Compensatory Physical Education For Motor Impaired, Approved School Boys.

[illegible]

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SUMMARY

This study is concerned with the identification, the aetiology and the treatment of the 'clumsy' child - the child awkward in everyday movements. Some clumsy children can be classed as mentally retarded, educationally sub-normal or physically handicapped, but they are beyond the scope of this investigation. The motor-impaired child studied in this work may have no obvious handicap but appear at the opposite end of the skill continuum to the expert athlete.

The 'awkwardness of the motor-impaired child may pose educational and social problems. With technological advances, certain personal skills are disappearing - slip-on shoes replace tie-ups, cars replace cycles, etc. - so it is becoming easier for a child to hide his inability to perform skillfully, and so escape treatment.

Failure in certain socially acceptable activities (e.g. sport), may lead to resentment and the seeking of recognition through less acceptable activities. The failure of a parent or a teacher to recognise the difficulties of the child, and their lack of sympathy (often shown in anger or derision), can slow the child's learning and create emotional problems.

Avoidance of activities associated with skilled movements will exaggerate inabilities. The pattern of:- continual failure- scorn - rejection - isolation - mis-behaviour - delinquency, is a familiar one. For this reason this study examines the incidence of motor-impairment among young delinquents. It also seeks to debate the possible causes of motor-impairment, and, in the belief that this impairment is not necessarily either congenital or permanent, a movement training programme has been devised aiming to compensate for the missed experiences which are necessary for the formation of early basic perceptions within a child about himself and his relationship to his environment.

The results of this work are very encouraging. The remedial programme administered would appear to go a long way towards alleviating the problems of motor-impairment in this population. Although this is

relating to young delinquents, any theories formed should apply equally as well to the 'clumsy' child within the 'normal' school situation.

CONTENTS

CHAPTER I

INTRODUCTION

The Concept of Motor-impairment.

Previous work in the field of motor-impairment has been very limited. The most reliable and detailed study of the subject was initiated by the Russian, Oseretsky (1923) and subsequent developments appear very much related to his original work as part of a chain of progressive research and development of the subject.

The original research was prompted by clinical observations of children of apparently normal, or above normal I.Q., who showed striking deficiencies in motor performance up to the point which was described as 'motor idiocy'. Oseretsky believed that such deficiencies could have marked clinical and social implications.

> "It is conceivable that a child is making poor adjustment from a personality and social point of view because of motor awkwardness."

In the light of modern psychological opinion it is evident that there is far more concern for the obscure and diverse effects of motor-impairment. No longer is it seen to be solely the manifestations of certain forms of brain damage but also as a result of other social and psychological problems.

Current interest in motor-impairment has been revived by Stott's (1966) description of a general test of motor-impairment for children. Stott (1964) had already pointed out the possibility of a close relationship between motor-impairment and behavioural problems, particularly of the type associated with delinquency.

Stott has defined motor-impairment as:-

> "...that which constitutes any dysfunction in the everyday activities of the child."

and,

> "...a condition which manifests itself in performances which are sub-normal or in performances whose efficiency has been impaired in some way."

In everday terms, motor-impairment shows itself in the inability to perform certain accepted skills to a suitable standard, e.g. dressing, tying shoe laces, running, throwing, etc. or in clumsy behaviour in the classroom or the gymnasium. Difficulties in using crayons, paint brushes, scissors and the like, or in sitting at the table and using a knife and fork may get a child labelled as 'clumsy' or even 'lazy' when in fact the difficulty is due to motor-impairment.

Recognition of motor-impairment simply by observing everyday activities is hardly satisfactory, because it is stating what is obvious:-

> " It would seem that the unqualified use of the term 'brain-damage' in a diagnostic psychological report on a child, is a gross over-simplification and somewhat analogous to a physician reporting that a patient is bodily ill."
>
> Herbert (1964).

By substituting 'motor-impairment' for brain-damage' in the quotation, it makes the point that having identified the impaired, we should go further and try to identify the factors underlying the impairment. Also, as Knobloch and Pasamanick (1960) have pointed out, diagnosis becomes increasingly difficult with age, as there is likely to be a certain amount of compensation for neuromotor disability, particularly by the more intelligent child, during the maturational process.

One of the difficulties in diagnosing motor-impairment is in arriving at a cut-off point for normality and sub-normality. In testing motor ability the median score is often used as a so called 'pass' mark so approximately half of the subjects would pass at their own age level. This is obviously unsuitable for a test of motor-impairment. As there is a continuum of ability, one point on the scale is not going to separate the normal from the sub-normal and therefore any cut-off point is purely an arbitrary one. It is also difficult to establish the percentage of the population suffering motor-impairment. In a study of 810 children aged 8-9 years old, with I.Q.'s of 90 or above, Brenner et al. (1967), 54 were classed as being 'clumsy' in movement or fine motor control. It is also interesting to note that their teachers described these as untidy, slovenly and careless. This gave a figure of 6.7 %

which may be a useful indication, but only an indication, of the problem.

In searching for the causes of motor-impairment a similarity was noticed between the behaviour manifested by motor-impaired children and that of cases known to suffer brain-damage, thus brain-damage makes an obvious causal factor. Brain-damaged children tested on certain psychological tests for example by Werner (1944), Wechsler (1949), Bender (1956) and Kephart (1965) showed certain characteristic disabilities believed to be detrimental to the learning process. Aspects of behaviour which may show disturbance in the brain-damaged child includes perception, concept-formation, emotional and social development and motor performance.

In considering brain-damage and its effects, Knobloch and Pasamanick (1959) postulate a continuum of reproductive casuality extending from death in utero and in the neonatal period to minimal cerebral damage resulting in minor behavioural difficulties. Support for this link between complication of pregnancy and behavioural problems comes from Pasamanick et al. (1956), Rogers et al. (1955) Corah et al. (1965) and Drillion (1964).

Although evidence of this kind indicates that minimal brain damage may result in perceptual- motor-impairment and later in social maladjustment, one cannot presume that all cases of such impairment are due to brain-damage (unless we are taking the extreme view of Knobloch and Pasamanick that we are all on the brain-damage continuum), as this would be to ignore factors of environment, maturation and genetics.

The environment in which a child develops can provide or deprive him of the necessary stimulation, care, etc. for normal development. Many of the deprivation studies (reviewed in Newton and Levine - 1968) show a high incidence of perceptual, motor, social, intellectual and emotional impairment resulting from various forms of deprivation. So a second cause of motor-impairment could be the adverse environment as seen in these deprivation studies. This is not to deny that if a child suffering from brain-damage is also subjected to deprivation, the effect of the deprivation may be magnified. The British Medical Journal (1963) suggested that ' clumsiness ' is due to delayed maturational process of the nervous system. This in turn may be the result of early deprivation, or adverse environmental factors.

The meaning of the word 'stress' has undergone change during the years but if we refer to it as abiochemical reaction brought about through stimulation, it will be seen that varying levels of stress will have varying effects.

> " Stress is an internal reaction, an intervening variable between situation and performance, evidenced by a marshalling of resourses to meet a threat."
>
> Cratty (1967)

Relating to learning, extremes of stimulation will possibly lead to deprivation. Many changes occur under different kinds of stress. As the immature organisms are relatively quickly altered by early experiences, it seems reasonable to assume that should the environment in which the child lives be too stressful, or under stressful, the child will be affected in a way which will adversely alter its future development. Stress, or the lack of it, may present itself inmany ways:-

a. Stress during pregnancy,
b. Crowded home conditions; unhappy family relationships
c. Over-protection (which may cause a reduction in stress)
d. Restricted movement - day-time suppression
e. Separation from parent/s.

The third and perhaps most recently discussed causal factor of motor-impairment is that suggested by Stott. Although there may be no organic damage to the brain, this is not to rule out what he has termed, brain-dysfunction. This is to suggest that although all'parts'of the brain are present, faults in output may be due to the way in which the brain parts have developed and work together. Stott (1964) suggested that many of the factors of impairment are congenital, that is that the antecedents of the condition date from birth or before, and so embrace factors operating during gestation or delivery. This did not deny the absence of hereditary influences or the effect of the environment.

Another interesting aspect raised by Stott (1964) was that of the "survival of thevulnerable". With the great advances that medical science has made since the war, particularly in the field of antibiotics, many more physically delicate children survive than previously. These will no doubt contain a higher proportion of motor-impaired children than the more physically robust population. Consequently there will be a higher proportion of 'vulnerable' children. With the emphasis put on saving children who would die at, or soon after birth, this tendency will be accentuated.

At this point it should be made clear that although what is being considered is MOTOR impairment, the motor aspect is that which we can observe, i.e. the end product, the movement or the attempted movement. Any attempt in the skill which results in a breakdown, is seen in the motor effort. Failure, however, may be due to, or caused by, a failure in any one of the sub-systems which go to make up the skill, e.g. the inability to take in the correct information to enable the correct movement to be made,

the inability to 'sift' the information,

the inability to interpret the information,

etc.,

therefore failure may be due not only to the output or motor response but to heeding the wrong cue on the input part or the inability of the brain to organise the correct response. This involves such things as perception, feedback, memory, etc. which will be dealt with later in chapter 2.

As previously stated, the motor-impaired child deviates only slightly from the 'normal' child. Because of this, the attention given to the problem has been minimal and the impaired child may often be the victim of misunderstanding and a cause of frustration to parents and teachers. The child may be classified as 'normal', but in the specific activities requiring high levels of skill, such as craftwork, games, art, writing and eating, he may be regarded as clumsy. This clumsiness may be put down to laziness or lack of concentration for which he may be rebuked or punished. He may just meet with failure in his efforts. Constant rebuke or failure could have more significant effects on the child. It may, at first, result in the 'avoidance' of the activity and a dislike of all associated with it. Avoidance may result in isolation which in turn could produce efforts to gain notice in other, perhaps less socially acceptable behaviour. This theory is suggested by Stott (1966) and supported by his study of thirty-three delinquent children in Glasgow, who showed far more neurological disturbances and poorer muscular co-ordination than normal children. On the basis of his suggested syndrome of pregnancy - multiple impairment, Stott (1962) further suggested that physical ill-health, defect, or abnormality of growth would be more prevalent in the delinquent child than in the normal child. This would also suggest that if motor-impairment was one of these abnormalities then one would expect to find a higher than average incidence of this amongst delinquent children. Bamber (1966) working in Glasgow, used the Stott Bristol Social Adjustment Guide to establish that approved school boys are more maladjusted than probationers who, in turn are more maladjusted than normal children. He went on to support Stott's theories when he found that 35% of a studied approved school population had histories of complication during pregnancy or delivery. Using the 'Oseretsky Test of Motor Ability' he also suggested that approved school children were more likely to show symptoms of brain damage or neural impairment. However, as this was a test of motor ability, and not motor-impairment it did not establish a high incidence of motor-impairment in approved school populations. Nor did it suggest any cause other than that of brain damage, although post-natal environmental stress such as illegitimacy, unemployment of father, physical neglect, etc., was still the most common factor to be found in the case histories of the approved school group.

Following this, Davies et al. (1969) using the Stott Test of Motor Impairment with a sample of 60 approved school boys, between the ages of 11 and 14 years, showed 16 (27%) to be motor-impaired (according to the cut-off point adopted). In only four of these cases was evidence of the possibility of brain damage found and from the records, (which may have been inadequate) only four pregnancy complications and one premature birth was reported.

Adverse environmental conditions were prevalent, rarely in isolation including:-

> delinquent sub-culture, criminal parents, impoverished home environment, separation, divorce, co-habitation, step-parents, mental cruelty, maternal or paternal deprivation, psychotic or physically handicapped parent, violence in the home, cruelty, rejection, institution--alisation, illegitimacy, over-indulgence, under-nourishment and emotional deprivation.

Of the 44 boys not deemed as motor-impaired, it was noticed that performance on the Stott Test, while not bad enough to class them as motor-impaired, was not up to the standard of a normal population (only eight scored nought or one).

Having established a high incidence of motor-impairment in the junior approved school population, the next question to ask is whether or not the impairment, at this age, is permanent. It is the hypothesis of this study that if the cause is due to adverse environmental factors, then compensatory education aimed at providing the necessary stimulation and opportunity for movement might help to alleviate the problem. If the cause is brain-damage, this would be more difficult, but according to Doman et al. (1960) not impossible. They have suggested that lags in neurological dev--elopment can be overcome through re-education, but what is more, that through their programme, it is possible to re-educate the brain to take over the functions of the damaged cells.

A certain amount of work (which will be reviewed later) has been carried out with children suffering from more severe handicaps. This type of training has generally been used as a special programme to supplement other forms of physical education, and often on an individual basis.

The purpose of this study is to take a population with lower than average motor ability and to devise a programme of physical education which could be administered to them as part of their normal physical education programme which would help them over-come their motor inabilities, and which would be acceptable to than as a means of gaining success and enjoyment through physical activity.

CHAPTER II

SKILL AND THE BREAKDOWN OF SKILLED BEHAVIOUR

The definition of motor-impairment, as given in the introduction, relates to the failure to perform certain accepted skills to a certain level. Before going on to examine the possible causes of motor-impairment, it will help to determine the aspects of skilled behaviour and the areas where skilled behaviour can break down.

Welford (1960) and Argyle & Kendon (1967) refer to all skills as perceptual-motor skills, pre-supposing a link between the input of information to the brain and the output in the form of a muscular response. Argyle & Kendon define a skill as:-

> " .... an organised co-ordinated activity in relation to an object or a situation which involves a whole chain of sensory, central and motor mechanisms."

The person having skill, according to Knapp (1964), has:-

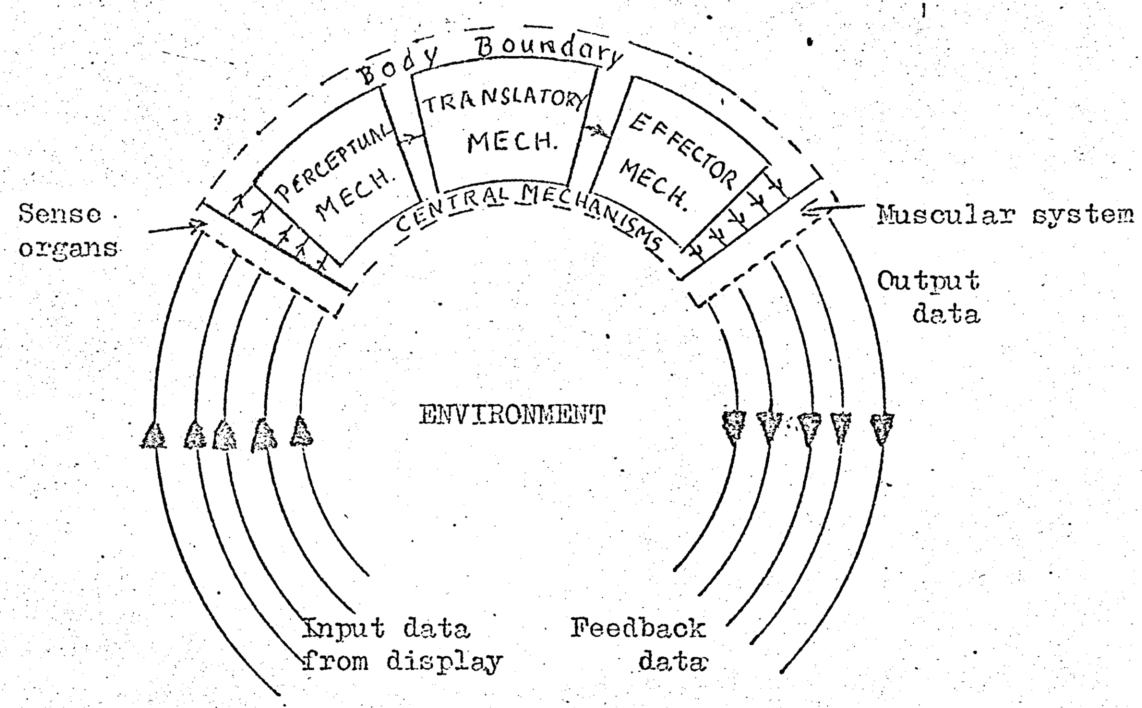
> ".... the learned ability to bring about predetermined results with maximum certainty often with the minimum outlay of time or energy or both."

This definition of skill includes the 'learned ability', itself a process involving internal neural factors dependent on factors other than drugs, fatigue, growth etc. .

Whiting (1969) constructed a model of perceptual-motor performance reflecting the major systems involved in such behaviour. This is illustrated in figure 1. The circular representation shows the ongoing procedure of; stimulus - response - feedback information which affects new stimuli and further response. It should be noted that the centre three systems make up what Beer (1960) and Klir (1965) had earlier called the 'black box' system. Klir suggested that the term 'black box' had been adopted for every system whose organisation and behaviour are unknown but which can be experimented

Perceptual-motor Skill

Fig. 1



Model of perceptual-motor performance.
From Whiting, H.T.A. 1969 Acquiring ball skill - a psychological interpretation. London: Bell.

with and whose activity can be recorded. As long as no information concerning the organisation of the 'black box' is available, we can acquire knowledge only of the relatively permanent behaviour corresponding to the ascertained activity.

With regard to fig. 1, it should be pointed out that these areas will vary in importance with the type and complexity of the skill. There have been many systems of skill classification described, but as classification should help in determining the method of presentation and learning, then perhaps the model in fig. 1 should be examined in relationship to the learning process. Fitts [1] comments on the process involved in the various types of learning as follows:-

> "Processes which underly skilled perceptual-motor performance are basically very similar to those processes which underlie language behaviour as well as processes involved in problem solving, concept formation, etc. If so, then laws of learning should be similar... distinctions between verbal and motor processes serve no special purpose."

Traditional learning is divided into three categories; 1. cognitive, 2. affective, and 3. effective learning.

Cognitive learning refers to changes in the behaviour of a person in the areas of problem solving, concept formation, reasoning, and acquisition of knowledge through memory and / or understanding. This deals with conscious awareness and involves the mental processes associated with learning and thinking.

Affective learning applies to changes in attitude, often difficult to achieve in adults. These are generally the most difficult to measure and occur over a longer period of time. Environment and experience would appear to be very important here.

Effective learning relates specifically to the motor output of the individual. Physical skill and motor learning are generally classified as effective learning, but they cannot be isolated. they require thought just as cognitive learning requires some physical act to demonstrate that cognitive learning has, in fact, taken place.

1. P.M. Fitts, in "Categories of human learning." Ed. A.W.Melton New York: Academic Press.

With regard to fig1. the systems can be further grouped into three areas for examination in conjunction with the learning processes. Perception- is the first essential step in performing a motor act. This is the process of becoming aware of objects, qualities or relations by way of the sense organs. This itself can be sub-divided into three categories;-

sensory stimulation - impingement of the sense organ / s by a stimulus / stimuli, in the form of either information from the external environment or the display, or proprioception.

cue selection - deciding which cues to respond to in order to meet the needs of the particular task requirement (selective attention).

translation - which relates the perception to the action in performing a motor task. This is the mental process of understanding the cues received for action, being reminded of something or 'having an idea' as a result of cues received. This may involve insight essential to the solving of a problem through perceiving the relationships essential to solution. Translation of sensory input and processing the 'feedback' are aspects of this level.

On a cognitive level this area includes recall and recognition of knowledge and is very much dependent on past experience. This is particularly true of 'selective attention', the ability to sort out and pay attention to the relevent stimuli and disregard others

Preparatory adjustment - is the process of getting ready for a particular action or experience, which involves;-

mental readiness, a level of perception already discussed as well as the ability to discriminate.

physical readiness for a particular motor act to be performed. This impinges on selective attention of the necessary sense organs, as well as postural readiness or positioning of the body.

emotional readiness - requiring favourable attitude to the response and willingness to respond.

This extends the cognitive level to the understanding of the knowledge received.

Response - in the initial learning phase this is a guided response, showing the overt behavioural response. This requires the selection of the correct response defined as the deciding what response must be made in order to satisfy the particular requirements of task performance. This would include imitation and trial and error.

The cognitive level is further extended to the application of the knowledge that is understood. If greater progress is to be made on the skill continuum, the performer has to develop two further important abilities. He must be able to analyse the situation or response(get feedback) and evaluate his response in relationship to the situation and the desired result.

The ability to learn from a particular attempt at a skill is largely dependent on the existence and the strength of feedback information and the ability of the performer to use this information. As with this original information, so the feedback can be internal - intrinsic to the movement - or external in the form of a change in the display. It can also be ongoing, and so affect the movement being attempted by re-inforcing, readjusting or altering a response, or it can be learning feedback which will affect subsequent attempts at the movement(providing the performer has the ability to analyse and evaluate his performance).

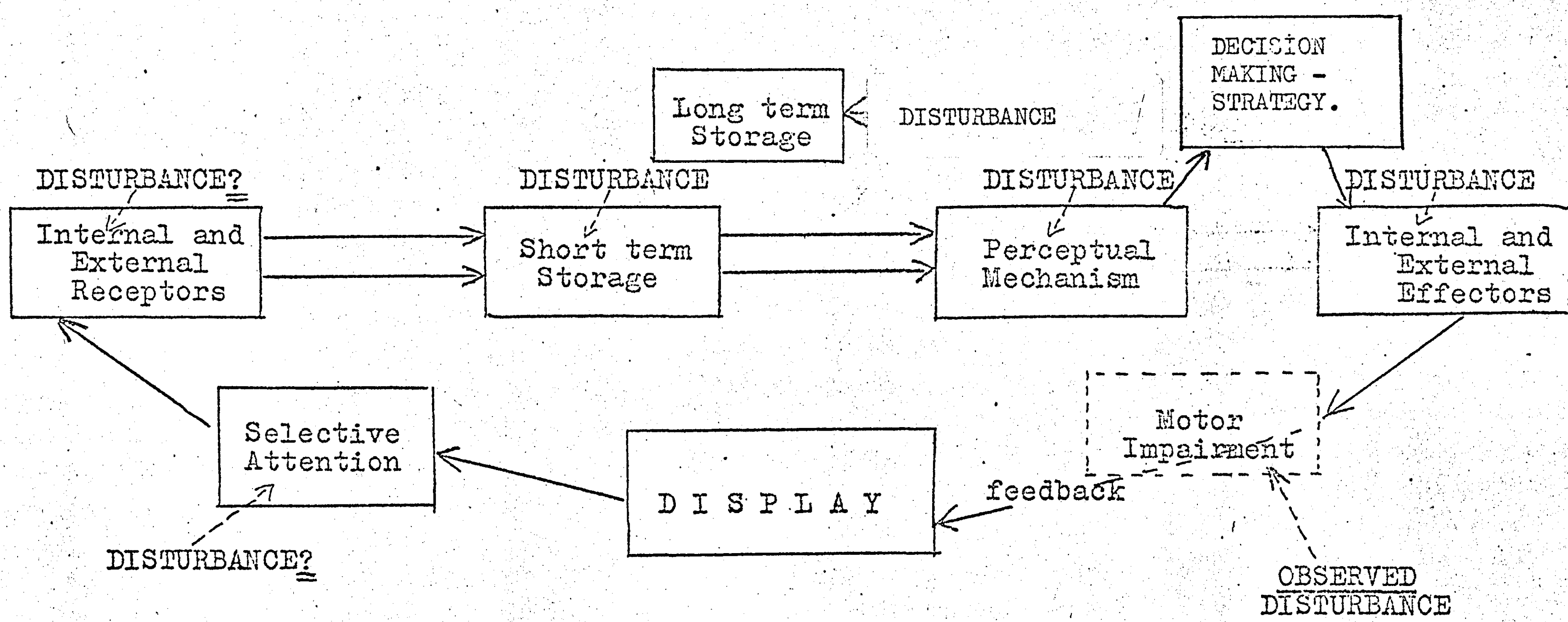
Skilled behaviour is, therefore, a highly intricate and precise system and although we see a breakdown in skilled behaviour through inadequate or in appropriate response, the fault causing the breakdown may not be due solely or even partly,therefore, to the faults in the motor system. Figure 2. shows the physical components involved in skill performance and disturbance arrows have been inserted to show were possible faults in the system could lie. Disturbance could lie in one or more points in the system so throwing the whole system into a state of instability.

Relating to sporting skills and cognitive development, the more skilled a performer is, the quicker he is able to reach a decision based on minimum cue information. In 'open' skill situations, this cue information may be the start of a pattern of movement, e.g. the bowler's wrist action in cricket, which the batsman can recognise

Fig. 2

PHYSICAL COMPONENTS INVOLVED IN MOTOR IMPAIRMENT

Diagram showing the significant variables of the system and the interconnection of these variables



and so anticipate the type of bowl and be able to establish the necessary response, in this case the type of stroke,if any. This establishes the value of previous experince in the ability to select the relative information in order to be able to decide on the correct response. In ongoing games such as soccer, fencing, tennis, etc. strategy becomes more important with the need to plan ahead to outwit opponents, and this would put the emphasis on the cognitive development of the performer.

CHAPTER III

The Possible Causes of Motor - Impairment

Though this study is concerned with the problems of dealing with motor-impairment, it is desirable to make a closer investigation of the possible causes, and the probable implications of this handicap.

The Brain-Damage Syndrome.

Due to the similarities of effects, early investigators were often led to associate motor-impairment with brain-damage. As pointed out in the introduction, the brain-damaged child may show disturbance in perception, concept-formation, emotional stability, social development and motor performance. With regards to perceptual disturbances, this could be due to faults within the senses, e.g. visual, auditory or tactile.

The term 'brain-damage' suggests a permanent alteration in the physical structure of the organism, but, as will be discussed later, it is perhaps not essential before there is any alteration in the functioning of the brain. Thus the term 'brain-dysfunction' as applied by Stott (1964) should be studied in conjunction with brain-damage. Before looking at this, an examination should be made of the causes of pre- and para-natal brain damage.

Knobloch and Pasamanick (1959) suggested a continuum of reproductive casuality as a result of which we are all brain-damaged to some greater or lesser extent, and the extent is linked, therefore, to maternal complications during pregnancy or birth, which may lead to foetal anoxia. Strauss and Kephart (1955) suggest the following causes of pre-, para- or post-natal brain-damage:-

> premature birth, caesarian section, dry birth, precipitate delivery, eclampsia, pelvic malformation, antepartum haemorrhage, anomalies in presentation, twisting of the umbilical cord, use of forceps, wrong use of anaesthetics, placenta praevia, rhesus incompatibility, hereditary defects and hormone disturbance.

However Caldwell (1956) groups these as follows:-

a. defects in germ plasma,
b. delitorious influences of noxious agents affecting the embryo, foetus and infant,
c. birth injuries of all types, chemical and mechanical,
d. post-natal infection or insult.

Some of the less well known but interesting findings with regards to the above, include work by Knobloch and Pasamanick (1959b) who suggested that children born in the winter months stood a greater risk of damage in utero due to the fact that during the period of greatest development of the foetus (during the third month), it was adversely affected by the heat of the summer. The suggestion of Weiner (1946) that all babies with seriologically proved erythroblastosis due to Rhesus + sensitisation as a result of a Rh- mother bearing a child whose father was a Rh+, should be treated after birth with a transfusion of Rh- blood, was to prevent later neurological disturbances. Recent work in the field of cigarette smoking and pregnancy, suggests that cigarette smoking by the mother reduces the birth weight of the infant (Smithells and Morgan 1970).

Prematurity at birth is a well established cause of brain-damage as shown by Lilienfeld et al. (1953), Greenspan et al. (1953) and Dundson (1952), and this in turn has been linked with behaviour problems in later life by Drillien (1964), Stott (1964), Prechtl (1961) and Rogers et al. (1955), and has obvious social implications.

Although the effects of stress on the young child are discussed later in this chapter, it would be helpful to examine the effects on the child of stressor agents bearing on the mother during pregnancy and the birth process.

The marked changes in incidence of malformation in the human being in wartime or other periods of stress, lend support to the arguments that emotional stress can harm the unborn child. Several studies in Germany revealed a marked rise in the frequency of malformations during the immediate post-war period of intense hardship. Eichmann et al. (1952) showed the pre-Hitler period to to produce 1.43 malformations per 1,000 births. This doubled in 1933, the year Hitler came to power, and the mean for the pre-war Hitler period was 2.3 per 1,000births. This rose to 6.5 for the years 1946-50. As employment and nutrition were better pre-war and during the war, the increase during these periods must have been due to other stressors, e.g. persecution, bombing, lack of living accommodation, etc. (see fig. 3).

