks and place one cocktail stick in each of the holes in the wooden jig (experimenter demonstrates). When you have finished the wooden jig, I want you to transfer these fifteen sticks in one container like this (experimenter demonstrates). The idea of this game is to see how many containers you can fill with fifteen sticks in each container. Ready? Go." Time limit for this transfer task is sixty seconds.

Score: One point is given for each stick correctly placed in the plastic containers.

PACKING COCKTAIL STICKS



A P P E N D I X D₂

TRAINING TASKS FOR EXPERIMENT 4

APPENDIX D₂

Training Tasks for Experiment 4

(1) Matching Coloured Pegs on a Board

Materials: The materials for this training exercise are:

- (a) a plastic board with holes;
- (b) sixty different coloured pegs; and
- (c) stop watch.

Procedure: Present six coloured pegs on the board in order of red, blue, green, yellow, red, and green (this is illustrated on page 273). Give the remaining pegs to the subject, and say, "Now you match these coloured pegs and insert them in this board under its appropriate colour, (experimenter demonstrates). Ready? Go!"

There is a time limit of sixty seconds for this exercise.

Score: 1 point is awarded for each peg correctly placed.

(2) Sorting Colours

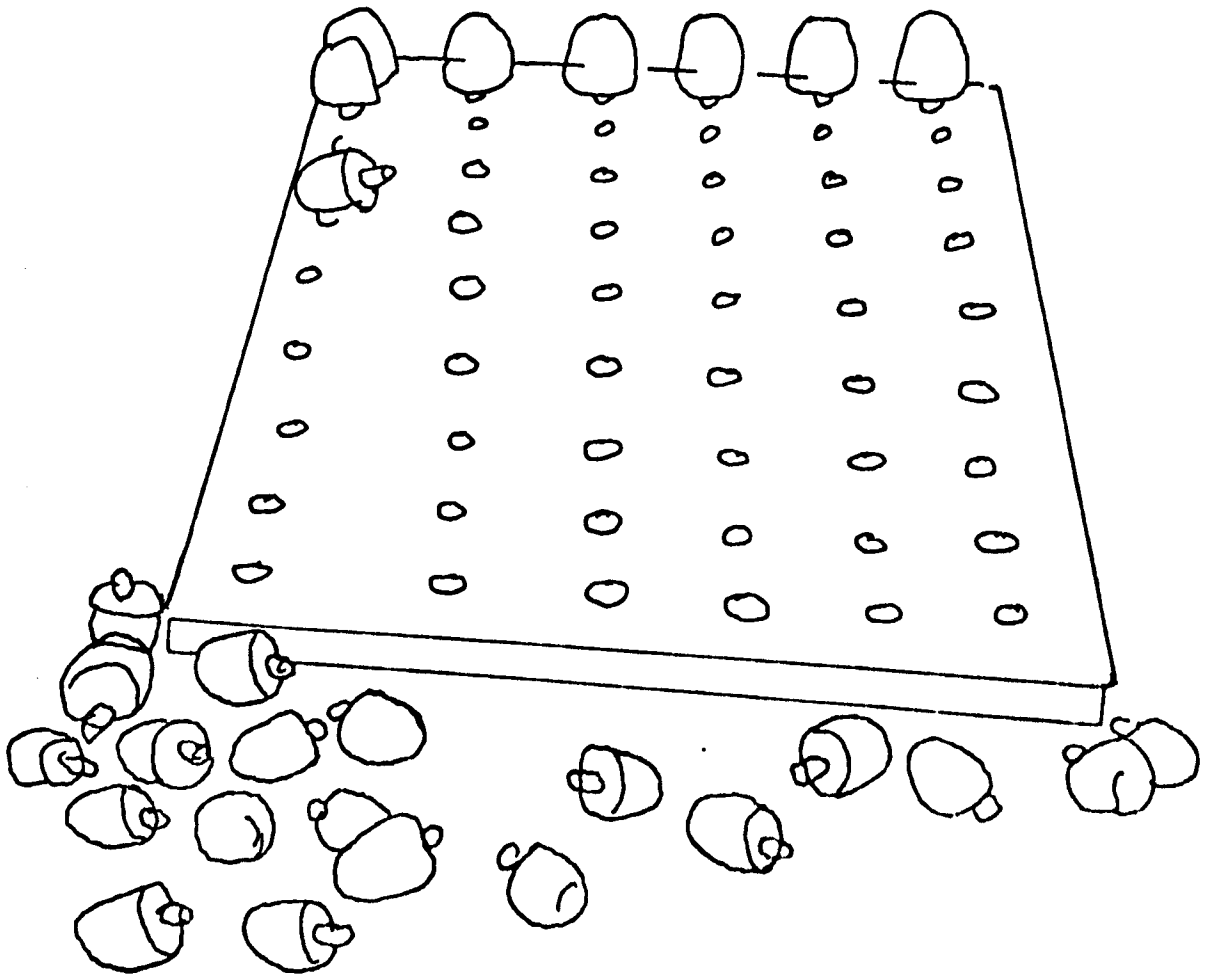
Materials: The materials of transfer task 3 in Appendix D₁ are used for this exercise.

Procedure: Lay out eight different-coloured stimuli on the table and give the remaining mixed-up coloured shapes to the subject and say, "Pick one colour at a time and place it on its appropriate colour (experimenter demonstrates). Let us see how many colours you can match in a short time. Ready? Start."

There is a time limit of sixty seconds for this exercise.

Score: 1 point is given for each colour correctly placed.