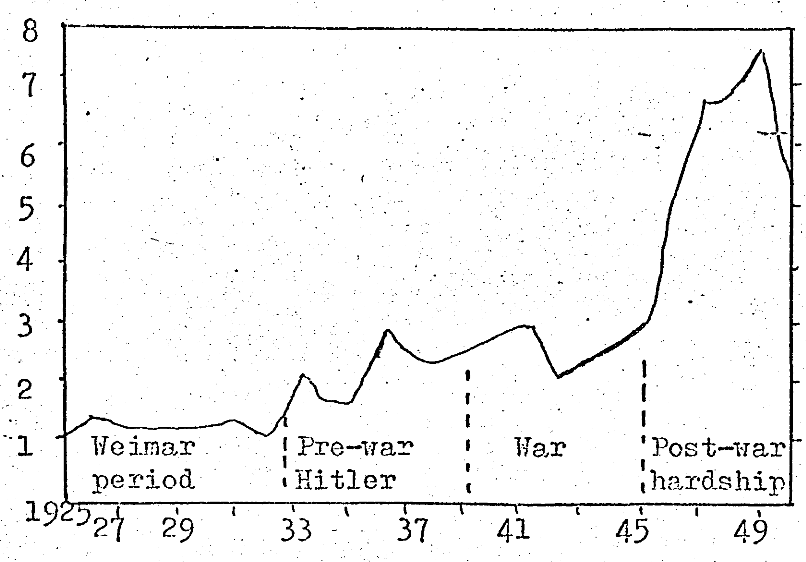
A similar trend was shown in Britain in the incidence of death in the first month after birth. The cause of death was given as malformation, (Stott: see fig.4). The distinct peak was in the period 1940-42 when the danger of defeat by the Germans was at its height. Therewas full employment and a high level of nutrition at this time.

Stott also puts forward evidence to suggest that the risks to the illegitimate child is greater due to the stress factors bearing on the mothers. He found double premature births among illegitimates and three times the number of neo-natal deaths in the first month. Stott suggests that a wide range of physical and mental stresses during pregnancy can harm the unborn child and assumes that stressful pregnancy can cause mental retardation, and physical illness. A defect which Stott observed after a disturbed pregnancy was an impairment of motivation, or lack of normal assertiveness, similar to the observations made by Thompson (1957) with his experiences with rats. It appeared to be caused in the second half of the pregnancy, after the stage of development at which malformation or other gross physical impairment can arise in the child. He suggests four possible sequels to stress during pregnancy:-

a. infantile ill-health,
b. defect of temperament,
c. malformation,
d. mental sub-normality.

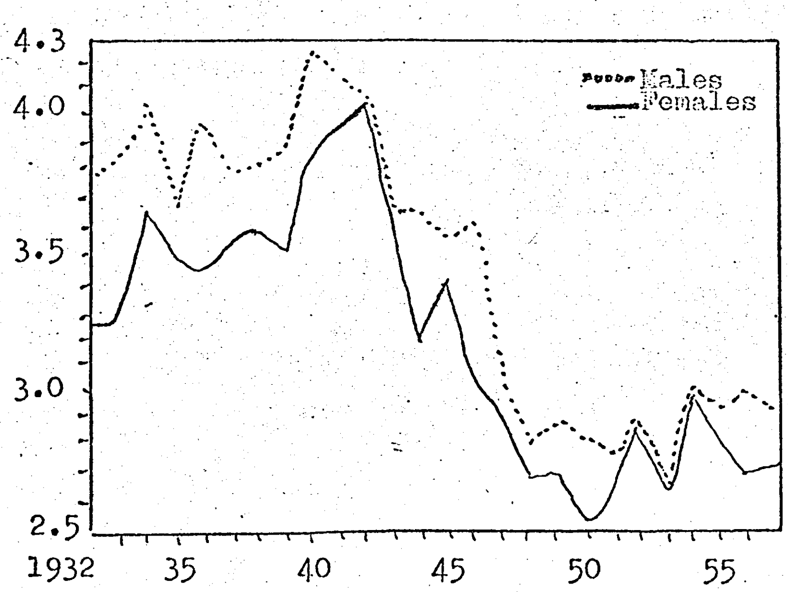
These form a syndrome which can be used as a criterion of which types of pregnancy are most harmful. A search for likely causes brought out severe emotional stress (e.g. husband's

Fig. 3



Ectodermal malformation per 1,000 birth in 55 German hospitals (From: Eichmann and Gesenius, Arch. Gynak, 181-188 - 1952)

Fig. 4



Neonatal deaths from malformation per 1,000 live births (England and Wales) From: Stott D.H. How a Disturbed Pregnancy Can Harm the Child - New Scientist, 17, 15-17.

unfaithfulness, severe illness, hostile in-laws and fear of eviction) was twice as frequent as physical illness but even illness came into the category of stress disease, e.g. toxaemia, gastric ulcers, heart disease and asthma.

Stott (1962) studying mongol births, related them to emotional shock and not to injury and so suggested that hormone disturbance resulted from the emotional shock and this led to various deficiences. This supported the view of Klebanov (1948) who found eight times the normal incidence of mongol births among Jewish women just released from detention camps. Stott further suggested that the hormone disturbance upset the weeding out process by which weak foetus are rejected, and that, but for the disturbance these mongol children might never have been born.

The Brain-Disorder Hypothesis

The brain-disorder hypothesis is obviously linked to the brain-damage syndrome but offers wider possible causal factors of motor-impairment. Stott (1957, 1962, 1964, 1966) when working in Bristol, Glasgow and Canada, linked motor-impairment with maladjustment and delinquency. As a result of his work, he preferred to substitute the term 'neural-dysfunction' for 'brain-damage' and it would be useful to trace his logic for the development of this term. His hypothesis states that there is congenital factor in maladjustment and delinquency, a factor of congenital impairment.

In his treatment of the topic, Stott identifies two inter-related concepts. The first factor is that of congenital / pregnancy - multiple impairment. As these are inter-related concepts they can be dealt with as two aspects of one general factor.

Congenital, as defined by Stott (1957) implies that the antecedents of the condition date from birth or before. It embraces factors operating during gestation and delivery. This does not imply the absence of hereditary influences. Landauer and Bliss (1946) and Clarke Fraser et al. (1954) show that manner and extent of pre-natal insult depends upon the genetic constitution both of the foetus and the mother. Therefore a genetic tendency to a particular malformation may become manifest only under conditions of gestational stress.

Stott's syndrome of somatic or neural impairment is a loose one containing a large number of alternative manifestations. Any one of these appear in only a minority of cases . By laws of probabilities, some of these impairments would appear in isolation. Thus, behaviour disturbance, if it is a component of the syndrome, could be the sole sympton. It cannot be assumed, therefore, that when there is no other somatic or neural impairment, the behaviour disturbance is without any basis in neural damage. In the study of 33 troublesome children, Stott (1964) found that the salient feature among a group of five of them from stable families (i.e. families which can contain and deal within themselves, phases of stress, and provide a secure family life for the children of the marriage), was somatic or neural impairments:

two were enuretic
one was an epileptic
two had speech defects
two had un-natural body posture

The impression formed from this group was that their disturbed behaviour sprang from an impairment of the neural structures, which could also have been congenital. In three out of the five cases the mother reported some complication during pregnancy or birth, and in another a birth complication was possible. Considering the group as a whole, there was a high incidence of somatic or neural impairment, affecting 26 of the 33 cases. Where there were symptoms of neural damage (of congenital origin), there was a significant excess of other somatic or neural impairment. The implication is that a multitude of physical susceptabilities and weakness, including certain habit disorders, e.g. enuresis, may also have congenital origins.

The extremely high incidence of this whole group of conditions among these disturbed children forced Stott to consider whether motor-impairment and behaviour disturbances, might in general, belong to the same group of disorders. This suggests that their origins are congenital but they aggravated when the affected person is subjected to stressful situations.

In formulating what is perhaps the most recent test of motor-impairment, Stott (1966) thus rejected the term 'minimal brain-damage' and substituted the term ' neural dysfunction'. This did not dismiss pre- or para-natal causes of motor impairment, but widened the possibilities to include adverse environmental influences, either on their own or [illegible] present congenital weaknesses.

Bamber (1966) supported Stott's theory of 'multiple congenital defects' as Davies et al. (1969). The latter study, however, doubted the view that motor-impairment was due mainly to brain-damage. Whiting et al. (1969a) examined 50 E.S.N. children using the Stott Test of Motor-impairment (1966), to assess brain damage through a test battery. High scores on the Stott Test related well with those who failed the tests of brain-damage. This suggested that in this population, the motor-impairment could be attributed to brain-damage. Davies et al. (1969) in a study of 60 boys from a junior approved school, also using the Stott Test Of Motor-impairment and other tests of brain-damage, found 27% failing in the Stott Test but only two of these failing on the tests of brain-damage. This was followed up with parental interviews and examinations of the records and lead to the suggestion that in the approved school population brain-damage was not the cause of the impairment in the majority of cases. It was further suggested that the causes were more likely due to the adverse environmental influences which involved various forms of deprevation, and that the impairment was almost impossible to attribute to one cause only. This supports Stott's view that effects on the brain may not be in the form of permanent damage but rather in affecting the correct functioning of the brain through inhibiting normal development.

Other studies lend support to the neural dysfunction theory, with regards to various forms of poor learning abilities. Gubbay et al. (1965) state:-

> "....various types of apraxia and agnosia of congenital origin in infancy may occur in isolation and may be quite unassociated with any other collateral clinical evidence of brain-damage."

In their study of 21 clumsy children the E.E.G. examination and high incidents of perinatal abnormality suggested underlying brain-damage in many cases, but in others, it appeared that the cause was a 'fundamentally disordered physiology (perhaps defective establishment of physiological dominance)'. The striking improvement which took place over a period of time in a number of cases, suggested a process of physiological maturation and reorganisation. The British Medical Journal (1962) also suggested that in some cases 'clumsiness' is due to delayed maturation of part of the nervous system. A defect in the cerebral organisation in a neurophysiological rather than anatomical sense is suggested by Walton et al.(1962) in discussing the clinical picture of clumsy children. Both Zangwill (1960) and McFie (1952) suggest that indeterminate cerebral dominance is a significant factor in the improper development of speech, reading, writing, spacial judgement and control. Ford (1959) uses the term 'congenital maladroitness' to describe intelligent children who are slow to learn complex motor skills and further suggested that this is possibly a 'developmental defect'.

Barbara Fish (1961) studied 85, twelve year old children whom she had been treating for the previous seven years and said:-

> 'Immaturity and poor organisation of functions under the control of the central nervous system can be seen in tests of mobility, perception, intelligence and in the E.E.G. Disorders of these functions are found in children with known brain-damage and in a large number of children whose behavioural disorders are accompanied by less specific impairments but whose acts resemble brain-damaged children in their hyper-activity, impulsivity and low threshold for anxiety.'

Walton et al. (1962) compare their clumsy children with the many studies of children suffering from congenital dyslexia and indicate that in clumsy children:-

> '....it is the pathways concerned with the organisation of skilled movement or the recognition of tactile and sensory

> stimuli which are poorly organised, rather than those concerned with the recognition of word symbols necessary for acquisition of the ability to read.'

..and hold that since there is ample evidence to suggest that dyslexia arises not from the acquired pathological lesion of any single area of the brain, but from a defect in the cerebral organisation. Drew 1956; Gutelius & Layman 1960; Gallagher 1960) then it seems probable that children in their study also had a defect in cerebral organisation.

Boshes & Myklebust (1964) suggest that children may be highly different in their psychological organisation and therefore attuned to reality in different ways. Minimal neurological disturbances may affect ones perceptual awareness and the process whereby one learns.

The above is a selection of the varied evidence which is encountered in any study of neural dysfunction and serves to illustrate the difficulties faced by any one wishing to test for neural dysfunction and, more important, indicate its exact location and suggest possible corrective steps to overcome it.

Kantor (1947) warns against placing too much emphasis on the brain:-

> "When brain injury or malformation can be co-ordinated with ineffectiveness of action, it is a common belief that the brain injury is the cause of the behaviour problem. The greatest objection to this is the over-emphasis of one object in a complex event on account of its construction even if in some instance more weight may be given to it than some other thing."

This view was largely supported by the findings of an enquiry made in 1960 by the special services branch of the Ministry of Education. The enquiry sought for information from all Local Education Authorities regarding the incidence of so-called 'brain-damaged' children in the following terms:-

> "... there is a fairly general agreement...that there are a number of very emotionally immature boys and girls...their chief characteristics are that they are over-active, easily distractable and have defective

> perception and judgement. They react vigorously to even slight frustrations and quickly get into a temper and become aggressive: they seldom present any neurological abnormality."

Williams (1966) makes a significant suggestion by proposing that incorrect diagnosis and mishandling of the child by the parents and society in general may be the cause of many chronic disorders which arise following the loss of brain function, while Clarke (1966) stresses that clinical and neurological examination should not be the only diagnostic form but that recognition of behavioural failings is very important.

Adverse Post-Natal Influences

As already stated, children may be born with minimal brain-damage or with brain dysfunction and will, therefore, posess at birth, less potential for development. This may be the cause of motor-impairment later. As soon as the child is born he must face an environment which is going to enable him to fulfill his potential or which is going to inhibit the development of this potential. Any deprivation of sensory, perceptual or movement experience may aggravate any brain disorder or be the cause of brain dysfunction. The development of motor behaviour arises as a result of the interaction of the environment and birth-potential. This is true of both phylogenetic (maturational)skills and ontogenetic(cultural - more specific to the individual) skills, although the former are altered only a little through teaching and are more dependent upon the necessary level of maturation.

Before going on to discuss various forms of deprivation, environmental influences and their effects, it must be pointed out that it is difficult to give universally acceptable levels of motor performance. The culture into which a child is born will put certain demands on him and 'normal' development will vary according to the standards of the culture. It is clear from studies of cases of extreme deprivation that sensory, perceptual and movement deprivation can impede the normal developmental pattern. What is not clear at this time is whether the impediment is permanent, or its effects on later development.

Critical Periods

It does appear that a minimal level of environmental stimulation and unrestricted practice are necessary in the maturational schedule to ensure optimum motor development. Various animal studies, among them Dennis (1941), Melts (1960), Hess (1964), Lorenz (1957) and Gray (1958), add support to the 'critical period hypothesis' and Scott (1962) defines this as:-

> "...certain limited time periods in development during which a particular class of stimuli will have profound effects and that the same stimulation before or after this interval will have little, if any, effect on the developing organism."

In child studies this is supported by Morgan (1966) who states that if the skill is not learned during this period it will be difficult or even impossible to learn later. Watson (1967) added to this by suggesting that interference with certain developmental phenomena, occuring at one point of the life history, rather than at another, may be of greater significance in the establishment of future trends.

Other writers point out the possible existence of 'critical periods' for the optimum development of motor skills in the human infant. McGraw (1946) concluded that there was a critical period for learning which varied from activity to activity in ontogenetic skills. This was later extended to cover phylogenetic skills.

It would appear, then, that the critical period hypothesis or age of readiness is an important feature in the learning process. How exact we can be with regards to the limits and rigidity of these periods is very much unknown. Connolly (1968) suggests that more attention should be given to the teaching techniques adopted when children find difficulties in learning, rather than putting their difficulties down to them 'not being ready to learn'.

We are all aware of the importance of early experiences in the developmental pattern of young children. With regards to the motor-impaired child, the suggestion is put forward that lack of adequate stimulation during the previously mentioned 'critical' learning period, may result in him failing to experience and master a certain movement which may in turn further inhibit development at a later stage. It is a further suggestion of this study, however, that motor-impairment due to this cause, is not necessarily a permanent impairment.

Deprivation

Deprivation appears to be an all embracing term for abnormal influences on normal levels of stimulation. Perhaps a better term would be 'restriction of stimulation'. Restriction of stimulation would impose lack of opportunities for learning particular skills as has been pointed out by Biesheuvel (1963) in studying African populations. Although Biesheuvel's study was concerned with limitation of movement experience, this is by no means the only form of deprivation. A closer look at the many 'deprivation' studies can be made under the headings of maternal, sensory and movement deprivation before examining the effects of 'stress' on the neurological development.

Maternal Deprivation - The 'loose' term, maternal deprivation, groups together the various deviating patterns of maternal care and their subsequent effects. It has been used as a broad descriptive term as well as an overall explanatory concept. Bowlby (1951) comments on maternal deprivation suggesting that:-

> "...what is believed to be essential for mental health is that an infant and young child should experience a warm, intimate and continuous relationship with his mother (or permanent mother-substitute - one person who steadily 'mothers' him) in which both find satisfaction and enjoyment."

Three linked circumstances in which a child suffers maternal deprivation can be distinguished:-

a. The partial deprivation that occurs when a child living with a mother or permanent mother substitute, including a relative, has little or no interaction with her and whose attitude to him is unfavourable.

b. The complete deprivation when a child loses its mother through death, illness or desertion and having no familiar relatives to nurture it.

c. The complete deprivation which occurs when a child is removed from the mother and given to strangers by courts of law or by medical or social agencies, including voluntary organisations.

Though the term used here is 'maternal' deprivation, this is not to suggest that sensory and movement deprivation will not be a result of maternal deprivation, and in discussing these later, it will be necessary to bear in mind that they may be consequences of maternal deprivation.

Taking a child away from a bad home or a bad parent, may not always be the bets thing for the child for as Bowlby (1952) states:-

> "The services that mothers and fathers habitually render their children are so taken for granted that their greatness is forgotten. In no other relationship do human beings place themselves at the disposal of others. This holds true even of bad parents... it must never be forgotten that even a bad parent who neglects her child is nonetheless providing much for him. Except in the worst cases, she is giving him food and shelter, comforting him in distress, teaching him simple skills and, above all, providing him with that continuity of human care on which his sense of security rests."

Bowlby suggests that this factor is the reason why young children thrive better in bad homes than good institutions and why children with bad parents are so attached to them.

Much of the early research work was done in institutions to assess possible detrimental effects upon the development of young children. However, many of the studies suffered from the same methodological deficiencies particularly with regards to the selection of subjects. All too often they were chosen from groups under treatment for emotional or personality disturbances. In most cases there was lack of information on the conditions of early maternal care. Rheingold (1960) characterised institutional settings in the extreme as lacking in sensory stimulation. He described them as drab with little or no visual or auditory stimulation and with few objects for the child to manipulate. They lacked emotional or tone variation so that children were not exposed to strongly positive or negative affective stimulation. The amount and quality of the mothering available in the institutions was criticised as producing too little mothering contact and less social stimulation.

Despite the enormous range of conditions evident in research data it is possible to note the following characteristics:- Bender (1947), Goldfarb (1945), Levy (1947) and Lowrey (1940) all found evidence of intellectual retardation in older children, while Dennis and Najarian (1957), Fischer (1952) and Spitz (1945, 1947) found this to be true of infants and young children growing up in institutional environments. The incidence and degree of the retardation varied considerably from one study to another, but in only a few did children show severe retardation:-Dennis and Najarian (1957), Gesell and Amatruda (1941), Goldfarb (1945), Skeels et al. (1938) and Spitz (1945,1947). Three factors emerge from these studies:-

a. the amount of individualised stimulation provided seems to be significantly related to the degree of retardation,

b. the age at which the child is admitted to the institution is important, and

c. the duration of the institutionalisation is significant.

Other forms of mother - child separation have varying effects depending on the age of the child at separation, the length of the separation and the severity of the separation. Bowlby etal. concluded that:-

> "...the outcome is immensely varied, and of those who are damaged, only a small minority develop those very serious disabilities of personality which first drew attention to the pathogenic nature of the experience."

Both Spitz & Wolf (1946) and Lewis (1954) suggested that the extent of the reactions of separation depends on the mother - child relationship preceding the separation and that the closer the relationship, the greater the effect of the separation. This would help to explain the findings of Raz (1968) who tested 361 Israeli infants aged 1-27 months. 130 were reared in a Kibbutzim (communal home where children are reared by a metapelet in a childrens' home, but not completely separated from their mother), 79 were reared in institutions and 152 were from 'normal' middle-class homes. Up to the age of 15 months, Raz found that the institutionalised children were retarded on both the Bayley mental and motor tests, but this was not so for the Kibbutz children. Beyond the 15 month stage, there was a catching up when the three groups performed at equal levels.

It would seem then, that deviation from the normal maternal patterns could form deprivation and formulate retardation. The amount and permanency of the effects of deprivation are in doubt. Some researchers suggest that some permanent damage to the central nervous system may occur (Spitz 1958), but in contrast, others (Doron & Ober 1950) point to the resilience of the organism and make a strong case for the modifiability of the effects of early infantile experiences. It is this latter line that this study will follow.

Many factors in complex interaction determine the extent to which recovery is possible, if at all, from early intellectual or personality damage. It would appear that more specific research is required to identify the specific conditions under which irreversible damage to the central nervous system occurs.

<u>Sensory and Movement Deprivation</u> - During the early months of a child's development, its whole education is in terms of movement experience. Although it is difficult to show beyond doubt, the value of wide movement experiences for young children, Newton & Levine (1968) have summarised some of the deliterious effects following an organisms deprivation of movement experience. As one evokes the other, it is difficult to separate the two, with regards to movement and sensory deprivation.

Environmental stimulation plays an important role in the acquisition of both phylogenetic and ontogenetic skills. With regards to the former, the maturational skills of locomotion have been subjected to research studies. The child will walk when the neuro-muscular system and the cerebral cortex have matured enough to gain control. But without the minimal stimulation appropriate, the child will not progress through the developmental sequences of walking smoothly. When there is deprivation of these stimulations, amazing results can follow. Dobshanski (1965) reports of the children brought up by wolves exhibiting the characteristics of their foster-parents, with regards to various aspects including both motor behaviour and social habits. This, he claimed, was entirely due to the stimulation the children had received from their early environment.

Observations have been made on the practice of 'swaddling' -i.e. severely limiting the child's movement experience,- by Danziger & Frankl (reported by Orlansky 1949) and by Lipton (1965). Dennis (1940) studied a similar practice among Hopi Indians who bind their children on cradle-boards for most of the day. All found no permanent retardation among the children, but it should be noted that they had been subjected to visual experiences of human movement, whereas the 'wolf children' received no such humanised environmental stimulation. The Hopi children develop the ability to sit, walk, etc. just as rapidly as children who are never bound. It would appear, however, that as one of the reasons for the binding of the children on to the cradle-boards is to enable the mother to carry the child from place to place on the mother's back, then the opportunities for other forms of stimulation and learning are increased. Through being placed in a variety of environments, visual and auditory stimulation would certainly not be diminished and more probably be increased. If norms are established for ages at which children acquire maturational skills this does not preclude that:-

> "...particularly favourable opportunities to learn in the general sense might not accelerate the potential age at which walking is possible, or particularly unfavourable conditions put back the age."

Whiting (1969) in 'Learning and Maturation'

This is also supported by the work of Geber(1958) studying the two factions of the Baganda tribe, when she found the precocity of the native reared children far in advance of the Europeanised native children or normal European children. These are studies with cultural influences and Stott (1957) underlines this when he states that:-

> "...cultural differences in patterns, specific to a particular environment, govern specific motor behaviour."

Stott (1966) further suggested that as neurological dysfunction is not easily detected, children suffering this impairment are often considered just less able than average, and often neglected. This in turn could produce even further retardation

An even less measurable aspect of early development is that of indi-

-vidual perceptual capacities and concept formation. Hebb (1949) hypothesises that certain types of early experience influence later behaviour by structuring the individuals perceptual capacities. He says:-

> "Early training is conceived to consist largely of the establishment of perceptual elements(phase sequences - neurologically) which serve as the basis for learning in later life."

Frasburg and Payne (1967) expand Hebb's theory by stressing the importance of sensory input and stating:-

> "Thus it is the early experiences or primary learning which form much of the pattern for later information processing capability in the system and serves as the programmer of the human brain computer."

Several experiments with animals by Ross (1951), Ellis (1953) and Thorpe (1951) have shown that an absence of 'normal' sensory or motor experience in infancy can severely restrict the abilities of the adult animals. Piaget (1953) says that the child acquires 'schemata' that are sensori-motor insomuch that they organise sensory information and result in adaptive behaviour. This process is dependent on the stimulation of the child's environment. Inadequate environmental stimulation, according to Piaget, would deprive the child of personal, practical experience with his environment and he would not develop a wide repertoire of fully co-ordinated schemata which are the basis of all future development. Wolff (1962) implied that inadequate stimulation in early life restricts the child in his self-stimulation and exploratory activities by suggesting that children who got a lot of stimulation early, also acquire a greater variety of functional needs earlier, and in other words, seek contacts with parts of the environment earlier and more actively.

Hebb (1953), as a result of his experiments, further noted that in the absence of stimulation from the environment, use was made by the subjects of past experience to provide stimulation to the brain. Very young children, having little or no previous experience to call on in such a situation, would in all likely situations be affected to a greater degree. Schaffer (1960) has emphasised the ability of some children to provide themselves with some form of self-stimulation in such a situation, but stresses the importance of the child's current environment to maintain arousal. As will be discussed later the level of arousal is an important factor in the learning and performance of a skill, and with regards to the young child, both Thompson (1958) and Reisin (1961) state that in the neonate the main effect of stimulation is one of arousal. Schultz (1965) says that the amount of stimulation produces the level of activation which will allow the opportunities for neural organisations to be developed via the specific nervous pathways. In later life, stimulation is provided via the specific projection system and its consequent cue functions. How adequately the organisms neural organisation can utilise and handle the cue functions depends on the level of cortical arousal built up by initial levels of stimulus variability. Fiske & Maddi (1961) condensed this and formed a summary of the possible causes and consequences of all forms of deprivation and with regards to the consequences stated:-

> "Thus the restricted early environment may have a double-barrelled effect: it limits or prevents the occurrence of crucial types of experiences and it reduces the ability to learn from whatever experiences are available."

What this suggests is that excessive sensory, perceptual or movement deprivation will result, not only in the failure to grasp skills at that stage, but also in lack of background or 'know-how' when problems arise in the future. At this stage, stimulation will be partly wasted as the inability to draw on past experience and select the correct cue or the correct cue response will show itself.

The Psychological and Physiological aspects of Stress

In recent years, 'stress' has become an increasingly popular psychological concept. It has become the substitute for what was previously called anxiety, conflict, emotional distress, extreme environmental condition, ego-threat, frustration, threat to security and tension. Examining the term stress, suggests an apparent and real possibility of correlating psychological events with physiological substrata. Cratty (1967) has defined stress as:-

> "..a temporary physiological or psychological imbalance caused by an event considered threatening to the individual."

This suggests that stress is an environmental influence, its magnitude being relative to the individual but nevertheless being characterised by a state of anxiety, tension or upheaval.

Richter (1958) refers to stress in biological, physiological and psychological terms:-

<u>Biologically:</u> " Stress may be defined as anything constituting a threat, real or apparent, to the biological integrity of the organism. Stress depends partly on the factors of the environment and partly on the vulnerability of the individual.

<u>Psychologically:</u> " Stress is a state or condition of an organism whose reaction to the environment is characterised by anxiety, tension or a defensive behavioural response."

<u>Physiologically:</u> "An environmental agent or influence affecting an organism adversely."

Tanner (1969) referring to stress and psychiatric dis-order suggests:-

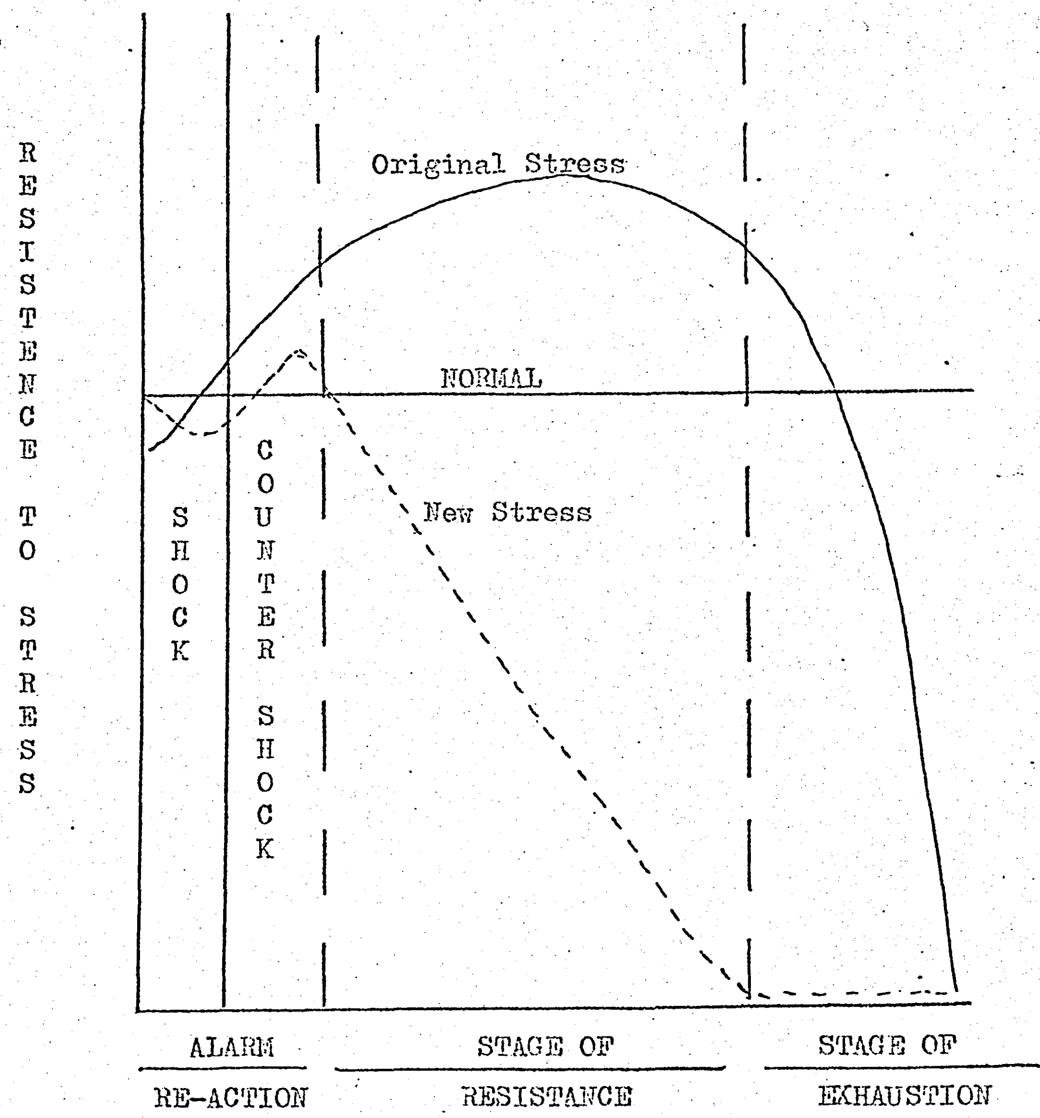
> "...apprehension, suspense, doubt, conflict or frustration, cover most of the situations so recognised as provocative of stress in man. At all events, this suggests fairly clearly that these situations, which we know through introspection, reflect conditions of neural excitement which are not confined to conscious states or to a nervous system as complex as our own."

Psychologically, stress can be induced through new. intense, rapid-changing, sudden or unexpected stimuli including (but not requiring) approach to the upper threshold of tolerabilty. At the same time, stress can also be induced through stimulus deficit, absence of expected stimulus, highly persistent stimulation and fatigue (mental and physical) producing settings. Stimuli leading to cognitive misperceptions, stimuli susceptible to hallucinations and stimuli calling for conflicting responses have at some times been used as an operational means of defining and producing stress.

On the response side, the presence of emotional activity has been used to define the existence of stress. This usually refers to any bodily response in excess of the normal or usual states of anxiety, tension and upset or any behaviour that deviates momentarily or over a period of time from the normative values of the individual in question or from an appropriate reference group. Indices used, include such over-emotional responses as, tremors, stuttering, exaggerated speech characteristics, loss of sphincter control or such performance'shifts' as perseverative behaviour. Selye (1950) suggests a'general adaption syndrome' which has

Fig. 5

THE GENERAL ADAPTION SYNDROME



A person develops some resistence to a continued stress at the same time he has less resistence to a new stress.
(After Selye H. 1950 from Morgan C.T. and King R.A. 1956. Introduction to Psychology. New York. McGraw-Hill)

three stages of development:-

a. the alarm reaction

b. the stage of resistance

c. the stage of exhaustion

(see fig. 5)

The exposure of an organism to a stressor, it may be extremes of temperature, or some toxic substance, brings the alarm system to counteract the stressor. The stage of resistance refers to the internal responses which stimulate tissue defence. If the conditions brought about by the stressor persists the stage of exhaustion is reached. This could be followed by extensive damage to the organism or death.

Although it is beyond the scope of this study to formulate the whole physiological changes brought about by the presence of stressor agents, it is sufficient to acknowledge their existence according to the literature as reviewed by Selye (1950 -56). The link between the physiological changes and the psychological effects is well supported by Richter (1958). It would appear that forms of deprivation previously discussed would act as forms of stressors on the individual and so support the hypothesis that the adverse environmental influences will affect the nervous system and could lead to varying degrees of neural dysfunction, which, in turn, could be the cause of motor-impairment.

Bearing in mind the definitions of motor-impairment as stated in the introduction:-

> "..a condition which manifests itself in performances which are sub-normal or in performances whose efficiency has been impaired in some way."
>
> "..that which constitutes any dysfunction in the everyday activities of the child."

we can summarise the ways in which stress and adverse environmental influences affect the natural development of the child in the following ways:-

a. stress can be responsible for the breakdown of tissues and metabolic changes in organisms.

(Selye 1950-56; Vitoke 1966)

b. stimulation providing a variety of experiences in early life can be termed stress in as much as there is a minimum level of stimulation required to achieve the arousal stage and the failure to experience this will result in the inability to cope with similar stimulation in the future.

(Levine 1960)

c. stress leads to the deprivation of a suitable challenge and lack of adequate stimulation, which may lead to a reduction in the capacity of a cell to carry on the transmission of electrical impulses which are essential for the functioning of the nervous system.

(Wolff 1958; Levy 1943)

d. the lack of opportunity for successful interaction with the environment can be regarded as a stressor agent.

(Anthony 1958)

e. prolonged periods of stress cause permanent impairment to parts of the nervous system.

(Kral et al. 1967)

f. stressor agents and conditions of stress in early environmental experiences can lead to retardation of brain functioning in infancy so as to lead to dysfunction of the nervous system.

(Stott 1964, 1966).

CHAPTER IV

The Implications of Motor - Impairment

As this study is concerned with approved school boys, it is perhaps as well to begin with the social implications of motor- impairment.

The theory put forward by Stott (1966) and raised in the introduction to this work, is very simple and straightforward. The impaired child is rebuked or punished, his efforts meet with failure, he takes avoidance action, becomes an isolate and seeks recognition in anti-social activities. The result is, at the best maladjustment, and in the more severe cases, delinquency. It is necessary, however, to examine this theory a little closer.

The link between motor-impairment and later behavioural problems in children has already been mentioned in the introduction, (Pasamanick et al. 1956; Corah et al 1965; Drillien 1964 and Knobloch & Pasamanick 1959). Not all these studies showed brain-damage as the cause of the impairment, and if, as is suggested in Chapter III, various forms of deprivation in early childhood can cause motor-impairment, then the results from these deprivation studies may help to explain some of the behaviour problems exhibited by these motor-impaired children.

Referring back to the general skill model in Chapter II, emphasis was put on the ability to select the correct information and to put a meaning to the information taken in (perception). It is always with difficulty that inference about human behaviour can be made from animal experiments, however, Melzack (1968) suggests that early experiences play a significant role in behavioural development. His experiments with dogs suggest that prior experience with the environment will determine the filtering of information which will take place in the early stages of synaptic transmission. Lack of ability to attend selectively to sensory stimulation was put down to early deprivation. Behaviour similar to hyper-activity in children was observed in the animals. Animals developed stereotyped responses which were often irrelevant but difficult to inhibit.

His explanation of the effects of restrictions on dogs is that:-

> " a. there is inadequate filtering of input on the basis of memories of the significances of stimuli normally acquired in early experience, so that:-
>
> b. The total input bombarding the C N S produces an excessive central nervous system arousal which, as Hebb (1955) has suggested, could be responsible for correspondingly low cue properties necessary for discrimination and adaptive responses."

He goes on to state that:-

> "As a result of restriction of prior experience, then, most stimuli in a totally new environment have no meaning or associations to provide a basis for selective attention to one stimulus rather than to another. Consequently there would be inadequate filtering at the early stages of information transmission, so that all inputs, 'irrelevant'as well as 'relevant' would reach the brain where they could bombard the neural systems that produce sensory and affective arousal."
>
> (Melzack 1968)

This process, then, describes a vicious circle. There is a failure to filter out irrelevant information which leads to excessive arousal, which in turn, interferes with the mechanisms both innate and acquired, that would normally act in the selection of cues for adaptive response.

Applying this line of thought to children with motor and behavioural difficulties, we can ask:-

a. are these difficulties due to their inability to pick out the relevant cues for response?

b. if the brain does not associate a past response to a particular stimulus, will the effects of adult re-inforcement to that response be nullified and so learning be inhibited?

c. is there some kind of conditioning of some particular response to a wrong set of stimuli, setting up stereotyped but irrelevant behaviour?

Also working with animals, Rosenzweig et al. (1967) sought to find how the brains of animals in enriched and deprived conditions compared with thoseof littermates raised under standard colony conditions. Their experiments showed that:-

> "...differential experiences lead to significant changes in the anatomy and chemistry of the brain of the rat."

Using an experimental design which involved raising groups of rats in " enriched environmental conditions and training" (E.T.C.) and in " impoverished conditions" (I.C.), for each rat in one group, there was a littermate in the other. At the end of the training period (generally 80 days), the brain was dissected and the various areas subjected to examination and measurement.

They showed that animals kept in an enriched environment (E.T.C.) in comparison with littermates kept in an impoverished environment (I.C.) develop a considerably heavier cerebral corticos and greater cerebral activities of acetylcholinesterase and cholinesterase.

More interesting is their work on 'environmental therapy for cerebral effects' i.e. the retraining of I.C. rats for 50 days in enriched conditions after 80 days in impoverished conditions. They developed significantly greater cortical weights than their littermates who remained in I.C. conditions throughout the experiment. It appears then, that the effects of early impoverishment on cortical weight can be overcome by later environmental enrichment.

With regards to behaviour, it would seem that one month of differential experience is sufficient to make enriched-experienced rats better at problem solving than impoverished-experienced animals. Due to the plasticity of the brain, cerebral effects of one environment can be reversed by reversing the environmental conditions.

Again it is difficult to extrapolate from animal studies but these experiments suggest:-

a. adequate environmental stimulation is required for full development of cerebral potential, and,

b. it may be possible to overcome the effects of deprivation during childhood by later enrichment experiences.

Rosenzweig comments, however, that:-

> " It seems quite possible that richness of experience will be found to be an increasingly important determinant of cerebral development as we go to animals capable of more and more complex behaviour. It may also be true that in higher animals the effects of early deprivation cannot be overcome in an adult as they can in the rat."

The next question requiring examination is in what way does congenital impairment, as described by Stott (1959), influence early deprivation?

> " Children are conceived, born and grow - the products of nurturing ingredients of life, love acceptance and parental devotion. Introduce a disturbance - of conception (congenital defect), of birth (brain-damage) or of growth (personality disturbance) - and more of these nurturing ingredients are needed. Combine some of these disturbances and extra-ordinary nurturing effort is required, effort which is not, unfortunately, always made. Too often the defect, damage or disturbance breeds anxiety, rejection, isolation - and further disturbance. And so a destructive cycle is initiated."
>
> Donahue & Nichtern

Maternal and therefore, to some extent, sensory and tactile stimulation may be inhibited by some congenital impairment the child may have. The mother - child relationship is a two way one and a child who appears unaffectionate or who exhibits some form of malfunction or who fails to develop at the expected rate, may cause the mother to feel embarrassed, become anxious, tense or even to withdraw her affection. This will again result in a failure to please on the part of the child, and a withdrawal of his effort. Again a vicious circle is established.

Beyond the baby stage, a child learns certain perceptual motor skills necessary for normal social adjustment, e.g. fastening buttons, using scissors or pens, toilet habits etc., and speed at these social skills will enable them to move on to other tasks while the less able child will still be struggling with the first task. Thus those who are slow or incapable at one task will miss out on other experiences which might have helped to produce development.

This process continues through nursery and junior school until the time of specialisation in the secondary school. Here the 'socially acceptable' skills with a certain amount of status significance belong to the team players and the athlete. Further social interaction takes place because they are in the rugby team or the tennis team, giving rise to further social skills which are denied the less able child. Sutton-Smith & Roberts (1964) have shown that boys who are successful at games of physical skills also rate high on popularity charts.

The implications of motor-impairment on intellectual development are not so clear. There seems to be some general agreement between clinical workers and research investigators that motor proficiency and mental ability are somehow correlated if the whole range of mental ability is considered. There is disagreement about the degree of the relationship between these variables however. In an investigation of the research done in this area, it is not difficult to see why there is some confusion about the question:-

a. measures of motor - proficiency do not correlate well with each other,

b. complexity of motor demands varies with different measures,

c. there is an apparent absence of any general factor of motor ability,

d. different investigators have used different criteria to assess both mental and motor abilities.

With regards to adolescents or secondary school children, it will be sufficient to suggest that although significant positive relationship between motor ability and intelligence may be established, (in certain circumstances), due to the reasons listed above, these relationships are specific and by no means assured.

What would be beneficial here, would be an investigation of the intellectual development of the pre- and early school child and its correlation with motor-impairment and motor development.

> " The most important task for the young child is that of finding out about this new world into which he has been thrust. He must determine what is the nature of things around him and what is his relation to them. He must orient himself to a concrete physical universe - a universe of space and time."

Kephart (1967 In Tansil & Gruber)

How does a child learn about his 'new' world? How does he relate himself to his 'concrete physical' universe? It is largely achieved by movement, exploration and manipulation. The action pattern of:- stimulus - organisation of information - response (as discussed in Chapter II) is evident in the young child, but this pattern of impulses is at this stage generally reform to a single stimulus and a single pattern of energy(which due to lack of muscular control may show itself in mass movement), and does not necessarily relate to cognitive action on the part of the infant. As the child progresses, he translates these perceptual messages into meaningful information which can be stored and used in future to reach a quicker and more efficient response, and so input information is correlated with output information.

As Stratton (1896, 1897) has shown with his experiments of distorting perceptual input by wearing reversing spectacles, if the subject is allowed to investigate the distortion through motor responses, the distortion can be eliminated. The distortion will remain, however, if experimentation is not allowed. This is perhaps the same kind of situation a young child finds himself in. If the initial perceptual input means little or nothing to him, he has, by exploration and manipulation, to develop a system for organising and handling the information. Piaget (1952) calls this a series of 'schemata', and this period of learning a 'sensori-motor period' which extends from the period of the reflex action to the time when language makes an appearance. As movement precedes verbal education, it is fundamental, at this time, to the learning process. He suggests that when these initial schemata have been established, they can be used to develop more complex schemata without the need for further motor intervention. Thus the ability of the child to develop thesecomplex schemata depends on his early encounters with his environment.

It can be seen from this that movement is important at this stage, not only for movements sake but as a means of exploration. Adequate motor ability will enable the child to get the right thing at the right time, from the right place, to assist his further development. So it becomes apparent that adequate motor ability (gained from adequate motor interaction) is essential for general development. If this is so then we would expect the child with limited motor responses to have difficulty in developing these schemata and thus show limitations in 'intellectual' development. Piaget (1953) further suggests that the sensori-motor system of the child constantly using it in it's interaction with his environment, will develop at a greater speed than if it were not used. This would suggest that opportunity and circumstances play a large part in the development of early intellectual capacities such as hand-eye co-ordination, ability to concentrate, etc., Magora (1959) affords a physiological explanation of this by stating that such things are maturational processes brought about by the myelinisation of the relative parts of the central and peripheral nervous system. He also suggests that the process is a reciprocal one in so much as myelinisation facilitates the maturation of hand-eye co-ordination and the conditioning process of hand-eye co-ordination helps to accelerate myelinisation.

It is perhaps significant to note how highly placed movement behaviour is in many developmental scales for infants, produced by various psychologists (Gesell 1928, Griffiths 1954, Hurlock 1949).

Cratty (1968) suggests that there is sufficient evidence to claim that infants not only have a capacity to perceive their own and others movements but that permitting them increased opportunity to do so has a marked influence on their later perceptual-motor ability. He further suggests that tactile and playful interactions between the parents and the child can positively influence the child's movement characteristics in later life, and even that:-

> "Children who were noted to have engaged in more extensive movement prior to birth evidenced more advanced motor development as infants and young children than did children who did not engage in pre-birth movements of as long a duration."

Early interaction with the environment would, therefore, seem to be of utmost importance in the development of perceptual capacities vital to intellectual and motor development in later life. The environment in which a child is reared will affect his brain organisation. Bean (1963) in a study into the factors affecting psychomotor development in very young children (under five years of age), showed two variables involving feeding routines and freedom of movement, indicated that the more flexible and / or permissive the home routine is, the more likely it is to benefit the psychomotor development of the child concerned. It would appear that a limiting environment will foster a brain that is limited in development and function, and that conversely, a highly varied, a highly organised and a highly dynamic environment will produce enrichment of stimulation which might result in a more highly developed, versatile and well organised brain. This discussion will be entered into in Chapter V when looking at compensatory education.

It would appear that motor-impairment as defined in this study is not a general impairment as evident perhaps in the E.S.N. child where intellectual, motor and social deficiencies can be observed. The motor-impaired child may or may not have other forms of impairment. He is judged 'impaired in this instance due to his inability to perform certain perceptual-motor skills. He is therefore 'unskilled'. However, before attempting a skill a child must have ability or certain basic abilities if he hopes to succeed. If he lacks these basic general abilities then training in a specific skill would be futile as the skill would never be reached, or at the best, would take a long time to achieve. What is meant by 'abilities' and 'skills'? Skill is specific. It is an appropriate response to a certain stimulus. Abilities are necessary to the proficient performance of a skill. Some abilities are more general than others and are therefore related to more skills. Most motor skills, for instance, require some form of co-ordination, therefore, if co-ordination could be termed an 'ability' then it would be a general ability. It is more likely, however, that co-ordination could be sub-divided into more specific abilities. The more 'open' a skill (as defined by Poulton 1957) the more perception is required, e.g. in a ball-game skill tracking of the ball, its direction, speed, rate of acceleration, etc., these are perceptual abilities which have to be achieved before specific skills can be mastered.

It is suggested in Chapter III that basic abilities will not be fully developed if the child is genetically unendowed, has a congenital defect or suffers from some form of early deprivation. If any, or a combination of these factors appears, then the child will have difficulties with specific skills in later life. Fleishman (1967) makes the point that the abilities necessary in the early stages of learning a skill are not necessarily the same as are required in the later performance of that skill. He further suggests that a child develops:-

general abilities
specific abilities
simple skills
complex skills

and that each stage depends on what has gone before. This would appear to link up with the 'critical periods' hypothesis as put forward by Piaget and stated earlier in this study. This would suggest that the critical period for the learning of a specific skill is when the specific abilities necessary have been developed. This will also link later to compensatory education through specific skills or through general abilities.

Work going on in assessing motor-ability is seeking to isolate any deficiency and so improve it by tailor- made programmes of 're-education' (Kephart 1960, Doman & Delacato 1967, Sapir & Wilson 1967) which will obviously be of value in the clinical situation but of little value to the general practitioner of physical education.

Before looking at forms of compensatory education for motor-impairment, it may be useful to look at one more of its implications, that of poor body image. Body - image has become an important area of interest among investigators into various forms of learning difficulties. Head (1920), Witkin (1954, 1962,) Kephart (1960), Merleau-Ponty (1962), Bonyon (1969), and more recently Morison (1966) and Dickinson (1970), have all entered the discussion on body-image and learning theories and it would appear that its relation to motor performance has been established and the link with cognitive development made. Various terms have emerged relating to this topic. Bonyon (1969) uses the term 'body-image' and defines it as:-

"..an overall concept of ones body and its movements with relationships to various environments."

Witkin talks about 'body-concept' meaning:-

> "The systematic impression an individual has of his body, cognitive and effective, conscious and unconscious, formed in the process of growing up."

This suggests that body-concept arises out of early experiences in the growing-up process, that a child has of his body and the bodies of others. Within these early experiences, movement is a basic ingredient, and if restricted, development of body-concept might well be hindered.

The control of movement responses by the 'body-image system' defined by Ritchie-Russell (1958) as:-

> "..that which makes it possible for appropriate bodily movements to be performed in relation to afferent stimuli."

makes the link between poor body image and a breakdown in skill, as described in Chapter II, particularly on the perceptual part of the skill model. This also associates with the more general term in use in physical education, 'body-awareness', although this term is connected to the more general aspect of 'kinaesthetic sensitivity'.

The effects of 'body-concept' on selective attention (another aspect of the skill model built up in Chapter II) was described by Witkin (1965) in explaining the terms field-dependence and field-independence. Field-dependent people have difficulties in separating out items from the background whereas, field-independent people had little difficulty in doing this. The field-independents were also shown to have the more sophisticated concept of body-image. This would suggest another possible area of skill breakdown in the impaired child.

The assessment of 'body-image' is described later in the development of the Draw-a-Man test and the Hanna Marlone scoring scale.

It would seem then that the implications of motor-impairment are four-fold:-

a. a reduced efficiency or total inability in the performance of a motor skill,

b. a more personal and inner failing shown through lack of body awareness and therefore body capability,

c. retardation of social skills and therefore inhibition of social interaction,

d. possible interference with intellectual development.

CHAPTER V

Compensatory Education for Motor - Impaired Children

Without entering too deeply into the 'nature v. nurture' debate, it would be beneficial to clarify certain terminology. It would appear to be firmly established that both heredity and environment will interact in the development of certain abilities. The child will be born with a certain capacity, which, by definition is 'innate potential'. Presumably this is not alterable by learning. The implication here is that persons with identical capacities subjected to identical environments (if it were possible) would eventually achieve the same performance standards. Whatever the genetic endowment, it can only achieve its maximum potential through the right environmental conditions. Just as genetic endowment differs from person to person, then the correct environment for optimum development will also vary. As Dobzhansky (1965) said:-

> "..equality means that all humans are entitled to equal opportunity to develop their capacities to the fullest not that these capacities are equal."

The term'motor capacity' is obviously related to the ultimate level of performance of the individual in so far as it sets the limit on performance. It is questionable as to whether or not this can be measured with any accuracy, and plain that any attempts made to measure this must utilise certain skills regardless of the developmental stage of those skills. This suggests that only present abilities can be measured, and the value of these as predictors of capacity is very dubious.

Given, then, that at birth a child has a certain motor capacity, which is the result of genetic endowment and congenital effects, what kind of environment is necessary for the optimum development of that potential?

The importance of the early period of development on the perceptual-motor behaviour has already been established. What should the environment hold for the very young child to enable him to achieve optimum motor development? Initial movements of the infant are largely involuntary and reflexive in nature. Quite early in life there is an integration of visual and motor capacities. The eyes see the hands move, and, in turn, their movement begins to be placed under voluntary control, (Smith 1965). Even in the first few weeks of life the infant engages in first fixating, and then, tracking behaviour with the visual system. Opportunity to allow this development has, according to Cratty(1968), a marked influence upon his later perceptual-motor attributes. Many pediatricians will, for example, various coloured and complex patterns be placed where the infant in his cot, may observe them. Similarly, the infant should, at some time be left to observe the clenching of his fists and other limb movements, in order to hasten visual-motor development.

Most reflex actions gradually come under the control of the voluntary system and mould perceptual-motor behaviour. The locomotor cross-extension reflex comes under voluntary control and continues to facilitate correct crawling and walking patterns later in infancy. It is during this period that careful observation of any forms of inappropriate interaction between reflexes and voluntary movements, may be valuable in indication any form of basic neuromotor abnormality. Careful observation of crawling, running, grasping, throwing, etc., may show up lack of co-ordination and provide a cue that something is wrong. As regards the perceptual-motor development at this stage, Cratty (1968) states:-

> "...early perceptual-motor malfunctioning, if not modified by early training, might prove harder to correct in later childhood. The close relationship between perceptual-motor problems and later learning problems in the classroom, primarily those evidenced as the child attempts to organise words and letters into words, and makes his first efforts to write, has been alluded to by several child development experts within recent years."

The child gains voluntary control of the larger muscles of the trunk and upper body before gaining control of the smaller muscles of the limbs and lower body. Bearing in mind the cephalo-caudal, and proximal-distal general developmental sequences, programmes of movement activities for infants and young children should contain activities to improve the control and integration of the larger muscle groups of the body. Rolling, turning and twisting are activities using trunk muscles, to be encouraged before integrating limbs into such movements. Activities for fine muscle control should come after this. Basic locomotor activities, together with tasks to improve balance and general body agility should figure in the pre-school programme. As tracking seems to be basic to even the most elementary controlled movements, e.g. moving the hand to touch an object, crawling to a toy , and later, catching objects, opportunities for the practice of the skill of tracking would appear to be advantageous. The tracking of balls hung on string would encourage this.

In this early period, physical ability is difficult to separate from social, intellectual and verbal ability. This is not to say that movement is essential for all cognitive functioning, but faulty early perceptual-motor development can limit the opportunities the child has to explore and to learn about himself and his environment, and so limit his growing intellectual awareness. Even in this early sensori-motor period activities which encourage the child to think, plan and control his movements are desirable.

Performance in perceptual-motor skills in infancy would seem to be more dependent upon inherent neuromotor characteristics, while in later years it is more dependent on specific environmental experiences. It is during this time, therefore, that assessment of neuromotor efficiency or deficiency will be easiest as, later in life, the abilities of the child may be due to a greater extent to the influence of the specific environment, thus making the assessment of the basic characteristics more difficult.

If the above pattern of development is followed, then in the later primary stage, the child should be able to cope with the more vigorous activities of climbing, running, rolling, jumping, etc., which should face him. This is a stage when perceptual-motor functioning becomes more specific and so the programme should offer a wide range of basic activities encouraging such things as balance, agility, hand-eye and body-eye co-ordination as well as more specific games and activities which require specific and more complex skills. Specific teaching of these more complex skills will also be desirable to improve the child's perceptual-motor ability.

This would suggest a structured programme of development for the normal child to enable him to approach his potential motor capacity. As this paper is concerned with compensatory education for those who are motor-impaired, one might question if the need for this compensatory education would be as great if parents of young children were more enlightened withregards to the child's needs in terms of motor development. The situation as it is now is that structured physical education begins at the earliest, at five, and more likely, at seven or eleven years of age. Anything that goes before this is incidental. Children who become motor-impaired due to some form of deprivation may be so unnecessarily. Perhaps adequate education of the parents would help eliminate the need for compensatory education later. If they were made to be more aware of the need for a structured environment for the young, there would be less deprivation.

This is speculation, however, and we must look at forms of re-education and compensatory education for those children who are motor-impaired.

Before listing examples of work going on in the U.S.A. and in Great Britain in the way of compensatory education for the various groups of sub-normals, it will be useful to look at the Doman-Delacato Therapeutic Programme as outlined by Doman et al. (1960), which tackles the problem of whether to eliminate the symptom of the impairment or to seek to correct the cause of the symptom. Dealing with this problem in respect of children with reading difficulties, Delacato (1963) expresses his view of <u>re-education</u>:-

> "To diagnose our language problems, therefore, we must start at the age at which we first see the child but we must look back developmentally to the original area of dysfunction. As a result, it may be in the terms of diagnosis, some of our children are not well developed at the level of the pons, some at the level of mid-brain, some at the level of cortex, and some at level of the cortical hemispheric dominance. If we are to diagnose validity and reliability, we must go through each succeeding stage to assess the mastery of each function at each stage. Treatment must also follow this sequence. In treatment we must go back to the original point of departure from developmental norms and we must recreate for that brain level and that chronological level those functions so that the child can go through the proper developmental stages and begin

to move on to the establishment of complete neurological organisation. In treatment, therefore, we must start at the lowest level at which there appears to be a lack of neurological organisation and we must give the child opportunities to master the activities and functions of that level and each succeeding level until we have mastered complete cortical hemispheric dominance."

The Doman - Delacato therapeutic programme was outlined by Doman et al. (1960) as:-

a. permitting the child normal developmental opportunities in areas in which the responsible brain level was undamaged,

b. externally imposing the bodily patterns of activity which were the responsibility of the damaged brain levels,

c. utilising additional factors to enhance neurological organisation.

Pavlov referred to the 'plasticity' of brain-function - it is the transfer of brain function which is the basic underlying principle of the Doman-Delacato re-education programme. The contents of their programme include:-

1. Providing the brain with an opportune environment.
2. Programming the brain (by assisting the child through various movements).
3. Augmenting the sensory environment.
4. Increasing cerebral blood flow.
5. Reducing inter-cranial pressure.
6. Stimulation of functional vision.
7. Establishing cortical hemispheric dominance.

This programme has been claimed to be quite effective when diagnosis and treatment are begun at an early age. There are already off-shoots of this system in the U.S.A. There has also been examination and criticism of the Doman-Delacato programme. Kershner (1968) dealing with retarded children, used a combination of simple locomotive tasks (as used in the

Doman-Delacato programme) with visual training and the use of reflex-like movements. His claim that one of the movement theories was tenable was offset somewhat, by the fact that more improvement was elicited in a wide variety of perceptual tasks by his control group. Other studies claiming to support the Doman-Delacato programme of movement education have also been criticised with regards to their content and methodology by Glass & Robbins (1967). Robbins (1966a, 1966b) using proper controls and stressing left - right and unilateral motor activities found the Doman-Delacato programme exerted no significant differences on the skills tested. Whitsell (1967) suggests that the reluctance of Doman and Delacato to subject their programme to experimental verification makes the medical profession wary of their true value. He is also critical of the physical demands made on the child.

So, although some children may benefit from this programme, it is one which obviously requires more investigation, individual diagnosis and careful administration.

In Piaget's terms, Kamii & Radin (1967), in their education programme for pre-school children, emphasise the need for a 'state of readiness to learn', for less able children and that recapitulation of the sensory-motor stage may be needed before progressing through other stages of development.