MATCHING COLOURED PEGS ON A BOARD



(3) Picture Classification

Materials: Forty individual cards with pictures of various types of food and articles of wear are listed below:-

- | | | |
|---------------------|--------------------|-------------------|
| 1. Lady's Coat | 14. Man's Shirt | 27. Lady's Blouse |
| 2. Cakes | 15. Blackberries | 28. Shorts (Boys) |
| 3. Girl's Dress | 16. Lady's Boots | 29. Ice-cream |
| 4. Strawberries | 17. Beans | 30. Banana |
| 5. Baby Winter Coat | 18. Lady's Sandals | 31. Sweater |
| 6. Peach | 19. Carrots | 32. Trousers |
| 7. Tie | 20. Pineapple | 33. Baby Mitten |
| 8. Grapes | 21. Baby Boots | 34. Biscuits |
| 9. Lady's Hat | 22. Leg of Meat | 35. Radish |
| 10. Spring Onions | 23. Jelly | 36. Apple |
| 11. Cherries | 24. Men's Shoes | 37. Lady's Skirt |
| 12. Baby Jacket | 25. Socks | 38. Orange |
| 13. Lemon | 26. Pie | 39. Pear |
| | 40. Sausages | |

A stop watch.

Procedure: Show one stimulus card with the picture of food

(e.g. Strawberries) and one stimulus card with a picture of an article of wear (e.g. Lady's Coat) and say "Form two groups from these cards, one group for articles of wear and the other group for types of food."

Time limit for this training exercise is sixty seconds.

Score: 1 point is awarded for each card correctly placed.

(4) Coin-Sorting

Materials: The materials for this training exercise are:

- (a) sixty coins of various denominations; and
- (b) stop watch

Procedure: Place six coins, $\frac{1}{2}$ p, 1p, 2p, 5p, 10p, and 50p, and give the remaining coins to the subject and say "Pick up one coin at a time and place the coin on top of the appropriate stimulus coin (experimenter demonstrates). I want to see how many coins you can correctly place in a short time. Ready? Start."

Time limit of sixty seconds for this exercise.

(5) General Aptitude Test Battery (Manual Dexterity Task)

- Materials:
- (a) a large pegboard with rows of holes;
 - (b) forty-eight pegs, each peg being half red and half white;
 - (c) stop watch.

Procedure: Present the board and pegs to the subject and say, "Insert the red half of the pegs into the holes like this, (experimenter demonstrates) and see how many pegs you can insert in a short time." The subject is then required to repeat by inserting the white half of the pegs. Time limit for this training exercise is sixty seconds.

Score: 1 point is awarded for each peg correctly placed.

(6) General Aptitude Test Battery (Finger Dexterity Task)

- Materials:
- (a) a board with fifty holes;
 - (b) rivets and washers;
 - (c) stop watch.

Procedure: Show the board to the subject with rivets and washers and say, "I would like you to fit a rivet and a washer into each hole like this (experimenter demonstrates). See how many rivets and washers you can fit here in a short time."

Time limit for this exercise is sixty seconds.

Score: 1 point is given for each rivet or washer correctly placed on the board.

(7) Coding Task

- Materials:
- (a) A4 size lined paper with a red stimulus vertical line (!) and a green horizontal stimulus line (-) marked;
 - (b) stop watch.

Procedure: Give the paper to the subject and say, "I would like you to mark these lines in rows alternating with red vertical lines and green horizontal lines like this | - | - | -

(experimenter demonstrates). See how you do this."

Time limit of sixty seconds is given for this exercise.

Score: 1 point is awarded for each correct mark.

(8) Paper-Folding Task

Materials: The materials for this exercise are:

- (a) 4" x 4" square papers;
- (b) stop watch.

Procedure: Give square papers to the subject and say, "Watch what I do (experimenter demonstrates how to fold a square paper in half).

See how many papers you can fold in a short time. Ready? Go!"

Time limit for this training exercise is sixty seconds.

Score: 1 point is given for each paper folded correctly.

Appendix E

Group Means For Each Experiment

Experiment 1

Table 3

	TRIALS			
	2	8	9	10
GROUPS	24.12	38.89	33.05	18.78
	16.80	16.37	16.12	11.57

Table 4 and 5

As in Table 3

Table 6

	SUB TESTS					
	A	B	C	D	E	F
GROUPS	.85	1.54	3.25	3.00	2.76	2.24
	-.12	-.20	-.12	.18	-.01	.02

Experiment 2

Table 8

	TRIALS	
GROUPS	1.10	5.30
	1.10	3.30
	1.10	1.50

Table 9

	TRIALS	
GROUPS	1.60	9.70
	.90	4.40
	2.10	2.70

Table 10

	TRAINING PERIODS	
GROUPS	8.10	1.60
	3.50	6.60

Table 11

	TRAINING PERIODS	
GROUPS	4.20	1.10
	2.20	2.10

Experiment 3

Table 13

	TRIALS	
GROUPS	0.00	7.93
	0.00	0.00

Appendix E (cont.)

Experiment 4

Table 15

GROUPS	TASKS			
	A	B	C	D
	22.73	12.60	9.40	16.33
13.73	8.53	5.20	9.26	

Table 16

TASKS (colours)	TRIALS	
	(shapes)	7.67
	7.00	16.13

Table 17

TRIALS	TASKS					
	1	2	3	4	5	6
4.93	7.67	8.60	11.47	15.27	9.73	
11.60	19.47	20.13	25.20	25.80	17.33	
TRIALS	7	8	9	10	11	12
13.93	6.80	18.00	10.46	7.00	17.00	
29.60	15.87	41.33	23.06	17.26	31.20	

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