Sherbourne (1965), working in Bristol, developed a programme of re-education for brain-damaged children through the medium of dance and educational gymnastics. This was based on the theory that movement is basic and any restriction of it will result in an all-round retardation of growth and development. Here, again, there is much emphasis put on the need for a close and informal teaching relationship with these children.

There are a number of other examples of different approaches to the problem of re-education and compensatory education for children with particular difficulties, - Jungjohann & Kaufman (1966), Mollo (1966), Neale (1966), Tither (1966), etc. with suggestions for the treatment of mentally sub-normals,- Eysenck (1968) regarding the diagnosis and treatment of subjects by computer, and Hobbs (1966), [illegible] & Richtern (1965) and Berkowitz & Rothman (1960) have given suggestions and systems for the 're-education' of the 'disturbed' child.

It may be useful to look closer at two programmes aimed not at severely handicapped children but at those who have difficulty with motor behaviour and with general classroom learning, who may well be classed at school as 'slow learners'.

Kephart (1960) suggests certain basic perceptual and cognitive skills are necessary on entering school to cope with the learning situations presented. The child who presents learning difficulties does not have these skills, and efforts should be made in the first year at school to prepare them with these basic skills. His programme does not involve training in specific skills but providing generalised activities aimed at the development of such capacities as:-

<u>laterality and directionality</u> - learning the concepts of left and right and relating them to objects round about, thus developing spacial relationships.

<u>eye control</u> - the ability to control and direct the movements of his eyes and maintain focus on a particular point.

<u>sophisticated body image</u> - awareness and kinaesthetic sensitivity of the different parts of the body will help a child respond more positively to the outside world.

<u>sensory-motor ability</u> - activities such as trampolining and balancing assist in the development of kinaesthetic awareness.

<u>form perception</u> - by using such things as jig-saw puzzles peg boards, match stick figures, etc., there is an integration of the perceptual process of building things up with the physical reality of going through the operation.

Poor visual perception was blamed by Frostig (1964) for many learning difficulties shown by children in the classroom. Children with poor visual-perception may have difficulties in recognising objects and their relationship to each other and, therefore, motor responses to these objects may appear to be inappropriate or clumsy. Weakness of sensory-motor functions are assessed in these aspects of motor performance:-

flexibility
strength
speed and agility
balance
gross and fine motor co-ordination
laterality of eye, hand and foot
eye movements

and according to the deficiencies, training given in any number of the aspects of the training programme, including:-

whole body co-ordination - through simple locomotive activities,

fine motor co-ordination - hand-eye tasks such as cutting, pasting tracing, etc. as lead ups to more complex tasks,

body awareness - development of 'body-image', 'body-concept' and 'body schema' through such activities as climbing, balancing, crawling over, under, along, through various kinds of apparatus,

eye movement exercises - similar to the Kephart programme but also to promote peripheral vision.

There are also various workbooks to be used in conjunction with the above programme aimed at developing:-

eye-motor co-ordination

figure - ground perception - (the ability to select and focus attention on the relevant stimuli),

form perception - recognising similar shapes, regardless of size,

perception of position in space - similar to Kephart's 'directionality',

perception of spacial relations - recognition of objects in relation to each other, or parts of an object as a whole.

The use of the workbooks should follow practical work, ensuring that the visual-perceptual training is reinforced with other forms of experiences.

The latter two examples, together with other similar programmes deal with attempts at compensatory education for the more or less 'normal' children with perceptual-motor difficulties. The overall plan is to fill in any gaps, through recapitulation, in the childrens experiences so focussing their attention on the next stage of development. As this study is concerned with compensatory physical education within the normal school programme, this school of thought would appear relevant, bearing in mind, however, that these programmes are aimed at those children who are slow learners in schools and, therefore, mental as well as physical improvement is looked for.

The link can be made here with Gestalt psychology, in terms of which, perception can be described as having two aspects. The first is a psychological process in which part of a 'whole' is seen, heard or felt in relationship to the other parts. The whole consists of the integration of all the parts into a unique entity which represents more than their mere summation. In normal perceptual activity, the 'whole' of the object is immediately recognised and acquires meaning and significance. The second area of perception is concerned with the ability to recognise the 'whole' as a foreground figure against a background. (This aspect links closely with Witkin's (1962) theory of field independence.) In this area the normal child would appear to be able to locate and identify the whole object from the background, (be 'field-independent' in Witkin's terms).

Many retarded children, however, are attracted to the details of an object and may have difficulties in perceiving their relationship to each other and to the whole. In this case the whole is seen as a collection of parts rather than something unique with qualities of its own. They may also be 'field dependent', that is, unable to abstract the whole from the background.

With this in mind, what can be done for the group of children, lower than average in perceptual-motor skills, but within the normal school programme.

In the belief that movement experiences are important for the establishment of early basic perceptions formed by a child about himself, his world and his relationship to the world, the total development, but in particular, perceptual-motor development, should be aided by exposing a child to a variety of perceptual-motor experiences. This relies on the theory of transfer of training or transfer of skill. Accepting that all skills are specific, positive transfer will take place between practices if the practices or skills contain parts or elements which are common to both (as floatation is a common element to learning the front crawl and the breaststroke). In other cases, positive transfer of more general elements is expected between skills where specific motor responses may differ but the perceptual aspects and abilities are similar (as,for instance, court awareness common to both badminton and tennis). This suggests that during the perceptual-motor stage of development, exposure to and experience in a wide variety of activities and situations is essential for maximum development. Success at various levels is also an essential in order to transfer confidence, brought about by success, to tackle other skills.

Hyperactivity, which oftens accompanies motor-impairment, prohibits concentration and meaningful practice of skills over a period of time. Sequence work in the gymnasium would appear to be a sound means of allowing the child to concentrate on selected movements and encouraging him to explore further possibilities. Thus, when he has mastered one task or movement, further practice is allowed and encouraged, but with an addition. This demands further concentration on the new aspect while allowing a recap on the original movement.

If, as is suggested by Witkin (and discussed earlier), body-awareness might relate to the systematic impression a child has of his body, and if this is a limiting factor in the child's motor ability it would suggest that movement training, involving the child experimenting and exploring a variety of situations, static and dynamic, using different apparatus and apparatus arrangements, different surfaces and positions would be of value in developing this ability.

Problem solving tasks rather than teacher-instruction will encourage cognitive development and allow co-ordination of movements to the best of the child's ability

Compensatory physical education for the motor-impaired child then, may consist of a programme of movement training based on the principles already mentioned. Movement training is already evident in schools, forming one aspect of the P.E. programme, Educational Gymnastics. With one or two modifications and a thorough understanding of the aims and principles of the programme, this could well be adapted to form the programme needed to present to motor-impaired children.

Allen (1970) and Allen & Morris (1970) based a movement programme on effort qualities, as proposed by Laban in his studies of human movement, to treat children (8½ - 10 years old) described as motor-impaired according to the Stott Test of Motor-Impairment, over a seven week period with two 40 minute additional P.E. lessons per week. Improvement was shown by the experimental group but it must be remembered that they received extra P.E. lessons and this in itself could be significant.

The point of this study is to assess the effect of adapting the P.E. programme, and not supplementing it, has on the children , and over a much longer period of time.

Two previous studies (Damber 1966, Davies et al. 1969) have already suggested that there is a high incidence of motor-impairment among approved school populations and for this reason it was decided to carry out this research work in this situation. Damber reported a 35% history of complication during pregnancy or delivery in a sample of 40, 15-16 year old approved school boys and also showed these boys to have symptoms of brain-damage or neural impairment. Davies et al. used the Stott Test of Motor-Impairment in a previously cited study with a sample of 60 junior approved school boys, and found 27% to be motor-impaired using this test. Viewing this in relation to findings from other populations in which a similar criteria of failure on the test has been used (Whiting 1969a, 1969b, Clarke et al. 1968, Lyton et al. 1969) it shows a high percentage. It also shows that of the 60 subjects only 5 recorded zero scores and the mean score was 6. This suggests a low motor ability throughout this population.

<u>The principles of this programme of compensatory education.</u>

Having established the existence of motor-impairment and hypothesised various causes, the next step is to consider what can be done to alleviate this impairment, within the framework of the ordinaryschool physical education programme.

If, as I have suggested, this impairment is due to inefficient or non-working neural pathways, caused by the lack of the correct kind of stimulation and experince in early childhood, is it too late to activate the pathways through a widening of movement experiences?
If the impairment is due to some minimal damage to the brain, would not the Doman-Delacato principles of making children face up to, and overcome the problems of varied movement, train other parts of the brain to take over the functions of the damaged cells.

As I was to be dealing with a particular population, that of the junior approved school, Ifirst had to consider what was being done for them in the field of physical education and then to formulate what I thought ought to be done for them. I took a subjective view of the type of boy sent to these schools and then the type of work being done in physical education in these schools.

From talking to the boys and examining many files and case histories I drew a general picture of the development of these boys in large families, itinerant families, broken families and other forms of instability. Here they regularly experienced failure and rejection as they did in most forms of education. If they were also behaviour problems they would be even more unlikely to make normal progress in the school group. Any disability they had would be magnified until they in turn would reject what was being offered. If they were behaviour problems the teacher may even have welcomed this rejection and self-isolation for the sake of peace within the rest of the group. If this failure - rejection - isolation process took place in physical education, then any existing motor-

--impairment would magnify.

This then was the picture which I had of the approved school boy, the rejected isolate who was afraid to tackle anything new for fear of failing as he had failed so often before. A view common, not only to myself, and one often consolidated in later dealings with these boys.

What was being done for these boys within the approved schools? From talking to a number of teachers of P.E. I gained a depressing view of the problems facing them in trying to present any form of P.E. programme. The total disinterest shown by many boys to anything presented to them reduced some teachers to accepting that some boys did not want to take part and so, more often than not they were allowed to withdraw to some corner of the gym or field and watch those interested take part. Some teachers were so frustrated at the lack of ability of the boys to co-operate in team games that these were removed from the timetable, and the teachers concentrated on such aspects as weight training or circuit training etc. Other teachers set about captivating the interest of the boys in some specific topic such as cycling, cyclo-cross, cross-country running etc. I found no evidence of any form of educational gymnastics being taught, in fact any form of gymnastics taught was formal or based on formal or traditional movements.

So I tried to see the problem from both points of view and then plan a programme of physical education to include what I thought was needed to supplement early movement experiences, and present it in a way that would meet with acceptance from this population.

Educational Gymnastics

All modern physical educationalists will have met this term. As terminology varies, however, it will be necessary for me to give a detailed account of what I understand by the term educational gymnastics and movement training through educational gymnastics.

First I must make it clear that I believe that the content of the lessons are not as important as the principles upon which the content is formulated. For this reason, I will make no attempt to present lesson content here. A full account of the lessons proposed can be found in appendix 1.

Even before the second world war, teachers of P.E. were beginning to experiment with various forms of presentation and content of P.E. lessons, trying to break away from the rigidity of the 1933 syllabus. This was the start of the drive for more envigorating and stimulating work which would be more acceptable to the children and the teacher alike. The general aim of physical education has not changed over the years with the stress being put on the education of the 'whole' child, in keeping with general aims in education. This implies that due attention should be given, therefore, to the maximum development of each individual child, physically, mentally, socially, and morally to prepare him for life and living and to satisfy his need for success and achievement in the activities in which he takes part.

Any P.E. programme should seek to secure and maintain high standards of bodily health with the correction of defects and with the development of physique, vigour and, of utmost importance, skill. This requires the development of the physical skills of each child to its full extent so that he can learn to appreciate the sheer joy of physical fitness and well-being and also acquire a basic skill to enable him to take part in healthy physical activity without undue fear of failure and ridicule.

Educational gymnastics developed, therefore, very much with the individual in mind. Words such as variety, choice, creativity, partner-co-operation, etc., were used in formulating a syllabus. It was realised that it was educationally unsound to force all children to conform to a pattern and that movement was as individual as the individual person. So whatever method was used it had to aim at developing to the full the individual's varying physical and mental resources to enable him or her to use them effectively in all physical situations. The emphasis on the individual shows itself in a number of ways. There is a greater readiness to allow scope for personal variations and interpretations of the same activity, even when the activity is either teacher-guided or even teacher-directed. Teachers recognised that there are many ways of performing a basic movement, no one of which need be 'the' correct one. Opportunity for individual practice has become a feature of educational gymnastics and informality has replaced the old military type 'drill' and formal gymnastic movements. The systematic progress of the 1933 syllabus,- progress of the whole class from one activity to the next at the same time- has gone and though systematic progress is still possible, it is the progress of the individual child along the ladder of skill acquisition. Free-practice and choice of activity and apparatus play a large part in this method, and individual ability and interest will vary, but although ability varies, each child has a maximum individual effort of which he is capable and nothing less than this standard should be accepted. This puts a great onus on the teacher to assess the capabilities of each child and demand that he or she works to this limit and re-assess when progress has been made.

This then is the change from formal 'gymnastics' training to the informal 'movement' training. The child is no longer required to conform to set exercises and the teacher is able to control the 'success - failure' line to suit the varying needs of the class. Thus there is a variety of stimuli and a variety of response. This, according to Piaget, should lead to cognitive growth and the development of curiosity. In this informal approach, what is asked of the child is within his reach and when it is reached a new and more challenging demand is made.

This Movement Programme.

This programme consisted of forty, 35 minute lessons, given twice a week to the children divided into groups of not more than 25 per group. Taking into account the Christmas break and other occasional interferences the programme took six months to complete. In the beginning, whatever the child produced in response to a demand was accepted as a success and further demands made based upon the first efforts. Thus success was all important, allied with confidence, one helping to produce the other.

Work was given in any combination of the following ways:-

individually,

in pairs,

in groups,

on the floor,
on small apparatus,
on large apparatus,
teacher directed,
teacher limited,
exploratory.

Time was spent in establishing a large vocabulary of individual movementsand in combining a number of these to form a sequence to solve a particular task. A great deal of repetition was emphasised and progress made in terms of:-

improved quality of movement,
extended variety of movement
more fluent continuity of movements.

It was also aimed to develop 'insight' into the movements performed. Insight into the movement will facilitate not only the acquisition of the skill but also the quality of its performance, so stress was put on the child understanding what he was doing or trying to do. This included the understanding of the different <u>types</u> of movement (stretching, curling, rolling, etc.), parts of the body being used, the speed of the movement, body shape, direction, height, etc. Thus by developing a wide variety of movements and a full understanding of the skills involved, a higher incidence of transfer of abilities and techniques can be expected between one skill and another.

The full lesson notes, together with the various apparatus lay-outs and gym dimensions, can be found in the appendix.

It can be stressed again that this was not an 'extra' programme of P.E. but made up the P.E. programme. Each boy also had a short swimming lesson per week and an occasional game of football.

CHAPTER VI

Methods and Procedures

This research design required the selection of an experimental group and a control group, the testing of these groups using the test battery listed and described later in this chapter, the training of the experimental group using the programme already outlined (details of which can be found in Appendix 1) and the retesting of the groups at the end of the training period.

Experimental Group

As previously stated, the experimental group was to be taken from an approved school, in this instance, Mile Oak School for Boys, Portslade. This is a junior approved school for boys aged between 10½ and 15½ years of age. The school could cater for up to 90 boys but during the time of this work approximately 60 boys were in attendance. These boys had been committed to the approved school by the courts for various offences. They were drawn from the London Boroughs and the Local Authorities (East and West Sussex and Kent).

As this work was to take seven to eight months to complete, only those boys who were likely to be in attendance for the full period of training could be used. This eliminated many of the older boys due for release and left 42 boys in the initial group for the first testing. Due to transfers, re-committals, etc., after the initial testing, the group was reduced to 34. Two other boys who were habitual absconders, and therefore missed more than 20% of the training programme were also ignored. This left a sample experimental group of 32 boys with a mean age at the start of the programme of 162 months, all of whom attended more than 80% of the training sessions (see Appendix 111 for attendance figures). Thus selection within this population was on availability only.

The experimental group was to receive three P.E. periods per week.

Two were to be devoted to the training programme allowing 35 minutes working time each lesson, and the other lesson to be devoted mainly to swimming but occasionally to a 'game' of football.

Control Group

This group comprised of 30 boys from the nearby Portslade County Boys Secondary School. The boys were matched with the Experimental group for age. Subjective attempts were made to match for intelligence. The two classes were selected particularly as they were receiving an educational bias towards practical subjects (handicrafts etc.) in the school programme. This matched the emphasis on these subjects in the approved school. The boys in this school received no informal gymnastics of any kind and with the co-operation of the P.E. master, the boys in the control group received no gymnastics at all during this period. Their P.E. programme consisted of a games bias with football and basketball figuring prominently and being supplemented by such activities as circuit-training, cross-country running and minor games. In all, they too were allocated 2½ hours per week for physical education.

Test Selection

For the reasons given below, the following tests were included in the test battery used.

1. Stott Test of Motor-Impairment. (Stott, Moyes and Henderson 1966).

This would appear to be one of the most recent tests of motor-impairment. Not only does it give an impairment score but it also narrows down the area of impairment to one of five, covering:- static balance, manual dexterity, dynamic balance, upper-limb co-ordination and simultaneous movement. Although a test of motor-impairment and not directly a test of motor ability, it would appear to be a suitable test for this study as few zero scores are registered particularly with low ability groups such as approved school boys (Davies et al. 1969). The use of this test would also allow comparison with other studies with similar populations (Barber 1966, Davies et al. 1969). This test provides tasks in each of the five areas according to the age of the subject, which he attempts at his own age level. If a failure is registered on any item, the corresponding item is taken at the next age level below until all items are completed. Failure at any one item registers two points towards a motor-impairment score (where both hands or feet are tested separately, failure with one hand or foot only is a one point deficit).

(It is evident from the conclusions of this study that the two groups should have been selected and matched for Stott Test scores as the control group were significantly better at the start and, therefore, less chance for improvement.)

2. Memory for Design Test. (Graham and Kendall 1960)

As minimal-brain-damage has been closely linked with motor-impairment, and often cited as one of the causes of the impairment, but on the hypothesis that this is not a major cause of impairment within this approved school population, it was decided to include a test of brain-damage. High scores on the impairment test with few failures on the brain-damage test would support this hypothesis.

This particular test involved the accurate reproduction of geometric figures from memory.

3. Draw a Man Test of sophistication of body concept. (Witkin 1960).

Evidence has already been put forward to link body concept and motor ability (ChapterIV), and if this is so, then some assessment of body concept should be made in order to examine the connection between the 'systematic impression a person has of his body', and his ability to perform perceptual motor skills.

This test was scored on the Hanna Marlens scale as described in "Psychological Differentiation" (Witkin 1962). The Hanna Marlens scale is a five-point scale but by scoring half-points this was extended to a nine-point scale with nine representing the most primitive drawing.

4. W.I.S.C. Performance Scores. (Wechsler 1949).

The performance section of this test consists of a number of hand-eye co-ordination tests and problem solving tasks which are described in more detail in the next section. Improvement in these tests would require improvement in both aspects of perception as described by Gestalt psychologists, seeing the 'whole' and extracting this from its background. Although in the context of this study, motor-impairment may not be related to intelligence, any improvement in hand-eye co-ordination could result in a slightly improved W.I.S.C. score.

9. Gibson Spiral Maze. (Gibson 1964).

This is a psycho-motor test scored on a time and error basis. The suggestion by Gibson is that the delinquent will forfeit accuracy for speed. If the lack of accuracy is due, however, to motor-impairment rather than delinquency, then a reduction of the error scores might be expected if motor-ability was improved.

These five tests made up the test battery used on both groups before and after the experimental group had received training. On each occasion full tests were used.

Testing Procedures.

All testing was carried out by the same examiner. This included subjects and controls for both the test and the retest.

The Draw a Man test and the Memory for Designs test were given as group tests to 10 - 12 pupils at a time. The other three tests, Stott test, W.I.S.C., and Gibson Spiral Maze were given individually and always in that order. The group tests preceded the individual tests.

The approximate time for the test administration was:-

Draw a Man	12 mins.
Memory for Design	10 "
Stott	25 "
W.I.S.C.	20 "
Gibson S.M.	3 "

Test Areas.

For all the group tests an ordinary classroom was used with each subject seated individually. For the individual tests:-

Control Group - the same room was used for the test and the retest. This was 16' x 8' with a plain wall and a wooden floor.

Experimental group - the school staff-room was used for the test and the retest. This was 16' x 16' with one plain wall and a wooden floor.

In both cases attempts were made to remove distracting objects from the rooms and white paper was used to cover walls with posters etc. which could not be removed, and which might have proved a distraction.

Testing Times.

To test the control group the examiner went into the school for one full week at the start of the work and again at the end. The subjects were tested during school time but standardisation of the time of day the test and retest were given was not possible.

The testing of the experimental group took three weeks and the retesting two and a half weeks. Testing took place during school hours or during the evening but again it was not possible to standardise the time of the test and retest, with regards to the hour of day.

BACKGROUND OF THE TESTS USED.

1. Stott test of Motor-impairment.

The history of the development of the Stott test originates at the Oseretsky Motor Development Scale of 1923 and the later revision of that scale in 1931. Full details of this and subsequent tests can be found in Davies et al. (1969). The main stages of development from these tests to the Stott Test were Yarmolenko (1933) tests, and Lincoln / Oseretsky test (Sloan 1955), and the Vineland adaption of the Oseretsky test (Cassell 1949).

It was not until 1960 that Gollnitz, a German neuropsychiatrist, concentrated for the first time on the idea of assessment of impairment as opposed to the ability of brain-damaged children. From this point of view, items from the Oseretsky scale were selected and grouped on the basis that only a very small percentage of children should fail. These were then tested at successive lower levels until all the items were passed. This revision can be seen as a breakaway from the original tests which attempted to calculate the motor age of the child.

In the light of modern psychological opinion, it is evident that there is far more concern for the obscure and diverse effects of motor-impairment. No longer is it seen as purely a manifestation of certain forms of neural dysfunction but as a possible cause of other social and psychological problems.

This possibility is well supported by the studies of maladjusted and delinquent children carried out in this country, recently, by Stott (1964). From his study of "thirty three troublesome children" he found a high incidence of associated conditions which could be attributed to neural dysfunction. He formed the opinion that a test of motor-impairment could well prove the best means by which the neurological factor in behaviour disturbance may be demonstrated. There was a strong possibility of a close relationship between motor-impairment and behavioural problems, particularly of the type associated with delinquency.

In recognising the harm that can be caused by failure to recognise and identify cases of clumsiness, Stott and others began the work of devising a test based on the Gollnitz revision.

Several tests of motor-impairment are available; they are, however, of little use in detecting neural impairment since, often, the latter condition is limited to one part of the body or to one function which may not affect the particular activity being tested. The need then is obviously for a test which samples a wide range of dysfunctions.

In considering the problems which were seen to be associated with this task, Stott (1966) points out that motor-impairment may be the result not only of neural impairment but also of physical malformation, injury or debility. His main criteria for item choice, therefore, is that motor-disability should be reasonably attributed to neural dysfunction. This he states can be inferred if there is a failure to control or co-ordinate simple actions without descernable physical disability, the inference becoming more probable if the incompetence is observed in diverse function.

He also acknowledges the difficulty in minimising the effect of other irrelevant factors present in all such empirical tests.

> "Since behaviour involves the whole person it can be affected by incompetence in any of a number of functions - perceptual, intellectual, motivational (emotional), or muscular...... it is a question of reducing their influence on the result by choosing activities which are relatively non-discriminating in these areas."

There is a further complication that with a tendency to multiple impairment, the child is more likely to be affected mentally, physically and emotionally. Consequently, the tasks set must have tolerance limits of spatial awareness, strength and intelligence only just above the range of obvious incompetence.

On the principle that apart from neural dysfunction, the test should be relatively non-discriminating, care was taken to avoid tests which demanded any more than minimal strength and did not penalise those children with minimal physical handicaps.

Attempts have also been made to eliminate any really unfamiliar tasks or tasks which might provoke resistance or fear.

Differences in previous learning, in cultural environments, and in educational opportunities were also seen to present problems of item choice that could not be completely eliminated. Both familiarity with activity and a knowledge of the physical properties of any object that is manipulated are relevant factors of the experience necessary in the accomplishment of any set task; such experience will differ with each subject, whether it is from previous practice,- for example, of throwing,- or familiarity with a tennis ball. The danger of selecting items that are more free from cultural familiarity is that they may become divorced from the fundamental activities of real life and may even conflict with the natural means of co-ordination.

When considering tasks involving two simultaneous but different movements,it has been taken into account that if, owing to their novelty, both demand attention, then the task would require considerable concentration, which amounts to the rapid alternation of attention from one movement to another. This type of task is obviously unsuitable for mentally slow children, thus in the test, when the inclusion of simultaneous tasks is demanded, one of them must be so familiar or simple that it can be performed without conscious effort.

The question of a cut-off point for success or failure has yet to be answered satisfactorily. As Stott points out, it would be unrealistic in a diagnostic test of motor-impairment to have a 50% pass / fail rate and hardly more realistic to pick on an arbitrary 10 - 20% failure, for the borderline has to be established by some independent criteria.

The ultimate yardstick of impairment must be that which constitutes impairment in the ordinary child's life. Stott suggests that the best way to note this is by trained observers spotting those children amongst representitive groups who show any degree of physical handicap during play: in this way an expected incidence would occur and emerge.

An important aspect of the failure rate is to appreciate the relative prevalence of the conditions in each sex, evidence which could show it to be congenital. With this in mind the test is identical for each sex, avoiding such activities which might give an obvious advantage, physical or cultural, to one sex or the other.

With these considerations in mind Stott has selected five tasks of increasing difficulty for each age level (5-16) which purport to measure the following:-

1. Static balance
2. Hand-eye co-ordination
3. Dynamic balance
4. Manual dexterity
5. Simultaneous movements

In view of the understanding that neural dysfunction can be specific to one function or to one part of the body, these items are thought to be suitable in as much as they show a reasonably comprehensive sampling of motor activity. Whether they represent the essential factors of motor performance sufficiently accurately to provide a means of detecting impairment has yet to be fully proved, but the impairment score registered on the basis of one point for a failure with each limb on each test, (or two points for a failure in a test not involving attempts with both limbs), will be very useful in this study.

Stott has laid down the criteria which each test item must satisfy as:-

It should,

1. Detect motor disability attributable to neural dysfunction.
2. Barring gross impairment, not involve greater muscular strength than would be common to all subjects.
3. Not involve fine discrimination of space or distance.
4. Be managed by children of inferior mental ability.
5. Not penalise children of short stature or with minor physical handicaps.
6. Not evoke emotional resistance.
7. Discriminate at the point judged independently to be the borderline of motor-impairment in everyday activities.
8. Minimise previous cultural and learning differences.
9. Involve a qualitatively different activity to that of tasks of other age levels.
10. Be scorable by a pass or fail with reasonable objectivity.
11. Test the sort of motor co-ordination and control for which the human organism is naturally adapted.
12. Be reasonably specific in the area or aspect of motor ability it is intended to test.
13. Require only such apparatus as can be carried and can be

used in a moderately sized room.

14. Not be unduly time-consuming.
15. Involve no risk of physical injury by falling or slipping etc.

It is Stott's intention that the Test should be applied in schools in conjunction with teacher's assessment as a screening device.

The difficulty with assessing motor-impairment relates to the validity of the test being used and the criteria establishing the cut-off point. Although the Stott Test represents the most recent work in this area, recent validation studies (Whiting 1969a, 1969b, Lyton 1969) have not produced over favourable results. The main criticisms, however, would seem to be in establishing the arbitrary cut-off point and in the relative difficulty of the graded tests. However, it would also appear from these studies that certain subtests at particular age levels are too easy and hence the children who do fail the test are in all probability more severely impaired than indicated.

<u>Sections of the Stott Test of Motor-impairment used in this study.</u>

<u>Five Sections</u>

1. Static balance
2. Upper limb co-ordination
3. Whole body co-ordination
4. Manual dexterity
5. Simultaneous movement.

Balance tests were done in bare foot.
All tests are designed to test motor-impairment and <u>not</u> inability to comprehend instructions or poor motivation. Every effort is made to get the best out of the children. Demonstrations, extra explanations, etc. should be given freely, if they might help.

<u>Age 10.</u>

1. Stand on one foot, other raised with thigh parallel with floor, arms stretched overhead, stick held in hands. Hold balance for ten seconds. Three attempts each foot. No swaying, dropping of free leg or displacing of foot.

2. Attempt to strike a table tennis ball with a T.T. bat on the rebound

from table. Ball dropped by tester from two feet. Two hits from three with each hand.

3. Jump off two feet over knee height cord to land on one foot and balance for 5 secs. Three attempts (slight foot movement allowed).

4. Take a single match from a pile of 40 at the centre of a 9" square and place them in turn in a box at the corners of the square. Either way but each box in turn. One match to be picked up at a time. 50 secs. each hand, two attempts.

5. Swing cotton reel round on 12" string while balancing two other reels on outstretch fingers of other hand. Both hands.

Age 11.

1. Stand on 4" x ½" side of a balancing board on one foot for 10 secs. Three attempts each foot. Free foot off the ground.

2. Throw tennis ball at a circular target at chest height on a wall 10' away. Throw underarm. 5 hits with dominant hand, 3 with other. Ten practice throws.

3. Jump in the air kicking heels behind and in doing so, strike both heels with hands. Three attempts. Simultaneous striking.

4. Paper with figure of 100 circles in front of subject on soft pad. Pierce as many circles as possible with a stylus in 30 secs. Two attempts each hand. 50 with dominant hand 35 with other.

5. Peg board on a pile surface with 6 pegs on each side. Place one peg from each side on the board simultaneously. 15 secs.

Age 12.

1. Stand on the 1" x 1" side of a balancing board on one foot for 10 secs. Free foot off the ground. Three attempts each foot.

2. Throw tennis ball at a wall from 10' and catch rebound with throwing hand. May move over 10' line to catch the ball. 5 from 10 with dominant hand, 3 from 10 with other. Clean catch.

3. Three bean bags, 16" apart on floor. One leg hop sideways over bean-

bags to balance at the end of three hops, repeat movement the other way to remain balanced. Test both legs. Three tries. No pause. Don't touch bean-bags, turn foot or overbalance.

4. Lacing board in one hand and thread lace from one end to the other through the holes. 12 secs. Three attempts.

5. Carry rectangular block in palm of hand, with a cotton reel on its side on the block, walk forward three yards, step over a 9" obstacle walk a further 2 yards, turn and walk back again. Three attempts with each hand.

Age 13 / 14.

1. Stand for 10 secs. on one foot with heel raised. Free foot off the floor, balance foot still. Three attempts with each foot.

2. Two stands with wire coathanger hanging from pegs at chest height. Pass wire ring along horizontal wire and back again. No touches with dominant hand, one with other. Three attempts. Stand away, encourage extension and flexion.

3. Start with both feet in large circle, jump so that each foot lands in a small circle, and back again. Sequence to be done five times. Fail if foot land outside circle, control is lost or sequence is not completed.

   Large circle 12" diam.
   Small circle 6" diam.
   Centres 18" away from each other.

4. On a table is placed a paper with a printed circular track. Tester holds a felt-tipped pen over the paper, motionless, so that the tip of the pen falls within the track. Subject rotates the paper so that a line is drawn inside the track. Fail if the line crosses the boundary of the track. Two attempts.

5. A peg-board (dominant hand) and pin-board on a table in front of the subject. Seven pins and seven pegs are placed at the appropriate side. Pick up one from each side simultaneously and place on the boards. 15 secs. All pegs and pins on the board. Three attempts.

Age 15 / 16

1. With two balance boards end to end, 1" by 1" upwards; Subject stands heel to toe. Balance to be held for 10 secs. Fail if board moves or feet are displaced.

2. 10 feet from the wall, subject throws a tennis ball against the wall strikes the rebound with the palm of the hand, to send the ball on to the wall again and catches the second rebound directly from the wall. The ball has not to touch the floor. The ball has to be struck by the throwing hand but may be caught by either, or both. 10 attempts with each hand. Subject must make 5 successful catches with the dominant hand and 3 with the other. Subject should be given practice attempts. Subject is allowed to step forward if necessary to pat or catch the ball.

3. Two, 9" diameter circles are drawn on the floor with centres 18" apart. Subject has to hop back and forward five times (to a count of ten). Three attempts. The movement must be continuous and the subject must remain within the circles.

4. Nesting jars are placed in front of the subject in descending order. Unscrew the lid of the second smallest and place the smallest inside it and screw on the lid. Repeat the sequence with each jar until the lid is screwed back on the largest jar, and it is placed back on the table. Time allowed for the complete sequence is 12 secs. and the lids must be on correctly. 3 attempts.

5. Figure of 100 circles fixed to soft paper is placed in front of the subject. Working simultaneously from both ends with a stylo in each hand, pierce as many holes as possible. 3 attempts - movements must be simultaneous. 12 circles must be pierced with each hand within 15 secs.

2. MEMORY FOR DESIGN TEST

The Memory for Design Test involves the presentation of simple geometric designs and the reproduction of these designs from immediate memory.

It was thought by Foster(1920) that the inability to reproduce designs from memory was associated with 'organic' impairment though no test had been validated in this respect.

Wood and Shulman (1940) took the Ellis Visual Designs Test, devised in 1927 and attempted to standardise it and evolve a scoring system for it. They concluded, after fairly extensive use with schoolchildren, that the test could well be used to bring to light disabilities in memory and reproduction of patterns and that:-

> "...it is the extremes of marked ability and inability which have educational significance."

Wood and Shulman made the following suggestions for the improvement of this test:-

1. The designs ought to be arranged in order of difficulty.
2. The addition of new figures would help to fill out the scale and give a better spread of results.
3. Designs with obviously meaningful associations should be rejected.

Working on these suggestions, Graham and Kendal (1946) designed 40 patterns and as a result of testing (1947, 1948) selected 15 which were:-

a. most promising in terms of scoring objectively
b. most likely to discriminate brain-damaged children.

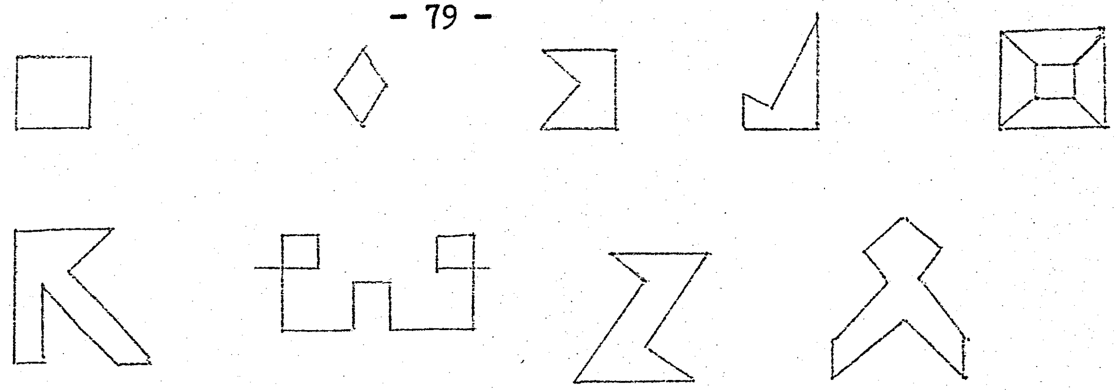
Two feature of the eliminated designs appeared unfavourable for these purposes:-greater complexity and orientation of a design so that it was not parallel to the outline of the card.

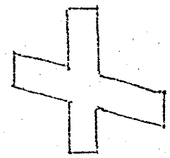
They concluded from their testing of known brain-damaged subjects, together with subjects with no known history of brain-damage, that the Memory for Designs test significantly differentiates the brain disordered from the normals.

Scoring system.

Graham and Kendal tried:-

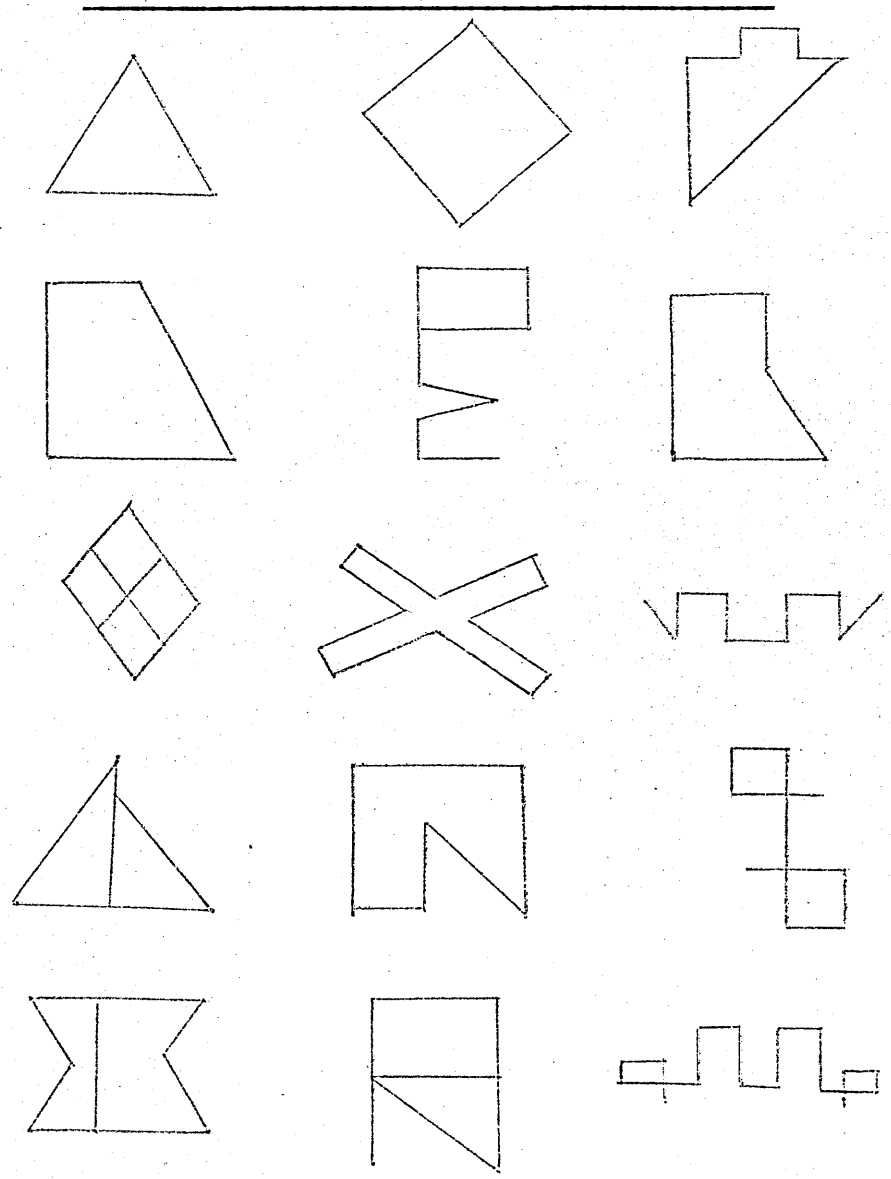
"... not to measure some function of theoretical significance





Ellis Visual Design Test

Memory for Design Test (Graham & Kendal)



> but rather to crystallise in the scoring system those differences in response to the test which distinguished criterion groups."

Thus, the scoring system is heavily weighted against the brain-damaged. For example, orientation errors are most frequent among brain-damaged, so are relatively heavily penalised, as are the closing of open designs (as in Nos. 5, 8, 9, 12, 15) which again is a feature of the reproduction by brain-damaged children.

The score for each design is determined by the number and type of errors made, so that the higher the score, the poorer the performance.

0 – for a satisfactory reproduction or an omitted or incomplete production.

1.– for two easily identifiable errors but general configuration retained.

2.– general configuration lost.

3.– figure is reversed or rotated.

<u>Procedure</u>

The designs shown on the previous page are drawn on white card in black ink, each card being 5" square.

The subjects are given a sheet of foolscap paper, a pencil and a rubber. The subjects are shown each design for five seconds before being asked to reproduce the designs from memory.

<u>Instructions</u>

" I am going to show you some cards with drawings on them. I will let you look at them for five seconds. I will then take them away and let you draw from memory what you have seen. Be sure to look at them carefully so that you can make yours just like them. Don't start to draw until I have taken the card away."

The examiner holds the first card at right angles to the subject's line of vision. No attempt is made to encourage guessing on partially remembered designs.

<u>Implications</u>

Scores of 0 – 4	– normal
Scores of 5 – 11	– borderline
Scores of 12 plus	– critical

More recent uses of this test show it to be quite reliable in identifying brain-damage. Garrett et al. (1957), comparing known cases of brain-damage with a cortical group placed 67% of the brain-damaged group in the critical area. Clarke et al. (1968) compared E.S.N. children with normal school children and found:-

44% in the critical area

30% in the borderline area

and only 26% in the normal area.

Davies et al.(1969) , however, used this test in a study into the incidence of motor-impairment in an approved school population and placed only 17% in the combined critical and borderline areas, although 27% were classified as motor-impaired according to the Stott Test of Motor-impairment.

3. DRAW A MAN TEST

This test sets out to measure a child's level of body sophistication, and should indicate the systematic impression that a person has of his body. Since it is considered likely that a child who has suffered deficiencies in movement experiences and, as a result, limitations of differentiations of function, then a measure of his present level of body sophistication would seem to be of real value in assessing his limitations.

The test was originally used by Goodenough (1926) as a test of intelligence scored on a scale later revised by Harris(1963), who regarded the drawings as a measure of intellectual maturity.

The test involved the child in drawing a figure of a person on one side of a sheet of paper and on the other side, drawing a figure of the opposite sex to the first figure.

Machover (1949) viewed the drawings as an individual's reflection of himself, with his own characteristics, stressing that:-

> "... the figure drawn is related to the individual who did the drawing, with the same intimacy characterising that individual's gait, his handwriting, or any other of his expressive movements...the figure drawn is related to the impulses, anxieties, conflicts and compensation characteristic of that individual. In some sense the figure drawn is the person and the paper corresponds to the environment."

Though Machover's scale refers directly to 'body concept' in terms of body esteem, it is not sufficiently specific to be of use to anyone wishing to measure a child's level of 'body sophistication' or 'body awareness'.

Witkin et al. (1962) developed such a test based largely on the original Goodenough Draw-a-Man scale but aimed at measuring a person's concept of his body. They used a five point scale as follows:-

1. Most sophisticated
2. Moderately sophisticated
3. Intermediate level of sophistication
4. Moderately primitive
5. Most primitive

The first step in formulating the scale was to group together sets of drawings of different levels of sophistication on the basis of an overal global impression. By then studying the drawings in detail to identify the graphic features present in each group. By this method three categories of characteristics were identified:-

1. Form level of the drawing; shape of limbs, general shape of body, method of attachment to limbs, relative sizes of parts, correct profiling.
2. Identity and sex differentiation; body shaping, appropriate features and clothing, activity depicted.
3. Level of detailing; clothing, facial expression, presence of neck, ears, eyebrows, etc., accessories such as necklace or cigarette, attempt at presentation of action.

Recent studies including this test in batteries together with the Stott test of Motor-Impairment have shown interesting results. Whiting et al. (1969b) sought to identify deficiencies in the skill performances of 50 E.S.N. children and 50 primary school children aged 10 years old. Reliability of scoring was achieved with correlations of 0.91 and 0.87 between assessors. Nine of the 50 primary children were placed in the most sophisticated group with none in the most primitive group. In the E.S.N. group, none were placed in the most sophisticated group and 23 in the most primitive group.

Dyton et al. (1969) examining eight year old children recommended as 'clumsy' by their teachers, produced a correlation of 0.7 between scorers. Using the nine point extension of the five point Hanna Marlens scale, a distinct 'skew' to the 'primitive' end was established. Within the group, 10 of the 13 who failed the Stott Test of Motor-impairment were in the eight or nine range. Only 30% of the non-impaired group were in this range.

Davies et al. (1969), in an investigation into motor-impairment and maladjustment, used the Draw-a-Man test with children referred to a child guidance centre and with children at a residential school for maladjusted boys. In both cases a distinct 'skew' to the primitive end of the scale was established. Mean scores of 6.9 and 7.4 respectively were gained by the two groups, on a nine point scale.

In the same study, the test was also administered to 60 boys in a junior approved school, together with other tests including the Stott Test of Motor-impairment. The 'skew' to the primitive end of the scale was not as pronounced and there was no significant difference in the Draw-a-Man scores between the boys who were motor-impaired according to the Stott test and the non-impaired, although the impaired scored slightly higher.

It was thought that this would be a valuable test to include in the battery because a. it may show an area of deficiency in an individual and, b. it may be valuable in assessing any improvement in this area by the programme of movement training.

Scoring

Scoring was carried out according to the Hanna Marlens scale (Witkin 1962) but sub-marking into half points to give a placing on a nine point scale. The most primitive having the higher score.

All the scoring for this test was first done by four independent markers. The sets of marks obtained were then inter-correlated.(The mean of the three highest correlation coefficients was calculated at 0.77.) A correlation matrix was drawn up and the actual scores used for all further calculations were the marks given by the scorer whose marks showed the best overall correlation with the other scores.

Procedure

Each subject is given a sheet of foolscap paper, a pencil and a rubber.

Instructions:- I want you to make a picture of a man. Make the best picture that you can. Take your time and work carefully.

Try hard and see what a good picture of a man you can make.

When the picture has been finished ask the children to turn over and make a drawing of a woman.

4. W.I.S.C. PERFORMANCE SUB-TESTS

The two intelligence scales prepared by Wechsler, one for adults, the other for children, originated from the first form of the Wechsler Scales, known as the Wechsler - Bellvue - Intelligence Scale published in 1939. One of the primary objects in its preparation was to provide an intelligence test for persons from 10 to 60 years of age, although norms were provided from 7.5 years of age. This, or a similar beginning is needed if adults and adolescents of inferior mental levels were to be tested by means of the scale. Wechsler (1939) pointed out that previously available intelligence tests had been designed primarily for school children and had been adapted for adult use by adding more difficult items of the same kind.

In form and content this scale was similar to the more recent Wechsler Adult Intelligence Scale (W.A.I.S.) which has now supplanted it. The earlier scale, however, had a number of deficiencies which have been largely corrected in the current form. The chief weakness of the Wechsler - Bellvue stemmed from the unrepresentitiveness of its normative sample which was drawn mainly from New York city and its environs. The total number of adults of both sexes included in this sample was only 1,081. The reliability of some of the subtests was quite low especially for the proposed profile analysis of sub-test scores. Obsolescent items, meagre validity data and inadequacies of the manual were among the other deficiencies of this scale. The Wechsler - Bellvue provided scales and norms down to the age of ten years; its total standardisation sample was 670 children between the ages of 7 and 16. The scale was not well suited for testing children, however, and was soon replaced at these levels by the Wechsler Intelligence Scale for Children (W.I.S.C.).

Content

The 1939 and the 1955 revision (W.A.I.S.) are in part verbal and in part performance, thus enabling the examiner to obtain three scores and three intelligence quotients.

They were constructed in this form on the principle that intelligence involves not only the ability to deal with situations, but also problems in which concrete objects rather than words and numbers are utilised. The scales are also put to the pragmatic test of whether a given combination of items serves the purpose of individual mental examination and analysis of capacities better than other combinations.

The types of tests used in this scale are not unique. They were selected from available sources after a study had been made of a variety of standardised tests in use at the time. The objective was the constructio of an effective instrument for adolescents and adults based on known and proved types of psychological material.

<u>The Intelligence scale for Children</u>

The W.I.S.C. was prepared as a downward extension of the Wechsler - Bellvue. Many items were taken from this, easier items of each type being added to each test.

It consisted of 12 sub-tests, of which two are to be used as alternatives or supplementary tests if time permits. These sub-tests are divided into verbal and performance as follows:-

Verbal	Performance
1. General information	6. Picture completion
2. General comprehension	7. Picture arrangement
3. Arithmetic	8. Block design
4. Similarities	9. Object assembly
5. Vocabulary	10. Coding
(digit span)	(Mazes)

The tests in the brackets, which are the alternatives, were those giving the lowest correlations with the rest of the tests. The only sub-test which does not appear in the adult scale is the mazes.

<u>Standardisation</u>

The scale was standardised on a sample group of 100 boys and

100 girls at each of the 11 age groups, each child being tested between one and one and a half months of his mid-year. Selection of the 2,200 children was based on:-

1. Rural - urban residence
2. Father's occupation
3. Geographic area

The proportions for the sampling factors were based on the U.S. census data for 1940; "...with some adjustment for the shift of population towards the West." In many ways, the W.I.S.C. standardisation sample is more representative of the country at large than any other sample in standardising individual tests.

Reliability.

Split-half coefficients were found for three age groups (7½, 10½, and 13½), 200 in each for each of the sub-tests of the W.I.S.C. as well as for verbal, performance and full-scale scores. Since the odd - even technique was inapplicable to the Coding and the Digit-span tests, scores on two parts of these tests were correlated. Owing to the lack of complete comparability of the two parts, however, the coefficients obtained for these two tests probably underestimates their reliabilities. The reliabilities for the performance scale were; 0.86, 0.89 and 0.90. Thus performance I.Q.'s appear sufficiently reliable for most testing purposes. Graham and Matyas (1956) in a four year follow up indicated that the W.I.S.C. I.Q.'s are about as stable as Stanford-Binot I.Q.'s over such an interval. When 60 fifth grade pupils were retested in the ninth grade, their Stanford-Binet I.Q.'s correlated 0.78. On the W.I.S.C. the performance I.Q.'s correlated 0.74.

Validity

In the manual for this scale, there is no data on the problem of validity as such. Data is available on the inter-correlation of the sub-tests. The assumption is that significant inter-correlations between sub-tests would validate the hypothesis that they and the scale as a whole measure common factors. The inter-correlation coefficients among the individual sub-tests on the whole, may not be as high as might be expected, although individual sub-tests in the performance section have a great deal of communality with the total performance scores. At the

13½ year level the coefficients between the performance subtests are scattered within the 0.20's, 0.30's and 0.40's. On the other hand, each verbal sub-test correlates quite significantly with the total verbal score, within the range 0.44 - 0.82, and the performance sub-tests correlate with the total performance score in the range 0.32 - 0.68, with some concentration in the 0.50's.

The correlation coefficient between the total verbal scores and the total performance scores in this age group was 0.56.

The data indicates that all the verbal sub-tests, taken as a whole, have considerable communality with the performance sub-tests as a whole. It should be noted that as the aforementioned coefficient 0.56 is fairly distant from unity, the measured abilities in one group (performance) can be used only for a general approximation of abilities measured by the other group of sub-tests (verbal) and vice-versa. The reporting, therefore, of verbal, performance and full-scale I.Q.'s with this instrument is essential.

The W.I.S.C., therefore, compares favourably with the more recently developed W.A.I.S. in the quality of its test-construction procedures. The size and representativeness of its normative sample and the careful procedures followed in determining reliability, set a particular high standard in test development. The relatively low reliabilities of some of the sub-tests indicate that considerable caution should be used in utilising a test profile for diagnosis or guidance. The full scores and total verbal and total performance scores, however, have yielded reliability coefficients at a satisfactorily high standard.

For the purpose of this study it was decided to use the following five sub-tests from the performance section:-

1. Block designs: this involves using coloured blocks to reproduce designs, and is a time test.
2. Picture completion: this requires noting important missing items from common objects.
3. Object assembly: also a time test which requires jig-saw puzzle type assembly of objects.
4. Coding: completing the correct code below a row of numbers within a given time.

5. Mazes: drawing a way out of a series of mazes which increase in their degree of difficulty.

The first of these sub-tests requires;

a. recognition of the whole and

b. awareness of the missing part,

the rest require hand-eye co-ordination as well as problem solving ability.

According to the work recounted earlier in this study, there does not appear to be a great deal of correlation between intelligence and motor ability, although what correlation there is, is positive. With regard to this study, however, any improvement in hand-eye co-ordination and / or manual dexterity as a result of the movement training programme might be expected to improve the scores on the performance subtests of this particular I.Q. test.

Procedure

The test is administered by one examiner, seated at a table, opposite the subject who should be comfortably seated and at ease.

Full verbal instructions for the various sub-tests and the scoring procedures can be found in the manual (Wechsler 1949). The raw scores are scaled according to age, totalled and translated into a single performance I.Q. score.

5. THE GIBSON SPIRAL MAZE

The Gibson Spiral Maze Test is a psycho-motor test and such tests are concerned with measuring speed, accuracy and general style of peoples muscular responses in reply to carefully controlled stimuli.

Historical Background

It has long been known by psychologists that performance is associated with emotional adjustment. Davies (1948) showed in experiments with pilot trainees, associations between psychomotor performance and both neurotic syndromes and accident proneness. Venables (1955) and Anthony (1960) found that those who exhibited abnormal psychomotor responses were, in many cases, involved in or were convicted of criminal offences.

Willet (1964) showed that accident prone motorists were not merely unlucky, but that the motoring offender was likely, more often than by chance, to have a criminal record involving non-motoring offences.

Perhaps one of the best known psychological instruments of pencil and paper type, is the Porteus Maze, first originated in 1914 as a test of intelligence.

With successful work by Maria Montessori with mentally retarded children in Italy, more emphasis was put on diagnosing pupils suitable for treatment. Porteus was given this responsibility in Melbourne, Australia. He defined the feeble minded persons as those who...

"by reason of permanently retarded or arrested mental development existing from an early age, are incapable of independent self - management and self support."

At this time the Binet-Simon Scale was being used but this proved diagnostically inadequate as it based too much dependence on previous educational experience.

Porteus developed a series of mazes to be solved by the individual. They were so arranged as to allow an evaluation of the individual's ability to carry out in proper sequence and prescribed fashion, the various steps to be taken in the achievement of a goal; in this case, finding his way out of a printed labyrinth. This series of mazes and the scoring system have been developed since their introduction in 1914, by revisions in 1933, 1955, and 1959.

In 1947, working with Hensik, he arrived at a system of allocating points for qualitative score ('Q'). A high 'Q' score indicates that the subject has produced a careless, slovenly performance and has shown certain characteristic errors of execution, even though he may have solved the the mazes quite successfully. Subsequent research by many workers has confirmed the finding that delinquent populations obtain significantly higher 'Q' scores. Foulds (1951) shows also that psychoneurotic populations obtain abnormal 'Q' scores.

The 'Q' score is made up of several more or less distinct categories of error; one of these comprises errors caused by cutting corners, touching the sides of the alleyways and making slovenly, wavy lines. This is the psychomotor component of the test.

Although the Porteus Maze test is a well-established and validated test, it is very lengthy to administer and the 'Q' score is obtained only by some complex scoring.

The Gibson Spiral Maze Test arose from research into aspects of the Porteus Maze test and is a direct descendant from it.

Test Materials

The maze is a single design printed on a large card. The design is spiral in form and presents a pathway 235 cms. in length; ¼" wide and bordered by heavy black lines. Obstacles in the form of a letter O in heavy type are scattered along the whole length of the pathway, 56 in all, each being 1/5th. of an inch across. The design is not a true maze because it has no blind alleys or alternative pathways, thus tracing a way through is not a matter of intellectual ability. It is not intended as a test of intelligence. A fresh card is used for every subject and for recording the two scores derived from the test;- TIME (T) and ERROR (E).

Carrying out the Test

The administrator sits at a table with stop watch in left hand, facing the subject who is also sitting. The maze card is placed in front of the subject with the starting arrow pointing to the subjects left. The subject has a ball-point pen or a sharp pencil.

Standard instructions are given (Gibson 1965) and the administrator starts the stop watch as soon as the subject begins. After 15 secs. and every subsequent 15 secs., the administrator says, in a sharp voice; " Go as quickly as you can! ... Quicker! ... You can go faster! " etc. to induce the subject to hurry, thus creating a time stress.

Scoring

TIME :- this is the time in seconds which the subject spends in tracing the maze.

ERROR :- cards are scored for errors thus;- every time the pencil touches but does not penetrate into the side of an object or the lines at the side, write a figure 'one' by the error. Every time the pencil line penetrates into an obstacle or the lines at the side, a figure 'two' is written by the error. If a pencil line remains in continuous contact with the printed line for some distance, score one point for every inch of contact and if the pencil line penetrates over a distance score two points for every inch of length. The points are then totalled.

<u>Validity of the Test</u>

In the earliest published study concerning the Spiral Maze, Gibson (1964) showed that among primary schools performance on the maze related to the degree of 'naughtiness' in school as rated by the class teacher. The results of this study are as follows:-

From a total of 100 children the class teacher was asked to classify the boys into the following categories;- Good boys, Average boys, Naughty boys.

Gibson classified the results of his test by zones on the plot of the time and error scores into - quick and accurate, quick and careless slow and accurate, slow and careless.

<u>Zones on the plot of Time and Error scores</u>

	<u>Qu. & Acc</u>	<u>Qu. & Careless</u>	<u>Slow & Acc.</u>	<u>Slow & Care/</u>	<u>total</u>
Good boys	29.5	24.6	32.8	13.1	100
Average boys	16.4	31.3	33.6	18.7	100
Naughty boys	10.2	40.7	25.4	23.7	100

It can be seen that the naughty boys predominate in the quick and careless zone and the good boys in the slow and accurate zone.

At a later stage, involving studies with factory girls, approved school girls, secondary school boys, junior boys in a remand home, boys in a senior approved school and maladjusted boys in primary and secondary schools, Gibson found that performance on the maze, and the Error Score in particular, discriminated significantly between these groups, postulating that performance on the maze demonstrates the tendency of the delinquent to sacrifice accuracy for speed. The worst group in this respect was the senior approved school boys, who, of course, the most serious delinquent tendencies.

The link between behaviour problems in schools and motor-impairment, as made by Stott, has already been quoted in this study. The use of this test in this study is twofold;- firstly to further examine the possibility of using this test as an initial screening test for motor-impairment and secondly to look closer at Gibsons suggestion that the delinquent will sacrifice accuracy for speed in this situation. With regards to the first point, Whiting et al. (1969) using various tests of motor-impairment or minimal brain-damage, found a high correlation between the errors scored on the Spiral Maze and other tests of impairment. They suggest that the Spiral Maze, being quick to administer and easy to score, might itself be an efficient screening device of motor-impairment, as they found that those classified as 'slow and careless' screened off a large percentage of those classified as impaired by other tests. This was further supported by Davies et al. (1969), when examining for motor-impairment using the Stott test with 62 junior approved school boys. Of the 16 regarded as being motor-impaired nine appeared in the 'slow and careless' quadrant of the Gibson Spiral Maze scatter plot, and a further two were borderline cases.

With regards to the second point, it would be interesting to note the effect, if any, on the Time and Error scores, that any improvement in motor ability brought about by the training programme, might have. If the large error scores is a result of motor-impairment and not delinquency then improvement in motor ability should be reflected in improved error scores.

CHAPTER VII

Analysis of Test Results

Raw scores for all tests by both groups can be found in Appendix IV.

The means and standard deviations for all tests were calculated and are shown in Tables 1 - 4.

Table 1 shows the experimental group to have a higher score on the Stott test (mean = 7.09) than shown by Davies et al. (1969), but lower than the 7.72 mean score for the 13 - 14 year old boys within their sample.

Examining the raw scores on the Stott test for this group, and using the previously mentioned cut-off point of a score of 10 or over, or a failure in any one sub-test at two years below his own level, 12 of the experimental group were in the 'motor-impaired' category. This represents 37% of this particular group as compared with 27% in the group studied by Davies et al. (1969). Thus the incidence of motor-impairment, as well as the general test scores, are markedly high. This gives some support to the results obtained by Bamber (1966) and Davies et al. (1969) previously reported.

The Stott results within this group contained only four scores of 2 and none below this. Although this is a test of motor-impairment and not motor ability, since it consists of perceptual-motor tests, the low performance on these test might suggest a rather low level of motor ability within this group.

The scoring for the Draw-a-Man test has already been discussed. Throughout all groups the scores for this test were higher than average denoting a general low level of sophistication of body image, most pronounced in the pre-training experimental group.

With regards to the Memory for Designs test, relating to brain-damage, the mean score shown in table 1 is 2.59 compared with 2.14 shown by Davies et al. (1969). Examination of the raw scores reveals only six subjects in the 'borderline' group and none in the 'critical' group. This would underline the suggestion previously put that motor-impairment within this population is due to factors other than brain-damage mainly.

Table 1.

Mean scores for the Experimental Group, first test.

	N.	Range	Mean	S.D.
Age	32	132–182	162.200	9.255
Stott Test	"	2–16	7.093	4.336
Draw a Man	"	4–9	7.4375	1.366
Memory for Design	"	0–11	2.594	2.906
W.I.S.C. Perf.	"	67–128	101.031	14.621
Gibson S.M. Time	"	28–60	42.310	7.739
Error	"	2–36	13.531	7.915

Table 2.

Mean scores for Control Group, first test.

	N.	Range	Mean	S.D.
Age	30	157–167	161.200	3.600
Stott Test	"	0–12	3.870	3.040
Draw a Man	"	1–9	6.207	2.145
Memory for Design	"	0–12	2.0	2.407
W.I.S.C. Perf.	"	80–129	101.333	10.826
Gibson S.M. Time	"	33–58	42.633	6.505
Error	"	0–32	10.933	7.320

Table 3.

Mean scores for Experimental Group, second test.

	N.	Range	Mean	S.D.
Stott Test	32	0–9	3.468	2.590
Draw a Man	"	2–9	6.531	1.586
Memory for Design	"	0–9	1.750	2.342
W.I.S.C. Perf.	"	78–131	105.906	13.913
Gibson S.M. Time	"	24–65	41.344	8.979
Error	"	0–25	10.406	5.994

Table 4.

Mean scores for Control Group, second test.

	N.	Range	Mean	S.D.
Stott Test	30	0–12	3.700	3.260
Draw a Man	"	1–9	5.766	1.888
Memory for Design	"	0–7	1.433	1.832
W.I.S.C. Perf.	"	83–133	104.033	10.67
Gibson S.M. Time	"	30–61	39.500	7.037
Errors	"	1–25	11.567	6.506

't' Tests

In order to examine the difference between the means of the groups, 't' tests were carried out between the experimental and control group, and pre- and post training. These are reported in Tables 5–8.

Table 5.

't' tests between the Experimental and Control groups:- FIRST tests.

Test	Group	Mean	S.D.	't'
Stott	Exp.	7.09	4.336	3.369***
	Cont.	3.87	3.04	
Draw a Man	Exp.	7.44	1.37	2.591**
	Cont.	6.27	2.13	
Mem. for Des.	Exp.	2.59	2.91	0.873
	Cont.	2.00	2.41	
W.I.S.C. Perf.	Exp.	101.03	14.62	0.091
	Cont.	101.33	10.83	
Gibson S.M. Time	Exp.	42.81	7.74	0.098
	Cont.	42.63	6.50	
Error	Exp.	13.53	7.91	1.339*
	Cont.	10.93	7.32	

* P<.2   ** P<.01   *** P<.005

Table 6.

't' tests between the FIRST tests and the SECOND tests of the Experimental group.

Test	Group	Mean	S.D.	't'
Stott	1st. Test	7.09	4.36	4.06****
	2nd. Test	3.47	2.59	
Draw a Man	1st. Test	7.44	1.37	2.449***
	2nd. Test	6.53	1.59	
Mem. for Des.	1st. Test	2.59	2.91	1.279
	2nd. Test	1.75	2.34	
W.I.S.C.Perf.	1st. Test	101.03	14.62	1.366*
	2nd. Test	105.91	13.91	
Gibson S.M. Time	1st.Test	42.81	7.74	0.701
	2nd. Test	41.34	8.98	
Error	1st. Test	13.53	7.91	1.781**
	2nd. Test	10.41	5.99	

* P< .20   *** P< .02
** P< .10   **** P< .001

Table 7.

't' tests between the FIRST tests and the SECOND tests of the Control group.

Test	Group	Mean	S.D.	't'
Stott	1st. Test	3.87	3.01	0.203
	2nd. Test	3.70	3.26	
Draw a Man	1st. Test	6.27	2.13	0.962
	2nd. Test	5.77	1.89	
Mem. for Des.	1st. Test	2.00	2.41	1.026
	2nd. Test	1.43	1.83	
W.I.S.C.Perf.	1st.Test	101.33	10.83	0.973
	2nd. Test	104.03	10.67	
Gibson S.M. Time	1st. Test	42.63	6.50	1.724*
	2nd. Test	39.50	7.04	
Error	1st. Test	10.93	7.32	0.354
	2nd. Test	11.57	6.51	

* P< .10

Table 8.

't' tests between the Experimental and Control groups:- SECOND tests.

Test	Group	Mean	S.D.	't'
Stott	Exp.	3.47	2.59	0.311
	Cont.	3.70	3.26	
Draw a Man	Exp.	6.53	1.59	1.731*
	Cont.	5.77	1.89	
Mem. for Des.	Exp.	1.75	2.34	0.590
	Cont.	1.43	1.82	
W.I.S.C. Perf.	Exp.	105.91	13.91	0.592
	Cont.	104.03	10.67	
Gibson S.M. Time	Exp.	41.34	8.98	0.873
	Cont.	39.50	7.53	
Error	Exp.	10.41	5.99	0.731
	Cont.	11.57	6.51	

* P< .10

Age

A 't' test between the means of the ages of the two groups produced a non-significant 't' value of 0.545.

With regard to Tables 5-8, the following points would appear relevant:-

Table 5

1. Quite a significant difference (p<.005) is shown between the two groups, before training, on the Stott test. This supports the general theory of a high incidence of motor impairment in the approved school population.

2. Although both groups show rather poor ability on the Draw a Man test, the approved school group were significantly worse.

3. As there is no difference between the scores on the Memory for Design test, this would suggest that the low motor ability and impairment in the approved school population is due, in the main, to factors other than brain-damage.

4. Similarities in the W.I.S.C. Performance scores would suggest that the subjective attempts to match the two groups for I.Q. were successful. A strong recommendation here, however, is that I feel it would have been more beneficial to have completed the full W.I.S.C. tests.

5. The significant difference in the error scores in the Gibson Spiral maze would appear to support Gibson's theory that the delinquent will sacrifice accuracy for speed in this type of test. As there is no difference in the speed scores, however, this would lend support to my suggestion that there is no such 'sacrifice' but that the lack of accuracy is due to motor inability.

<u>Table 6</u>

1. A very significant improvement is shown (P<.001) in the Stott test. This is the subject of further analysis and discussion later in this section.

2. The significant improvement in the Draw-a-Man test (P<.02) would support the theory that improvement in motor ability will result in an improvement in sophistication of body concept.

3. The slight improvement in the Memory for Designs test, which is not significant, (and which is also shown by the control group - see table 7), may be due to test familiarity.

4. The W.I.S.C. Performance scores show a significant improvement (P<.20) and this related to the scores on the Stott Test and the non-significant improvement by the Control group, might suggest that with regards to the Performance sub-tests at least, this improvement was brought about by an improvement in motor ability. Again, more significant information would have been gained by using the full W.I.S.C. test.

5. The time scores on the Gibson Spiral Maze test are very little altered. The error scores, however, are significantly lower (P<.10). This would further strengthen my earlier suggestion that high error scores on this particular test by delinquents are due more to the lack of motor ability than delinquency (though the two may be related), and I would restate that I feel Gibson (1965) is incorrect in suggesting that:-

"...performance on the Maze demonstrates the delinquent tendency to sacrifice accuracy for speed."

The delinquent does not have the ability to perform accurately, therefore, there is no sacrifice.

Table 7

1. As expected, there is little change in the Stott test scores. These were quite low to start with and, therefore, were not expected to change much. The scores suggest that there is little effect of test familiarity.

2. No significant difference is shown in the scores of the Draw-a-Man test, Memory for Design test or the W.I.S.C. Performance tests. This was to be expected and shows little effects of test familiarity.

3. With regards to the Spiral Maze test scores, the errors are similar but what improvement there is is shown in the time scores ($P < .10$). This is the opposite effect to the experimental group (see Table 6).

Table 8

1. There is now no significant difference between the groups on the Stott test, in fact the experimental group has slightly lower scores than the control group. On the face of it, this would appear to be a strong claim for this type of physical education programme for motor-impaired children and children with low motor ability. This, however, is the basis for further analysis and discussion later.

2. Although there is a narrowing of the difference between the groups on the Draw-a-Man test, the control group remain significantly better.

3. The only other significant change is seen in the error scores of the Spiral Maze test. This has already been mentioned and is the subject of further analysis.

Correlation Matrix.

Tables 9 - 12 show the correlation matrices for the two groups first and second tests and are based on the raw scores. With regards to these tables, the following points appear to be relevant:-

1. There is no significant correlation between the Stott test

and the Draw-a-Man test. This is particularly noticeable in the experimental group where what correlation there is is negative. This is surprising in view of the suggested relationship between motor ability and sophistication of body concept, already put forward. Although the experimental group appeared 'poor' in both these areas, the tests used would seem to measure different abilities.

The control group maintained constant correlation coefficients of 0.29 and 0.27 for the first and second tests respectively.

2. As would be expected, there is inter-correlation between the Memory for Designs (brain-damage), Draw-a-Man (body awareness) and W.I.S.C.Performance (intelligence) tests. The first two have drawing as a common ability, there is the obvious link between brain-damage and intelligence and the Draw-a-Man test was originally designed as a test of intelligence.

The weakest correlations within these tests are found in the experimental groups first test. This may suggest that this group is under-attaining in some areas.

3. With regards to the correlations between the Gibson Spiral Maze time and error scores and the Stott test, there appears to be a reversal. The experimental groups first test tends to show a positive correlation between the Stott test and the ERRORS on the G.S.M. (subjects with poor motor ability make errors on the G.S.M.). On the retest, however, the errors show little correlation with the Stott test, but those who perform quickest on the G.S.M. tend to score highest on the Stott test.

The control group shows similar trends on the first test, but on the retest, the slowest on the G.S.M. tend to score highest on the Stott test.

Table 9.

Correlation Matrix:- Experimental group- FIRST test.

	Stott	Draw a Man	Memory for Des	W.I.S.C. Perf.	G.S.M. Time	G.S.M. Error
Stott						
Draw a Man	-0.18					
Mem. for Des.	0.10	0.37*				
W.I.S.C. Perf.	-0.19	-0.11	0.43**			
G.S.M. Time	-0.04	0.26	0.40*	-0.22		
G.S.M. Error	0.54***	-0.07	0.04	-0.03	-0.43**	

* P< .05   ** P< .02   *** P< .01

Table 10.

Correlation Matrix:- Experimental group- Second test.

	Stott	Draw a Man	Memory for Des.	W.I.S.C. Perf.	G.S.M. Time	G.S.M. Error
Stott						
Draw a Man	-0.03					
Mem. for Des.	0.23	0.48***				
W.I.S.C. Perf.	-0.30*	-0.36**	-0.60***			
G.S.M. Time	-0.23	0.32*	0.59***	-0.24		
G.S.M. Error	0.17	-0.23	-0.19	0.03	-0.60***	

* P< .10   ** P< .05   *** P< .01

Table 11.

Correlation Matrix:- Control group-
FIRST test.

	Stott	Draw a Man	Memory for Des.	W.I.S.C. Perf	G.S.M. Time	G.S.M. Error
Stott						
Draw a Man	0.29					
Mem. for Des.	0.23	0.34*				
WISC Perf.	-0.38**	-0.65***	-0.48***			
G.S.M. Time	0.13	0.01	-0.16	-0.10		
G.S.M. Errors	0.35*	0.17	0.31*	-0.24	-0.14	

* P< .10 ** P< .05 *** P< .01

Table 12.

Correlation Matrix:- Control group-
SECOND test.

	Stott	Draw a Man	Memory for Des.	W.I.S.C. Perf.	G.S.M. Time	G.S.M. Error
Stott						
Draw a Man	0.27					
Mem. for Des.	0.43***	0.39**				
WISC Perf.	-0.41**	-0.57****	-0.53****			
G.S.M. Time	0.33*	0.05	-0.04	-0.13		
G.S.M. Error	0.18	0.10	0.23	-0.13	-0.49****	

* P<.10 ** P< .05 *** P< .02 **** P< .01

Stott Test of Motor Impairment

In view of the results of the 't' tests on this test, the scores were subjected to an analysis of variance.

Table 13.

Analysis of Variance.

Two factor fixed-effects ANNOVA for unequal numbers.

Source	df.	MS.	F.	p.
Between groups- Exp. & Control.	1	69.75	6.04	$p < .025$
Between tests- 1st. & 2nd.	1	117.88	10.35	$p < .01$
Interaction	1	92.16	8.09	$p < .01$
Residual	120	11.39		

Table 13 shows the results of the analysis of variance. These results themselves suggest a weakness in the experimental design. The significance of the 'interaction' is likely to be due to the large improvement shown by the experimental group between their first and second attempts at the Stott test. The suggestion is that a control group should have been chosen to match the experimental group on the Stott test first attempt. This would have given more meaning to the results of the second attempt at this test. (see later discussion).

This does, however, show that there is a significant difference between the groups on the first test and there is a significant improvement made by the experimental group between the tests. That this improvement was due to the programme of physical education administered to the group would have been supported if a control group had been selected from the same, or a similar approved school as the experimental group.

<u>Gibson Spiral Maze</u>

In order to examine the changes in the time and error scores on the Gibson Spiral Maze, and to further examine its use as a quick and easy to administer 'screening' test for motor-impairment, scatter plots were established according to Gibson (1964). These were computed by using percentile scores and the four quadrants were produced by fitting regression lines.

Table 24 shows the plot combining the scores of the experimental and control groups, first attempts, computing their percentiles as one group and plotting accordingly.

Of the total of 13 children deemed motor-impaired according to the Stott test, 8 appear in the 'slow and careless' quadrant, 3 in the quick'and careless', and one in each of the other two areas.

Table 25 shows the relative screening efficiency of the four quadrants in relation to the results of the Stott test and the Memory for Design test (brain-damage). As well as noting the high number of motor-impaired subjects screened off by the careless quadrants, the high mean scores for the Stott test are significant.

Using the same procedure, Table 26 shows the plot of the experimental and control groups retests on the G.S.M., and Table 27, the general movement trend of each group between the first and second test.

Further comments on the efficiency of the G.S.M.as an initial screening device for motor-impairment will be made later in the discussion but two points can be made here:-

1. Compared to the Stott Test of Motor-impairment (which takes an average of 35 - 45 minutes to administer), there is no doubt this is a quick and easy to administer test, and even with a population containing a large number of motor-impaired subjects the majority of these appear in the 'careless' quadrants particularly the 'slow and careless'.

2. As the percentiles and regression lines are calculated according to the group under examination, the tendency for the motor-impaired subjects to appear in the 'slow and careless' quadrant is likely to be even more significant when examining more 'normal' populations.

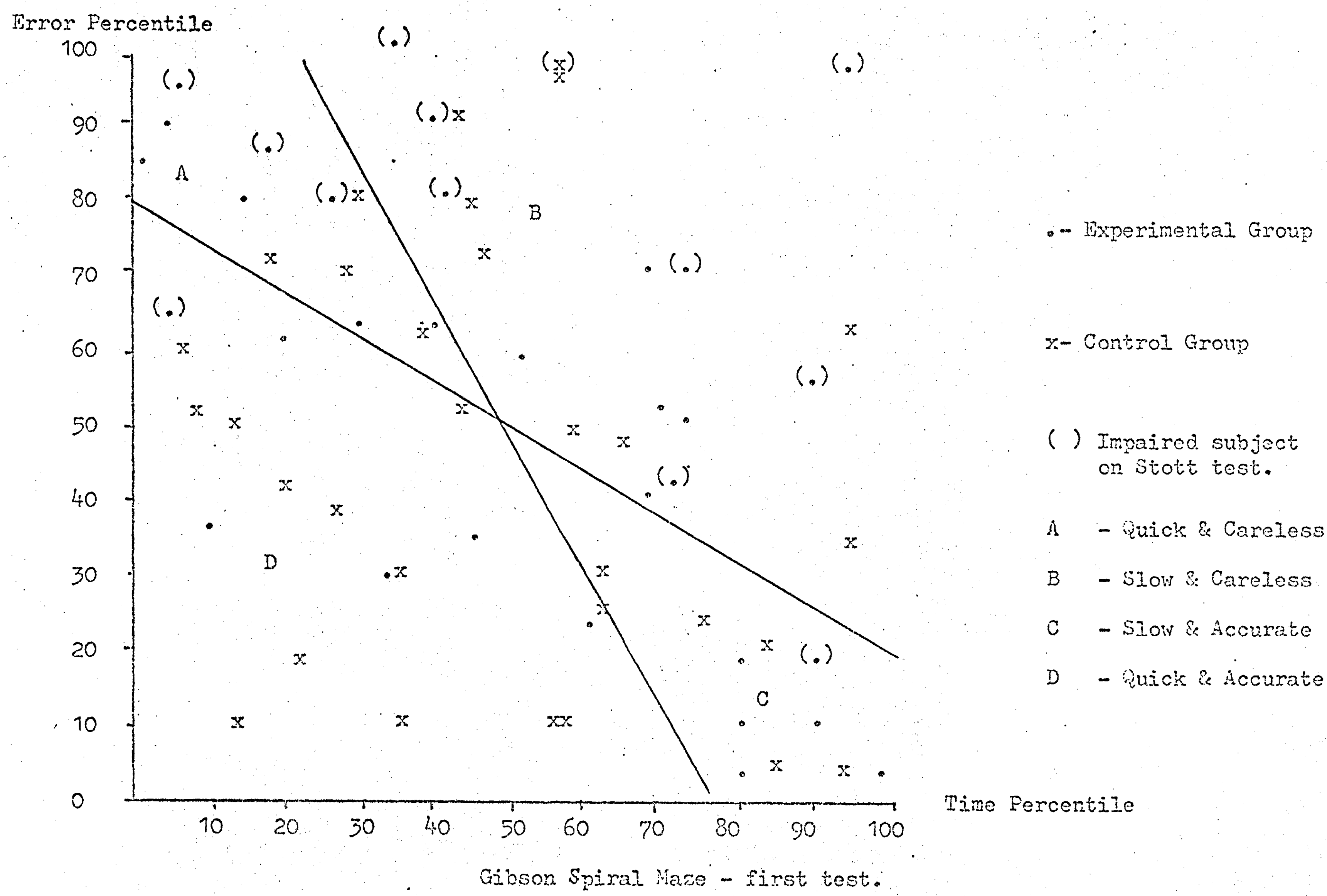
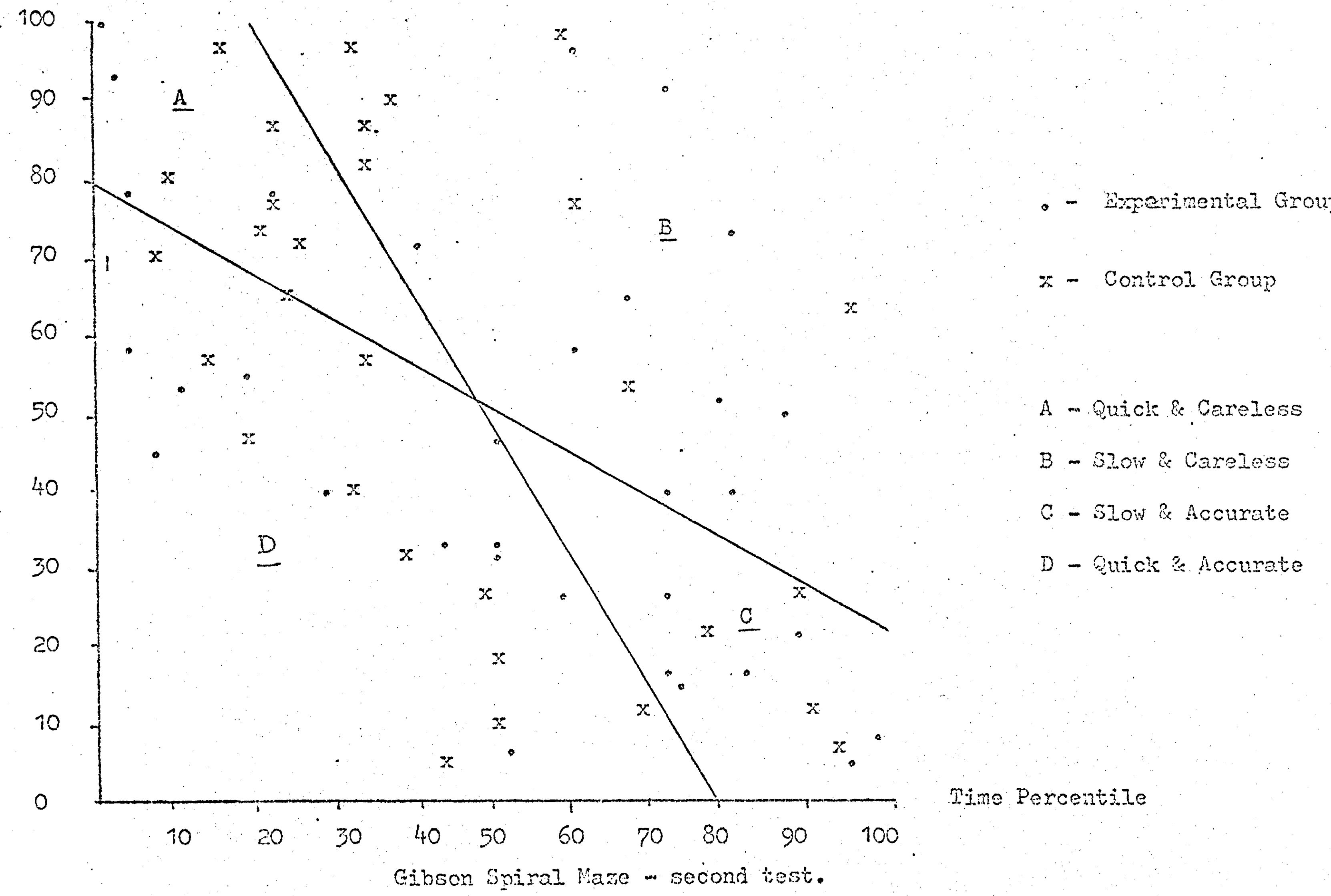

Error Percentile
100
90
80
70
60
50
40
30
20
10
0
A
B
C
D
10
20
30
40
50
60
70
80
90
100
Time Percentile
Gibson Spiral Maze - first test.
• - Experimental Group
x - Control Group
( ) Impaired subject on Stott test.
A - Quick & Careless
B - Slow & Careless
C - Slow & Accurate
D - Quick & Accurate

Table 15.

Screening efficiency of the Gibson Spiral Maze with regards to motor impairment and motor ability measured by the Stott test, and brain damage as measured by the Memory for Designs test as critical or borderline. This Table relates to the first tests as plotted in Table 14.

Quadrant	Spiral Maze	Stott Test		M.F.D
		Impaired.	Mean score	
Slow and Careless	21	8	7.3	3
Quick and careless	11	3	6.4	2
Quick and accurate	19	1	3.8	1
Slow and accurate	11	1	5.0	3
Total	62	13		9
		Mean	5.53	



100
90
80
70
60
50
40
30
20
10
0
A
B
C
D
10
20
30
40
50
60
70
80
90
100
Time Percentile
Gibson Spiral Maze - second test.
. - Experimental Group
x - Control Group
A - Quick & Careless
B - Slow & Careless
C - Slow & Accurate
D - Quick & Accurate

Table 17.

Gibson Spiral Maze quadrant placings of experimental and control groups on the first and second tests.

Quadrant	Experimental		Control	
	1st. Test	2nd. Test	1st. Test	2nd. Test
Slow and careless	37%(12)	32%(10)	30%(9)	27%(8)
Quick and careless	25%(8)	12%(4)	10%(3)	20%(6)
Quick and accurate	19%(6)	34%(11)	43%(13)	40%(12)
Slow and accurate	19%(6)	22%(7)	17%(5)	13%(4)
Percentage in 'careless' zones	62%	44%	40%	47%

Discussion

Incidence of Motor-impairment

The incidence of motor-impairment found in this group of junior approved school boys was 37% (12/32). This can be compared with the findings of other studies using the Stott test with other populations, and adopting a similar criteria for failure. Davies et al. (1969), also examining junior approved school boys (mean age = 153 months) found 27% (16/60) to be motor-impaired. Whiting et al. (1969a and 1969b) in a sample of 4 to 16 year old children attending a paediatric out-patients clinic, found 4.7% to be motor-impaired, and in a sample of 50 'normal' ten year old primary school children (I.Q. mean = 100.54) found 10% impaired. Whiting et al. (1969) found 34% (17/50) of E.S.N. children (I.Q. mean = 60.74) motor-impaired and Dyton et al. (1969) used a selected group of 50, eight year old primary school children already designated as 'clumsy' by their class teachers, and showed a 26% incidence of motor-impairment.

The mean score on the Stott test (first attempt) for this approved school sample was 7.09 and this compares with the overall mean score of 5.98 by Davies et al. and with the score of 7.72 for the 13 - 14 year olds within that sample. It also compares with the mean score of 6.04 by Dyton et al.

Thus the incidence of motor-impairment shown by the experimental groups first tests in this study is quite high and the high mean score on the Stott test suggests a low general level of motor ability. Even when compared with 'normal' children already designated as clumsy this incidence is high, and together with the findings of Davies et al. (1969) and Dunbar (1966) suggests that there is a general low level of motor ability among approved school boys.

Causes of Motor-impairment

Within this population and relating to the tests administered, there is little evidence to support the theory that motor-impairment is due mainly to the effects of minimal brain-damage. The results of the experimental groups first attempt at the Memory for Designs test revealed no subject in the 'critical' area and only six in the 'borderline' group. This further supports the findings of Davies et al. (1969) and gives weight to the suggestion made earlier that motor-impairment in this population is due not only to brain-damage but in most cases to the adverse environmental conditions to which the approved school boy has been subjected in earlier life.

Examination of the records of the approved school boy may reveal many abnormalities of their environment. Too often one can note one or a number of the following adverse factors:-

Large families (in which the parents are unable to cope)
Impoverished home environment
Delinquent sub-cultures, delinquent parents
Separation, divorce, co-habitation, step-parents
Maternal or paternal deprivation
Psychotic parents
Physically handicapped parent
Violence and cruelty in the home
Rejection
Institutionalisation
Illegitimacy
Over-indulgence
Undernourishment
Lack of discipline
Emotional deprivation

In many cases the young delinquent often exhibits one or more of the following:-

Neural somatic dysfunction (including speech, hearing and sight defects)
Enuresis
Slight deformities (of fingers ears etc.)
Previous serious illness

which would enhance the theory of pregnancy multiple impairment put forward by Stott and discussed earlier in the introduction. This would also support the theory of multiple causality of motor-impairment as opposed to minimal brain-damage.

It would appear, therefore, that deprivation, as discussed earlier, could affect the motor development of these children and that the rejection brought about by constant failure at motor tasks and the withdrawal which might follow, would magnify and accelerate the problem. As the child constantly fails he will eventually 'opt out' and so increase his inability. According to Denen (1967) and Rosenzweig et al. (1967) this would affect the C.N.S. Rosenzweig's suggestion is that, with lower animals at least, this effect is temporary and that an enrichment of the environment in the future will lead to a 'catching-up' phase.

Validation and Reliability of the Stott Test of Motor-impairment

As the Stott test is a recent development and validity and reliability limited, it is interesting to make some comments on this in the light of this study. The question of the validity of the test has already been raised by Whiting et al. (1969, 1969a and 1969b). Arising from these one of the problems seems to be that these studies have tended or attempted to equate motor impairment with some other specific impairment, e.g. brain-damage, teacher assessment of 'clumsiness', etc. using this as a criterion of validation, and so not very favourable results have been obtained. This may be linked with one of the other problems namely the establishment of a meaningful and reliable 'cut-off' point to establish who is 'normal' and who is 'impaired'. This has also been raised by Whiting. Although the cut-off point has been used in this study, it has been more concerned with raw scores of the test.

As yet it would seem that nothing has been done about a test retest reliability investigation on the Stott test and perhaps this should be done with a standard two week gap between tests. Using the scores obtained by the control group, the correlation coefficient between the first and second attempts (separated by 6½ – 7 months) was 0.86.

Programme of Compensatory Physical Education

Table 5 shows that the attempts to match the two groups for age and I.Q. (bearing in mind the suggestion that full W.I.S.C. scores should have been obtained), was quite successful.

The stability of the control groups first and second tests (shown in Table 8) support the reliability of the testing procedure, and largely eliminate the effects of test familiarity.

The significant changes shown in the results of the experimental group may well be due to the movement training programme to which they were subjected but other factors must be mentioned. For many of these boys, their stay in the approved school was their first real taste of consistent education. Many had been constant school refusers and I had the impression that many others who attended school would have taken little advantage of what had been offered. The fact that here, they had to attend school and were in sufficiently small groups to gain attention from the teacher could, in itself, have affected the retest results. The 'home' afforded by the approved school, was to some, the first stable environment they had experienced and this too may have nurtured developments within the boys which caused some of the improvement. The very fact that they were in attendance in the approved school is an important one.

This, together with the results of the analysis of variance shown in table 13, would level criticism at this research design, particularly with regards to the selection of the control group. Although the control group selected for this study did illustrate various differences and similarities between the groups and supported the reliability of the testing procedure, it would have been more significant to have selected a control matched for initial scores on the Stott test, either from the same approved school or from a similar establishment. It should be mentioned, however, that it was, in fact, impossible to select a control group from the same school due to the lack of sufficient subjects to produce reliable results from two groups. The selection of a control group from another approved school, although not being impossible, would have been very difficult to organise within the time available.

Against this criticism of the selection of a control group, and the suggestion that attendance at this type of school would in itself produce improvement, Davies et al. (1969) suggested the reverse. Within the three age groups they examined, the older boys (13 - 14 year olds) who had been in attendance at the school longest (some up to 18 months) had significantly higher scores on the Stott test than the younger boys. This suggests that attendance at this type of institution produced a deterioration in motor ability and that the stable environment, in itself, was not sufficient to produce improved motor ability. It is clear that any future work in this area will require carefully selected controls.

What this research design did show was that in comparing the approved school group with the initial tests of the control group:-

1. The approved school group had a lower level of motor ability.
2. The approved school group had a lower level of body awareness or sophistication of body concept.
3. The relation ship between I.Q. and motor ability is not very clear. The initial results fail to relate the two, however, the retests show improvement in both by the experimental group and neither by the control group.
4. That brain-damage is not significantly more prevalent in the approved school population.

By comparing the approved school groups results before and after training:-

1. There is a significant improvement in motor ability
2. There is a significant improvement in body awareness.
3. There is a significant improvement in the Performance section of the W.I.S.C. test
4. There is a significant reduction in the errors made on the Gibson Spiral Maze (suggesting an improvement in motor ability?).

I would suggest that the improvement shown (in 1, 2, and 4) is due to some extent at least, (bearing in mind the previous criticism) to the designed programme of movement training administered over a period of seven months.

In the design of a teaching programme, it is always difficult to isolate the effects of the personality of the teacher. This programme is no exception. Although attempts have been made to catalogue this programme and present it in a way that the majority of teachers of physical education could easily cope with, the effect which the individual teacher will have should not be overlooked. Any method of presentation is as good as the teacher presenting it.

This programme is based on pupil participation - pupil success - and further participation. Although this was carried out in an approved school, I would suggest that with only minor modifications it could be equally well used in a 'normal' school setting. If, as has been suggested, technological advances in everyday areas will tend to increase the number of clumsy children as well as enable them to successfully conceal their clumsiness, the use of this kind of programme would benefit many children in their normal school programme.

The results of this research are at least encouraging enough to suggest that it would benefit most of the boys in approved schools and also to promote further interest and work in this area. I would also suggest that the earlier this approach is adopted the more successful it will be in improving motor ability. As this type of programme is largely a matter of making up for experiences that have been missed previously, the later it is left the more difficult it will be to show success.

Another point of interest worthy of mention here is what effect, if any, this improvement in motor ability has on social behaviour and the personality of the approved school boys. Having linked motor ability and behaviour problems etc. in the earlier chapters, it would be interesting to see if the improvement in motor ability had any beneficial effects on the future behaviour of the young delinquent. This would require a carefully controlled longitudinal study.

<u>The Gibson Spiral Maze as a Screening Test for Motor-impairment</u>

In the search for an easy, efficient and quick-to-administer screening test for motor-impairment, Whiting et al. (1969a) have suggested that those subjects falling in the 'slow and careless' quadrant of the G.S.M. scatter plot are the subjects for further examination. This test is quick to administer (less than two minutes per subject) and easy to score. The difficulty is that the scatter plots and quadrants are formulated according to the population being examined, and therefore biased populations will produce biased scatter plots and quadrants. This could be overcome by further research and the establishment of reliable norms.

Table 16 shows that of the 13 subjects classed as motor-impaired on the first attempt at the Stott test, 8 fall into the 'slow and careless' quadrant, another 3 in the ' quick and careless' area, and one in each of the other two areas. This would support the suggestion that the 'careless' sectors and particularly the 'slow and careless' sector contain most of the motor-impaired subjects. The mean Stott scores for the four quadrants are shown in Table 15 and further support this. The reduction in the errors made by the approved school group after the training period coincides with improvement in motor ability and could well be a result of this improved motor ability. The shift of the approved school group from the careless sectors to the accurate sectors is shown in fact, in Tables 16 and 17.

These scatter plots are based on the percentile scores of the approved school group and the control group combined. I would suggest that within a more 'normal' population, the tendency for any motor-impaired subjects to appear in the 'slow and careless' quadrant would be even greater, accepting that the incidence of motor-impairment would be less.

The following table shows the relative screening efficiency using firstly the 'slow and careless' quadrant and then the two 'careless' quadrants, in four different studies, and also the number of impaired children who have been 'missed' by this screening criteria.

	SLOW AND CARELESS			CARELESS		
	Impaired	Non-Impaired	Impaired Missed	Impaired	Non-Impaired	Impaired Missed
Present study	8	13	5	11	22	2
* Davies et al. 1969.	9	10	7	12	21	4
** Davies et al. 1969.	6	4	1	7	7	0
Lyton et al. 1969.	7	7	6	10	16	3

* Using approved school boys

** Using 'maladjusted' boys

Summary

The results of this study do much to support the theory that motor-impairment in the approved school population is independent of pre- or para-natal brain damage. It suggests that the main cause of poor motor ability is, in this instance, adverse environmental conditions which lead to various forms of deprivation. It further suggests that these results of deprivation are not necessarily permanent and that a well designed programme of movement training to 'enrich' movement experiences, based on the principles of sound education, can do much to alleviate this impairment.

APPENDIX 1

LESSON NOTES

Apparatus lay-outs as per diagrams in Appendix 11. Figure numbers refer to figures in that Appendix.

Times shown were the planned times and are generally fair representation of the time spent on that activity.

Introduction

Free running - noisily, heavily, lightly, quietly
Encourage quiet running - finding spaces 3 mins.

Class Activities

Four groups, mats as in fig 1.

a) Running, keeping off mats
b) Running, jumping over mats - emphasise height of jump.
c) Demonstrate forward roll - formal practice.
d) Develop backward rolls - informal practice.
e) Linking of forward and backward rolls. 12 mins.

Group Activities

Four groups as above. Explain apparatus positions as Fig. 2. Supervise movement of apparatus.

a) Free practice on own apparatus.
b) One movement of groups clockwise - free practice. Encourage variety of movement.
c) Free practice on any apparatus:
   No queuing
   No interrupting any other boy's work

Apparatus away. 17 mins.

Conclusion

Game: explain game 'sitting doge ball'
2 games 3 mins.

LESSON 2

Introduction

Free running into space - lightly - keep away from others - use change of direction to find space. 2 mins.

Class Activities

Mats as fig. 1.

a) Demonstrate a handstand - free practice.

stretching.

c) Free practice of rolling movements.

d) Weight-on-hands (stretched) to roll (two part sequence) 14 mins.

Groupwork

Groups as lesson 1: apparatus as fig. 2.

a) Free practice on own apparatus when out correctly - variety of movements - children demonstrating.

b) Two further moves anti-clockwise - free practice

c)

d) 4 mins. free practice on any apparatus. 15 mins.

Conclusion

Two games of 'sitting dodge ball' 2 mins.

LESSON 3

Introduction

a) Game - 'sitting dodge ball'.

b) Free running into spaces, changing directions and speeds. 5 mins.

Class Activities

a) Practice of 'weight-on-hands' - stretching

b) In 3's - 'Leap-frog' - demonstrate - practice - high-backs - stretched vault - good landings.

c) Mats as fig. 1. Leap frog and forward roll (a stretched and curled sequence).

d) Leap frog + 2 varied movements. 10 mins.

Group Activities

Apparatus as fig. 2, free practice on own apparatus when ready.

a) Develop a 2 or 3 movement sequence on own apparatus.

b) As above, but on any apparatus - boys demonstrating to show good quality or continuity.

Apparatus away. 20 mins.

Introduction

Mats as fig. 1. 3 part sequence practice - leap frog + 2 movements - higher backs - suit landing for next movement. 10 mins.

Class Activities

a) Cartwheels - demonstrate - practice vary take-off, landing, speed, etc.
b) Benches as fig. 1 - use benches and vary type of cartwheel. 6 mins.

Group Activities

Apparatus as fig. 2.

a) Free practice of 2 or 3 movement sequences - quality, variety, and degree of difficulty. Use any of the apparatus.
b) Task: movement on to apparatus - jump - shape in air and good landing. Vary apparatus used. 19 mins.

LESSON 5

Introduction

Benches and mats as fig. 1.
Show a variety of cartwheels + 2nd. movements. 5 mins.

Class Activities

Free running - use of benches as take-off platforms - high jumps - stretch - show shapes in the air - stretch shapes, narrow shapes, wide shapes, etc. Concentrate on shape being made and quality of landing.
Add a 2nd. movement to this - position your landing for this second movement. 7 mins.

Group Activities

Apparatus as fig. 2.

a) Using own apparatus - movements on to apparatus - jumps off - use shapes in air and good landings.

b)
c) } 3 moves anti-clockwise.
d)

in development of sequence. 22 mins.

LESSON 6

Introduction

a) Explain 'sitting dodge ball' as played with two balls. Two games. 4 mins.

b) Floor work - free practice of any movements, linking movements where possible. 4 mins.

Class Activities

Balance positions - what is a balance position? - how can it be made more difficult? - use of different parts of body for balance.
Combine 'balances' with movements 'taking feet higher than head' - develop 3-5 part sequence - practice. 8 mins.

Group Activities

Apparatus as fig. 2.

a) Free practice using any apparatus.

b) Practice different ways of getting onto and off from apparatus.

c) Find movements in which legs go higher than head.

d) Put these movements into sequences. 19 mins.

LESSON 7

Introduction

Two games of 'sitting dodge ball'. 4 mins.

Class Activities

Sequence work - on the floor: Task include a balance, roll, weight on hands and jump and landing. Demonstrations. 8 mins.

Group Activities

Apparatus as fig. 2.

a) Free practice

area to work in and stay there until sequence is perfected. 18 mins.

Conclusion

Hand-stand - direct teaching and coaching. 5 mins.

LESSON 8

Introduction

Handstand practice - hand walking.
Combine handstand and forward roll.
Find different ways to approach and descend from handstands. 8 mins.

Class Activities

Partner work: dive rolls over partner - partner co-operation, e.g. leap frog.
Methods of supporting partners weight.
Partner sequences either:
 simultaneous movements
 or successive movements 10 mins.
Teach various partner activities and encourage boys to find their own and put into sequences. 15 mins

Conclusion

Game - 'sitting dodge ball' 2 mins.

LESSON 9

Introduction

Free running - to weight on hands activities - to running. Develop continuity. 5 mins.

Class Activities

Free practice of partner activities - end with demonstrations of partner sequence work. 10 mins.

Apparatus as fig. 2.
Select an area in which to work and develop a sequence with partner in that area - simultaneous or successive movements or partner co-operation. 16 mins.

Conclusion

'Sitting dodge ball' - two games 4 mins.

Lesson 10

Introduction

Benches and mats as fig. 1.
Cartwheel practice - introducing 'running cartwheels' and adding further movements. 8 mins.

Group work

Apparatus as fig. 2.
Last chance to use the apparatus in this set-up for a while, therefore free practice of sequence work with unrestricted movement between apparatus.
Regular use of demonstration by boys to show good points and explain various aspects, e.g. variety, continuity, degree of difficulty, etc. 25 mins.

Conclusion

Game - 'sitting dodge ball'. 2 mins.

LESSON 11

Introduction

a) Free running for quality - lightness and good use of space.
b) Mats only: free practice of agilities using floor and/or mats - individual coaching. 11 mins.

Group Activities

New apparatus arrangement. Explain apparatus set-up as fig. 3 and supervise moving of apparatus.

b) One change anti-clockwise and repeat (a) 20 mins.

Conclusion

Free practice on any apparatus. 4 mins.

LESSON 12

Introduction

Free running - jumps and landings - concentrate on full control during take-off and landing. 4 mins.

Class Activity

Use wallbars - jumps - for height and lightness. Add shape in air. Vary shapes made. Make landing to suit the jump and shape made.
Add a second movement after landing. Make a sequence to include: jump, shape in air, landing, roll, weight on hands. 10 mins.

Group Activities

Apparatus as fig. 3.
Make two changes clockwise.
Allow free practice - encouraging full use of apparatus and variety of movements. 20 mins.

Conclusion

One game of 'sitting dodge ball' 2 mins.

LESSON 13

Class Activities

Apparatus as fig. 3.

a) Find a piece of apparatus where you can show a position or movement with feet higher than your head. Practice one movement at one place.
Find a different piece of apparatus and a different movement (change each 2-3 minutes) develop work on

b) Show a balance on a piece of apparatus: differentiate between a balance and a hanging position Practice hanging from different parts of the body, showing different shapes, etc. 6 mins.

Group Activities

Apparatus as fig. 3.

a) On own apparatus develop a sequence involving all or as many as possible, pieces of apparatus within your group.

b) One change anti-clockwise and repeat task. 19 mins.

LESSON 14

Introduction

Climbing frame only out.

Find different ways of getting up and down - arms only, upside down, etc. 6 mins.

Class Activities

a) Circles in the squares at the top - touch downward circles and then upward circles (using legs if necessary).

b) Try travelling from square to square, twisting from one to another.

c) Link together - climbing, travelling, circles, descending, jumps and landings. 10 mins.

Group Activities

Apparatus as fig. 3.

Task as last lesson: two moves clockwise from own group 19 mins.

LESSON 15

Introduction

Climbing frame only. Free practice. 5 mins.

Four beams out - one per team: approximately stretch height. Find ways of travelling along the beam without touching the floor - practice various ways using different parts of the body. (frequent demonstrations) 10 mins.

Group Activities

Apparatus as fig. 3.
Start on own apparatus.
Task: show as many circling movements as possible on each piece of apparatus. Make three moves anti-clockwise with same task at each area. 20 mins.

LESSON 16

Introduction

Climbing frame, mats and floor. Free practice and revision of any work already covered. 6 mins.

Class Activities

Four beams out, one per team, at about waist height. Practice circling movements. After free practice, teach formally upward and downward circles. Split class up in ability groups. Raise beams according to ability. 12 mins.

Group Activities

Apparatus as fig. 3.
Select one area in which to develop an individual 4-5 movement sequence. Individual coaching - boys demonstrating where appropriate. Aim at quality, variety and difficulty. 17 mins.

LESSON 17

Introduction

Free running - finding space - varying speed and height - emphasise lightness of movement.
Mats only - coach individual movements on mats and floor.

movements. 8 mins.

Class Activities

Climbing frame: free practice - circles - twisting movements - different descents to floor. Build up a sequence to include these. 8 mins.

Climbing ropes: climb using hands and feet - hands only.

Formal teaching of rope climbing - particularly foot grip.

Use ropes for circling movements - forward - backwards - static - swinging, etc.

Balance positions using double ropes - static and swinging. 10 mins.

Free practice on mats, frame or ropes - encouraging combinations of apparatus. 9 mins.

Conclusion

Game - 'sitting dodge ball'.

LESSON 18

Introduction

Free running practice

Cartwheel practice

Dive-roll practice

Make a combination of the three in any order. 3 mins.

Class Activities

Floor work to include stretching - curling, bridging positions.

Develop a sequence of bridging positions connected by rolls. 6 mins.

Group Activities

Apparatus as fig. 3.

a) Free practice of sequence on own apparatus. Develop this to include each piece of apparatus and to show some degree of difficulty. Demonstration by each group on their apparatus.

sequence as above. 20 mins.

Conclusion

Explain the game 'Pirates' using all the apparatus.
Game for 5 mins.

LESSON 19

Class Activity

Develop floor work sequence from last lesson, (bridging and rolling) and introduce weight on hands in the sequence. 12 mins.

Group Activities

a) Free practice - any area.
b) Now use the apparatus set-up as a whole, not divided into groups. Task: to develop a sequence between groups of apparatus trying to incorporate many pieces of apparatus and at least one from within each of the original groups. Concentrate on variety of movements, speed of movements and fluency (connecting the movements). 18 mins.

Conclusion

Game: Pirates. 5 mins.

LESSON 20

Introduction

Pair (or threes if necessary) work. Select a piece of portable apparatus and a working area and work a sequence on and around the apparatus with partner, either simultaneous or subsequent movements. 10 mins.

Group Activities

Apparatus as fig. 3.
As this is the last time for this apparatus set-up for a while, free practice of sequence work and individual movements. Free movement around apparatus.

involve every boy in demonstrations. 20 mins.

Conclusion

Game: Pirates. 5 mins.

LESSON 21

Introduction

Continue pair-work from last lesson, developing quality, variety and continuity. 5 mins.

Class activities

Divide class into three groups and set up apparatus as fig. 4: introduce the apparatus gradually, e.g. upturned bench and climbing frame first with task to climb bench, cross the frame and descend. Add mat for agility or to assist landing. Add box, buck or horse for vaults. Develop this sequence around the apparatus. 15 mins.

Group Activities

Apparatus as fig. 2.
Rivision and free practice of movements.
Develop a sequence to use any of the apparatus (not just one group). 15 mins.

LESSON 22

Introduction

Game: 'sitting dodge ball' (see lesson 3) 3 mins.

Class Activity

Get out apparatus as last lesson (as fig. 4.) Free movement around the apparatus.

a) Progress from last lesson's work i.e., sequence building, using all apparatus.
b) Now concentrate on movements OVER the vaulting apparatus: Find different ways (regular use of demonstration to show variety).

jump upwards, use arms in flight, soft landing, etc.

d) Back to free practice on sequence work - try to include some of the better movements that you have Group Activity ing. 12 mins.

Group Activity

Sit in your four groups. Explain the new apparatus lay-out (as per fig. 5.) and get apparatus out. 4 mins.

a) Free practice on own group apparatus first.
b) Free practice on any group apparatus

In this section encourage variety of movement and experimentation on the apparatus, mainly of individual movements but also of sequences where appropriate. 16 mins.

LESSON 23

Introduction

Game - 'sitting dodge ball' 4 mins.

Class Activities

a) Handstand practice formal class teaching and individual coaching.
b) Informal - find other parts of body on which to balance.
c) Develop 3 part sequence of balances - using different parts of the body.
d) Headstand practice - formal teaching of this. Vary the movement e.g. ascent, shapes made, descent, etc. 15 mins.

Group Activities

Apparatus as fig. 5.

a) Free practice on own apparatus as last lesson. Try to link movements (not necessarily for repetition as a sequence) to gain flowing actions and continuity.
b) One change clockwise and repeat above. 16 mins.

Class Activities

Apparatus as fig. 5 out at start of lesson.
Find a piece of apparatus where you can practice any circling movement. Find other pieces of apparatus to do the same. Use different apparatus for different types of circling movements.
Change the task to moving OVER apparatus.
Find different ways of moving over the same piece of apparatus. 15 mins.

Group Activities

Apparatus as already out (fig. 5)
Repeat work done last lesson but with two moves anti-clockwise. Again emphasise fluency of movements and continuity. 16 mins.

Conclusion

Game - sitting dodge ball. 4 mins.

LESSON 25

Introduction

Practice a floor sequence based on balances and bridging shapes. 5 mins.

Class Activities

Double beams out in holes 8 and 18.
Find ways of:-

a) moving from one side of apparatus to the other.
b) moving over the apparatus.
c) moving between the beams.
d) formal teaching of gate-vault - practice.
e) formal teaching of heave-vault - practice. 15 mins.

Group Activities

Apparatus as fig. 5.

groups to ensure use of all apparatus and space

b) As above with one move clockwise. 15 mins.

LESSON 26

Introduction

To show variety in speeds.
Show different speeds in running. Use the mats, find an agility and practice it at three different speeds - fast, slow and inbetween.
Develop a sequence of 3 different movements, one fast, on slow and one inbetween. Stress the difference in speeds. 10 mins.

Class Activities

Apparatus as fig. 5.
Experiment with movements on any apparatus, performing them at different speeds. Find which movements feel beeter done quickly and which feel better done slowly.
Build a 4-5 part sequence to show variety of speeds. 10 mins.

Group Activities

Group work as for last lesson - different directional tasks - with two moves anti-clockwise. 15 mins.

LESSON 27

Introduction

Game - sitting dodge ball. 4 mins.

Class Activities

Apparatus as fig. 5.
Free movement around apparatus finding different parts of the body to take body weight.
Try to think which part of the body is supporting your weight as you perform the movement and try to involve as many different parts of the body as possible.
Frequent use of demonstration and discussion. 15 mins.

Select one area in which to work and develop a sequence of individual choice to show, (a) quality of movement, (b) variety (c) difficulty (d) continuity. Try also to show variety of speed.
Individual coaching. 16 mins.

LESSON 28

Introduction

Free practice of floor agilities using mats if required - individual coaching of single movements and sequences. 5 mins.

Class Activities

a) Develop introduction towards handstands, and hand-walking.
b) Teach basics of handwalking, e.g. controlled over balance.
c) Suggest mats end to end to develop two directional floor sequence. 18 mins.

Group Activities

Climbing frame with two sets of double beams in Nos. 8 and 16. Use this apparatus freely but trying to make continuous movement - use the floor - make end of one movement suit the start of the next. 19 mins.

Conclusion

Game - sitting dodge ball.

LESSON 29

Class Avtivities

Each boy with one plastic football: Running with ball at feet - varying speed and direction - use each foot, etc.
Various ball-control skills, e.g. kicking against the wall, heading, hand dribbling, etc.
On ball between two boys - repeat skill practices in kicking, throwing, heading, etc. 20 mins.

Apparatus as fig. 5.
Select a different area to the one chosen in lesson 27, to work out an individual sequence as in that lesson, but to include more floor work as practiced last lesson. 15 mins.

LESSON 30

Introduction

Game - sitting dodge ball. 3 mins.

Class Activities

Free practice of floor exercises and movements, coaching individual skills and encouraging sequence work, building on work in previous lessons.
Encourage highest degree of difficulty possible. 15 mins.

Group Activities

Apparatus as fig. 5.

a) Free practice.
b) Develop a timed sequence (approx. 30 secs.) to use some apparatus from each of the four groups. Take particular care with linking movements making full use of floor exercises
Full use of demonstration. 17 mins.

LESSON 31

Introduction

Plastic football each; skills practice and coaching, e.g. dribbling, heading, etc.
Pairwork, kicking, passing, heading, etc. 10 mins.

Group Activities

Apparatus as fig. 5.
As this is the last time this apparatus set-up will be used, this lesson will be given over to free practice and demonstration of:-

b) sequence work within a group,
c) sequence work using all or combinations of groups. 20 mins.

Conclusion

Game - Pirates. 5 mins.

LESSON 32

Class Activities

Apparatus as fig. 2.
a) Free practice within any group.
b) Free practice using floor movements to link apparatus in different groups. 15 mins.

Group Activities

Apparatus as fig. 4.
Free practice and revision of any work done. Individual coaching and frequent demonstration. 15 mins.

Conclusion

Game - Pirates. 5 mins.

LESSON 33

Introduction

Each boy with one plastic football, practice and coach ball skills, ball control off a wall using head, hands, feet, shoulder, etc. 10 mins.

Group Activities

Apparatus as fig. 4.
Revision and free practice of individual sequence and pair work - individual coaching and frequent demonstration 20 mins.

Conclusion

Explain and play the game 'crisp and crunch' 5 mins.

Group Activities

a) Each group to have a bench, a mat and a working area - task, to work out a group display - full use of space and apparatus - correct timing - variety in types of movement.
Each group to demonstrate. 15 mins.

b) Apparatus as fig. 3.
Each group to stay with own apparatus and again, develop a group sequence for display - try to include simultaneous and consecutive movements - display to last about 30 secs. 18 mins.

Conclusion

Game - crisp and crunch. 2 mins.

LESSON 35

Introduction

Plastic football for each boy and continue ball skill practices - ball control, etc. 10 mins.

Group Activities

Apparatus as fig. 3.
As last lesson, group sequence after one move clockwise from own apparatus.
Each group to demonstrate. 20 mins.

Conclusion

Game - Pirates. 5 mins.

LESSON 36

Introduction

Game - sitting dodge ball. 3 mins.

Class Activities

Frame and double beams at 8 and 16.

the beams.

b) Formal teaching of the 'gate-vault' - add second movement. 12 mins.

Group Activities

Apparatus as fig. 3.
As last lesson, group sequence on third group of apparatus - concentrate on timing - variety of movements. 20 mins.

LESSON 37

Introduction

Plastic footballs each - ball skill practices, dribbling - changing speeds and directions, etc. 5 mins.

Class Activities

Weight on hands practices - handstands - vary ascent and descent, hand walking - controlled.
Individual coaching. 6 mins.

Group Activities

Apparatus as fig. 3.

a) Final group apparatus for group sequence, as last lesson.
b) Free practice on any apparatus. 20 mins.

Conclusion

Game - Pirates. 4 mins.

LESSON 38

Introduction

Develop short floor sequence to emphasise directional changes. 6 mins.

Class Activities

Apparatus as fig. 2.
Free practice - concentrate on individual movements - then on sequence work. 10 mins.

Apparatus as above.
Each group to own apparatus.
Develop a group sequence in own work area as done in last lessons. Groups may alter their apparatus if they wish. 15 mins.

Conclusion

Game - crisp and crunch. 4 mins.

LESSON 39

Introduction

Game - sitting dodge ball. 4 mins.

Class Activities

Apparatus as fig. 4.
Revision and free practice of individual movements and sequences - individual coaching and frequent demonstrations 10 mins

Group Activities

Divide into three groups and select an area in which to develop a group sequence. Alter apparatus if wished.
One change to another apparatus group. 21 mins.

LESSON 40

Introduction

Pair work - find a partner, free practice.
Simultaneous and consecutive movements. 6 mins.

Class Activities

Apparatus as fig. 5.
Revision and practice of individual movements and sequences - frequent demonstrations. 10 mins.

Group Activities

Apparatus as above. Each group select an area to develop a group sequence as previous lessons. Arrange apparatus if needed. 14 mins.

Conclusion

Game - Pirates 5 mins.

Sitting Dodge Ball

All play. Anyone can pick up the ball and throw it to hit another person, on or below the waist. Anyone so hit must sit down straight away but may still take part in the game. If the ball comes to them they can (if they remain seated), throw at someone still 'in', or pass to some other seated person. Last to be hit is the winner. This can be played with one, two or many balls at the same time.
No running with the ball - no dribbling.

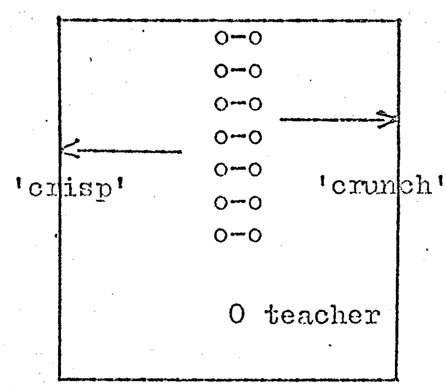
Pirates

Use whatever apparatus is available. One person, the 'pirate' against the rest. No one is allowed to touch the floor. Pirate uses apparatus to chase others. Any he catches must rétire to the pirates 'den'. Any who touch the floor are out. If pirate touches floor all in the 'den' are free.

Play until all are caught or to a time limit.

Crisp and Crunch

Pupils pair off, stand side by side in centre of gym.



They hold hands all the time. Teacher shouts 'crisp' or 'crunch' or any combination of these (e.g. crunch-crisp-crunch). For crisp, pairs run to right hand wall, one to touch it, and back to centre, for crunch they do the same to the left hand wall and back to centre. First pair back to centre after completing necessary runs is the winner.

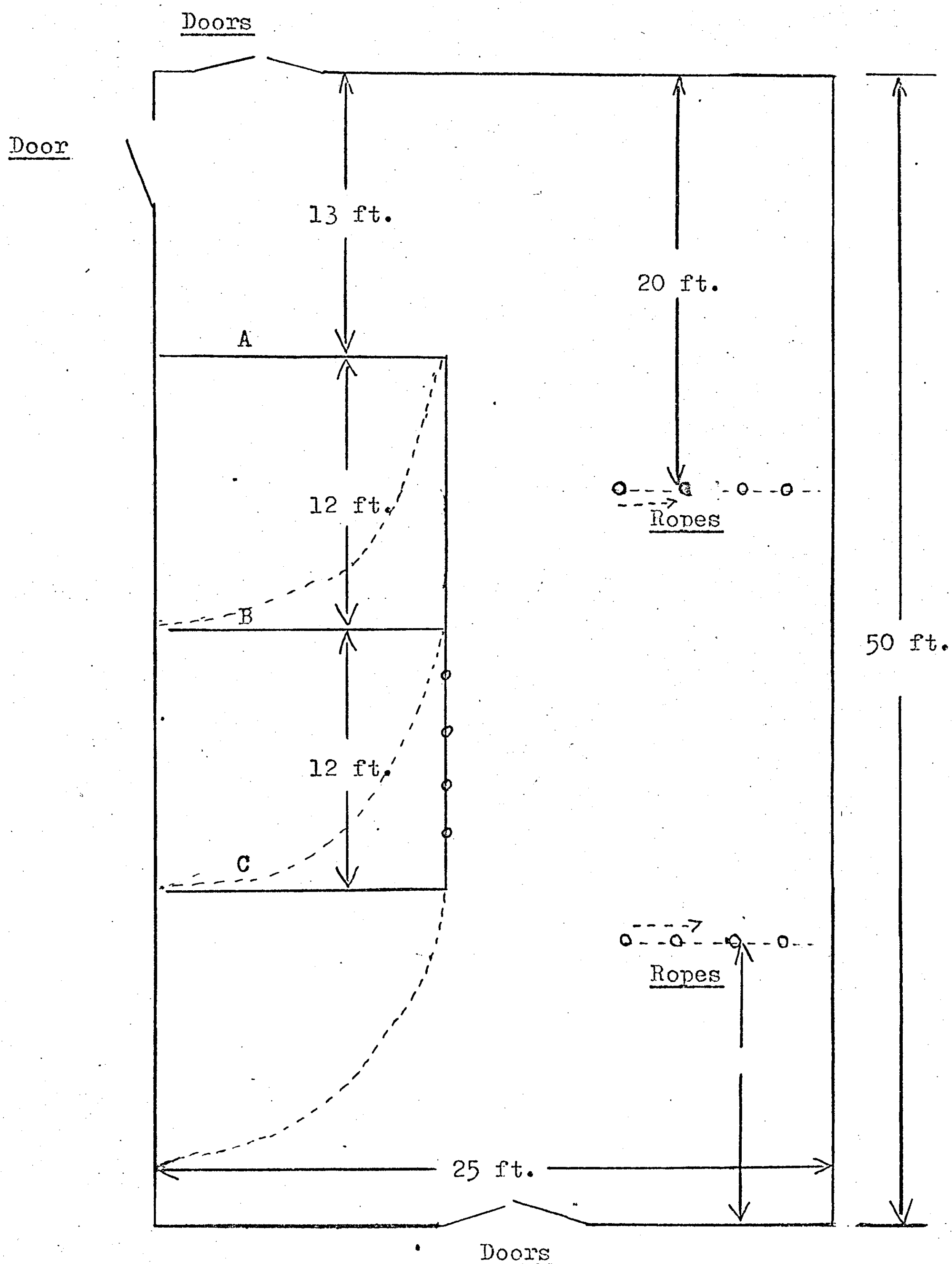
APPENDIX II

APPARATUS LAY-OUTS.

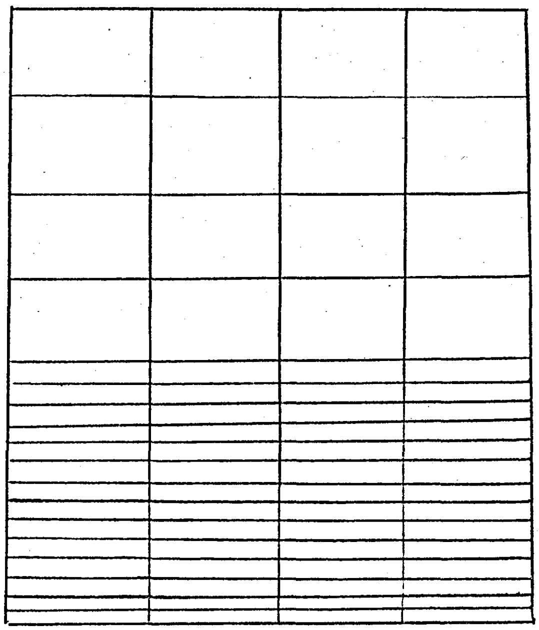
Note:- Drawings are not to scale.

DIMENSIONS

Gym and Fixed Apparatus:- dimensions of the wooden-floored gym and fixed apparatus.



A, B and C are the three sections of an 'all-or-none' climbing frame. Beams may be fixed between these frames, connecting A to B or B to C. Four ropes are suspended from the overhead bar connecting B to C. Each of the frames A,B and C, consist of wall-bars up to 5 feet from the ground and window-frames up to 13 feet. When not in use, the frames are supported close to the wall.



1 2 3 4

Beams can be attached to the uprights 1 - 4 to connect the frames. The beam hole-numbers and corresponding heights are:-

Beam No.		Height
8	-	2 ft. 9 in.
10	-	3 " 3 "
11	-	3 " 9 "
14	-	4 " 9 "
16	-	5 " 6 "
19	-	6 " 3 "
21	-	7 " 0 "
24	-	8 " 0 "

Key to following figures.

Bch.	-	bench.	Mtts.	-	mattress.
Bck.	-	buck.	T.B.	-	take-off board.
Hse.	-	vaulting horse.	Sp. B.	-	spring board.
Bm. (14)		beam and hole-number.	Tr.	-	trampette.
D.Bm.	-	double beam.			

FIG. 1

Mats and benches.

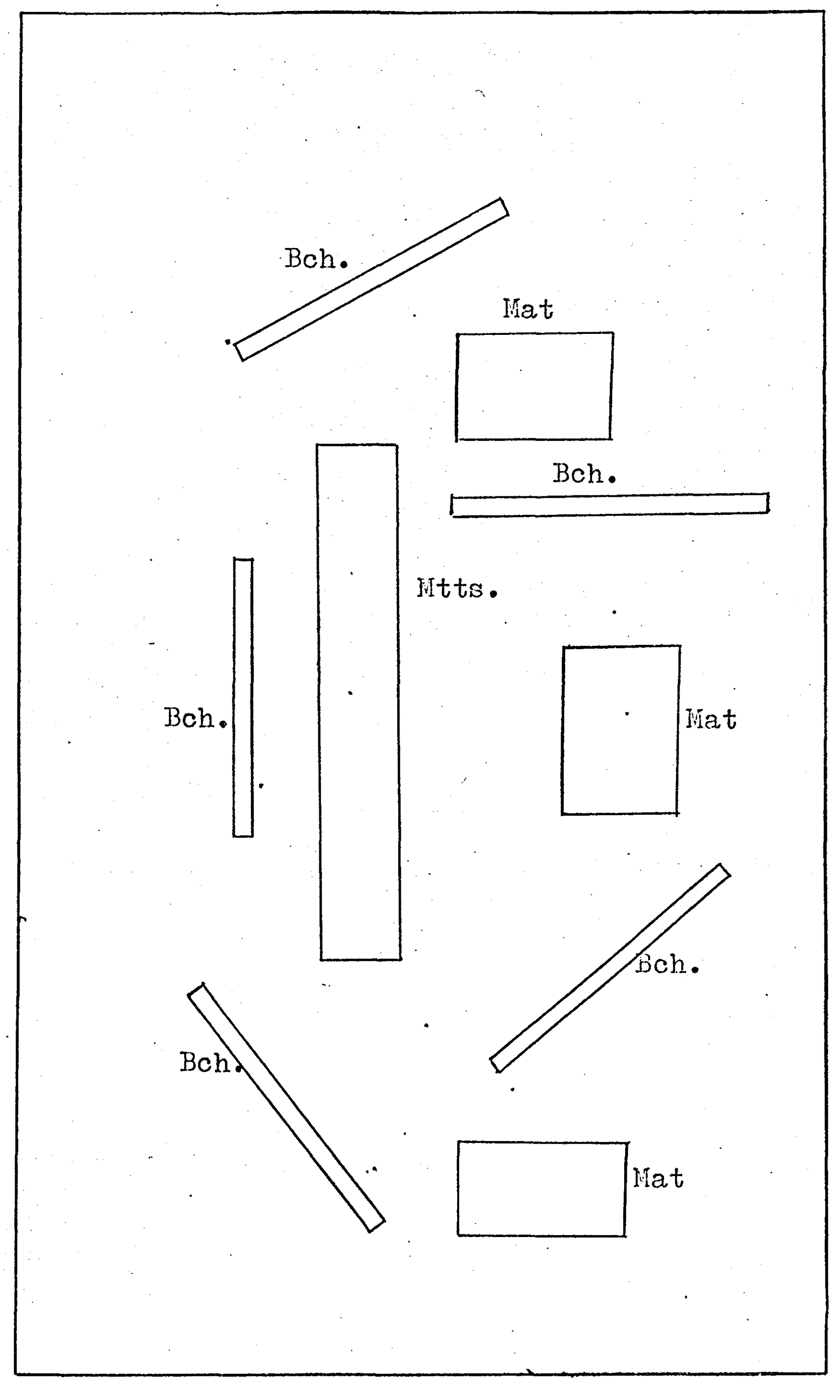


FIG. 2

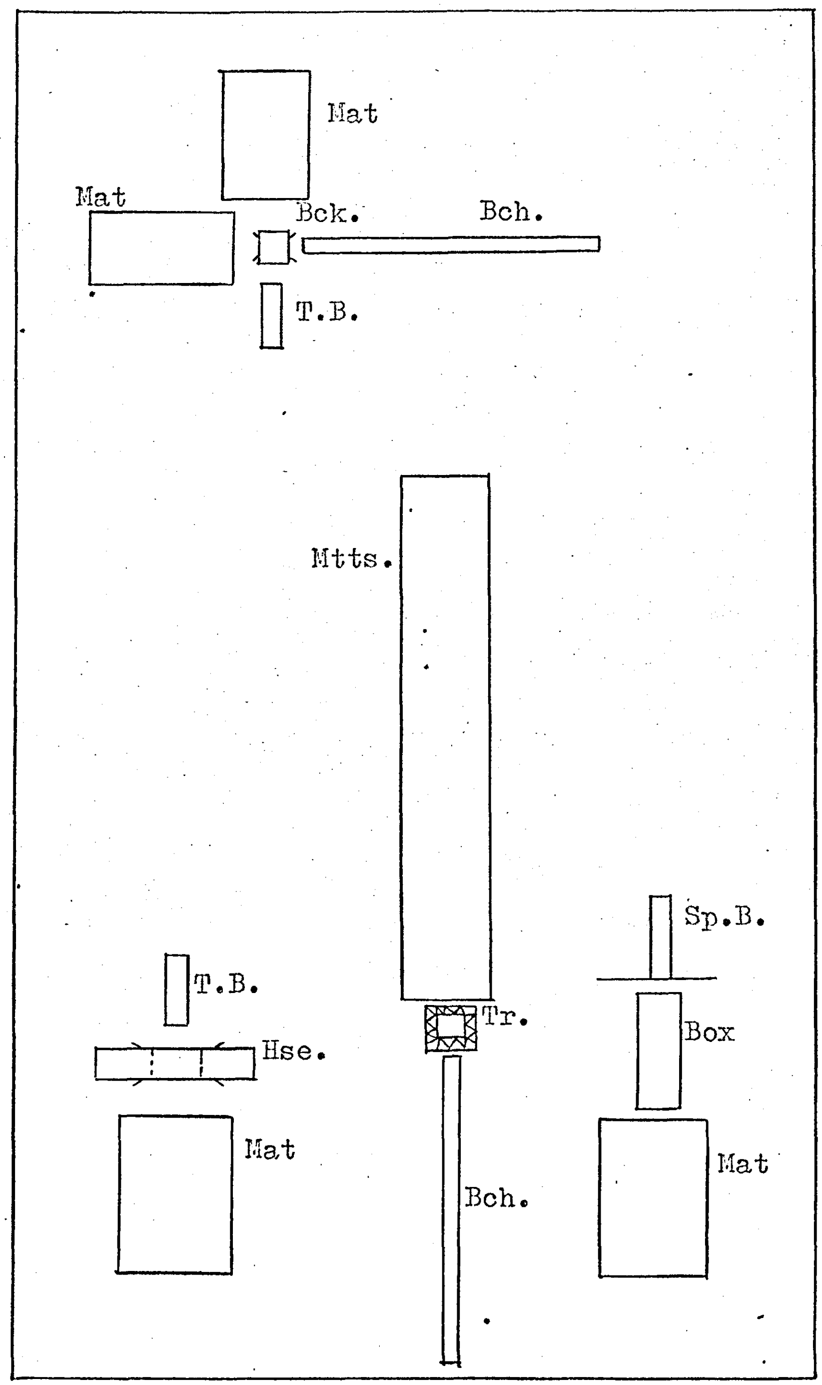


FIG. 3

* This bench was balance-side up and hooked at one end to the wall-bars at 4 ft. 6 in.

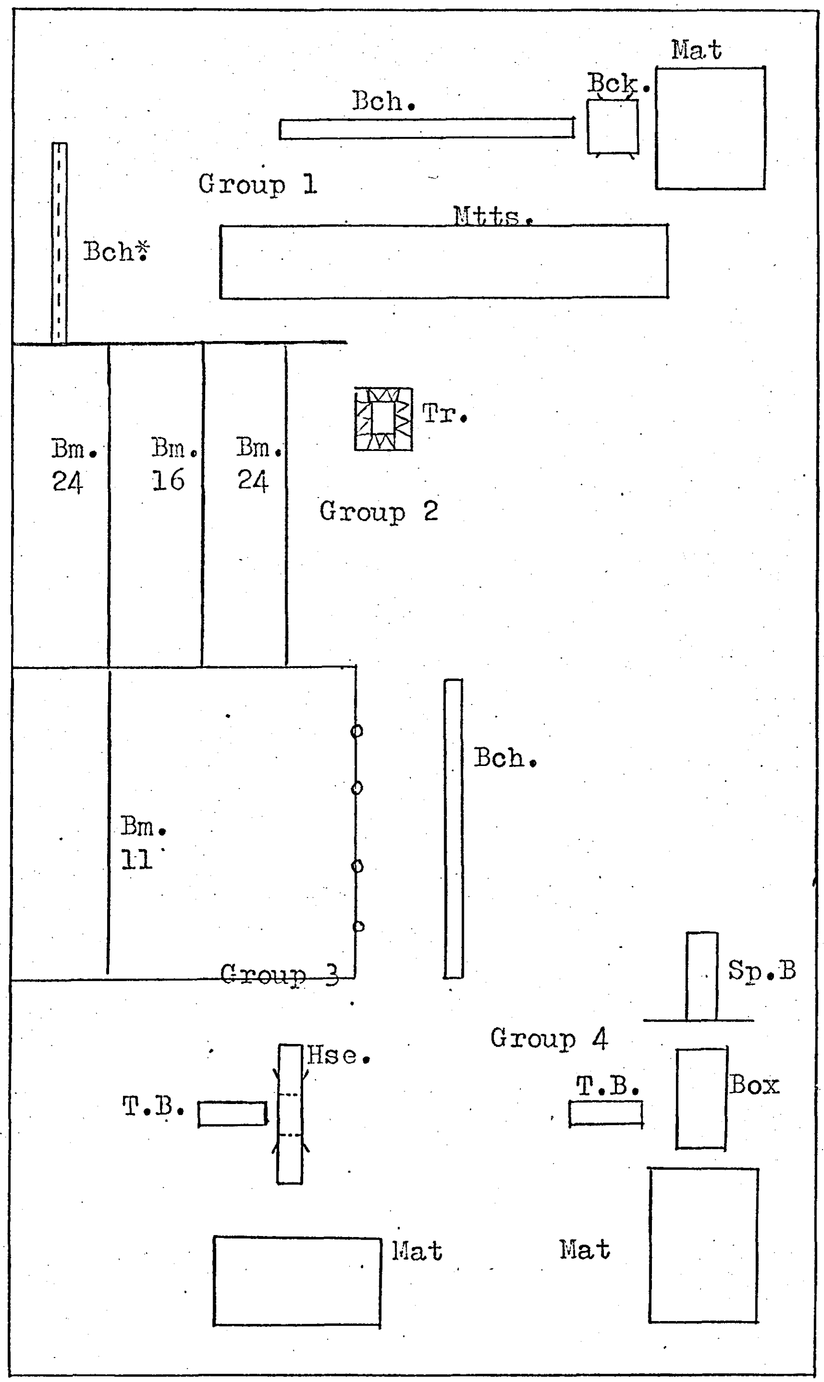


FIG. 4

* Climbing frame used against the wall.

** Upturned benches hooked to the frame at 4 ft. 9 in.

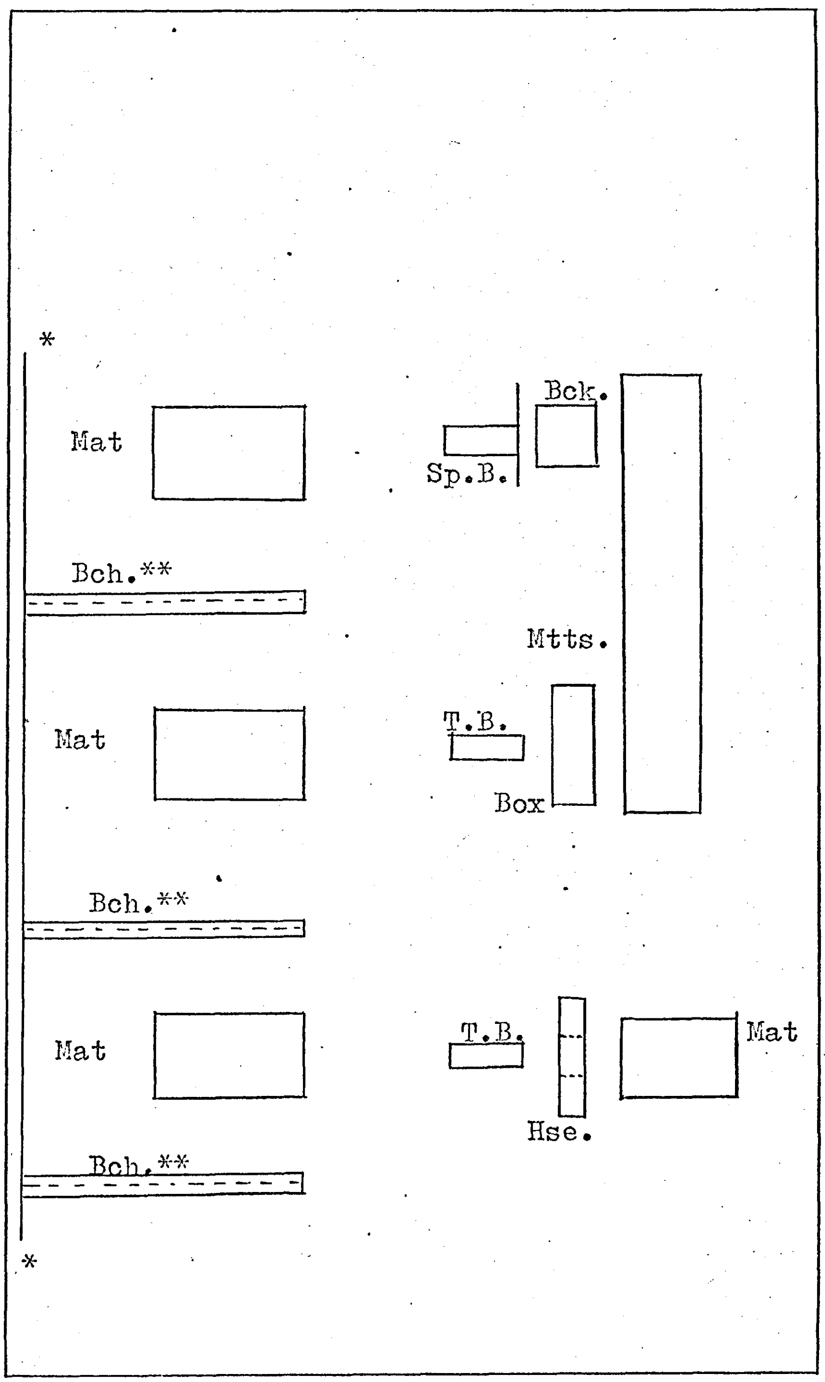
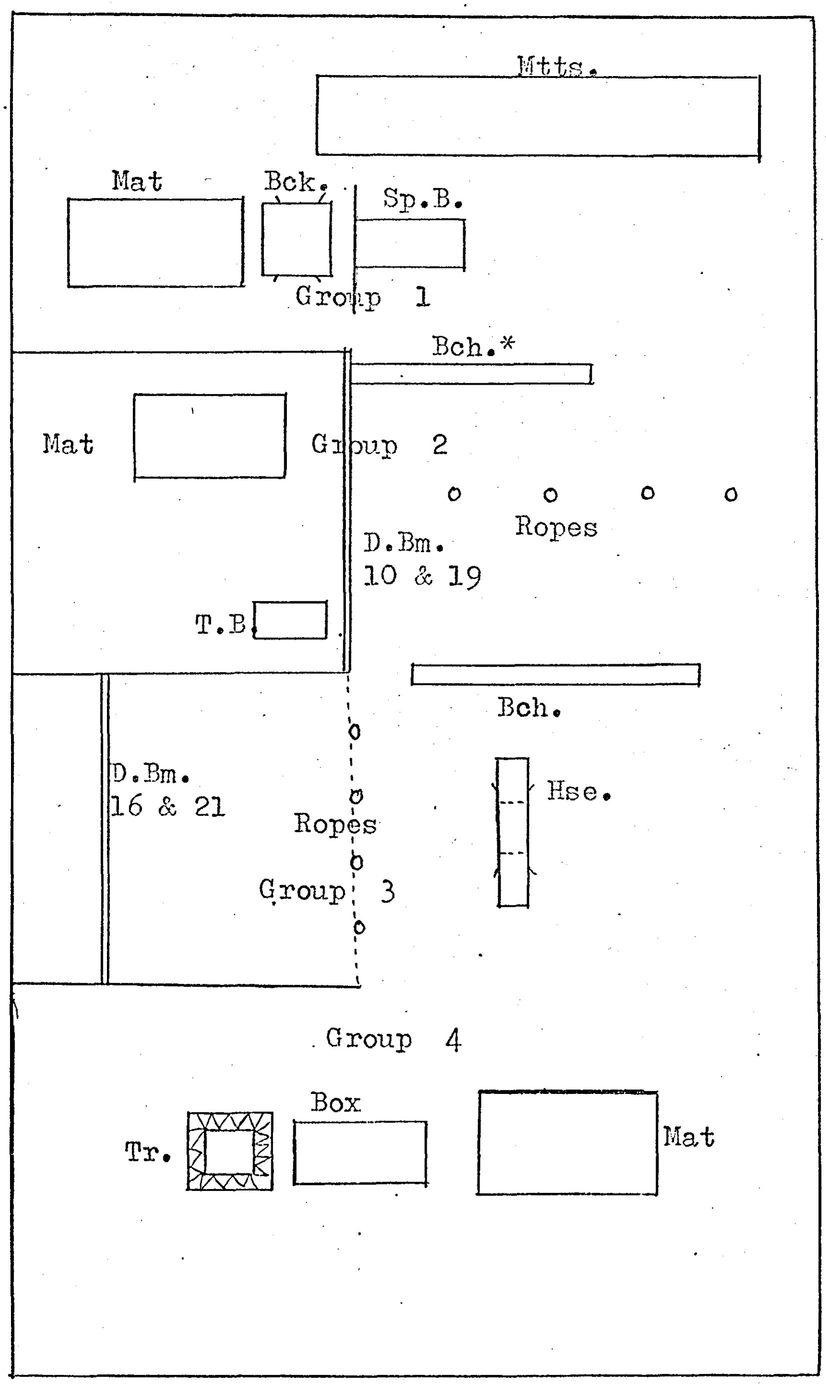


FIG 5

* Bench hooked to bottom beam at No. 10.



APPENDIX III

Attendance at Movement Training Sessions

Subject No.	Total Sessions Attended.
1	39
2	40
3	38
4	38
5	37
6	40
7	37
8	40
9	38
10	39
11	40
12	36
13	38
14	40
15	40
16	38
17	40
18	36
19	40
20	36
21	39
22	40
23	40
24	40
25	40
26	40
27	39
28	39
29	38
30	39
31	40
32	40

APPENDIX IV

TEST RESULTS:- RAW SCORES

TEST

1. Stott Test of Motor Impairment.
2. Draw a Man Test.
3. Memory for Design Test.
4. W.I.S.C. Performance sub-tests.
5. Gibson Spiral Maze:-

   T = Time Score

   E = Error Score.

Experimental Group:- First Test.

Subject	Age	Test:- 1	2	3	4	5 T.	5 E.
1	152	8-	9	3	104	28	29
2	171	2	9	0	128	42	8
3	171	5	7	4	111	47	12
4	170	5	6	1	107	40	7
5	168	2	9	2	128	48	5
6	153	3	8	0	118	47	16
7	169	10-	7	2	93	46	11
8	174	10-	8	2	124	42	17
9	169	4	5	1	99	34	17
10	171	6	7	0	124	33	8
11	159	6	5	1	114	43	14
12	163	3	7	3	110	45	6
13	158	15-	9	3	90	39	17
14	145	10-	8	6	94	52	5
15	164	6	8	4	92	36	14
16	156	14-	8	8	107	40	36
17	156	5	9	1	89	46	9
18	162	4	7	2	99	41	15
19	170	8-	6	1	101	42	21
20	175	6	8	6	67	52	4
21	161	12-	4	0	96	46	16
22	148	10-	9	11	83	56	28
23	171	14-	8	0	79	37	18
24	153	2	9	1	107	48	4
25	167	5	7	3	93	29	18
26	151	4	9	10	87	46	9
27	162	4	8	2	99	50	3
28	167	16-	5	0	111	32	15
29	138	5	8	5	80	60	2
30	174	5	7	0	103	39	15
31	159	2	7	0	92	32	21
32	164	16-	7	1	104	52	13

Experimental Group:- Second Test.

Subject	Test:- 1	2	3	4	5 T.	5 E.
1	5	8	0	105	29	12
2	1	7	0	131	47	4
3	3	8	5	124	50	10
4	3	4	1	117	45	4
5	0	5	1	117	41	10
6	1	7	0	125	41	3
7	7	5	2	101	41	8
8	6	6	0	124	41	8
9	2	7	0	114	31	11
10	2	5	0	128	30	10
11	3	7	0	111	45	4
12	1	6	0	115	45	6
13	8	8	1	90	47	9
14	3	7	4	93	50	5
15	3	8	4	97	34	16
16	9	7	5	103	42	24
17	2	8	1	103	35	9
18	1	4	1	113	33	11
19	4	4	0	113	39	14
20	4	8	4	78	40	8
21	7	6	1	99	47	11
22	7	8	9	82	65	2
23	4	7	0	93	42	12
24	4	8	1	104	42	6
25	0	7	0	108	24	25
26	2	9	6	89	45	9
270	0	5	2	101	44	13
28	7	2	0	101	26	20
29	2	8	6	82	59	0
30	3	7	0	121	49	14
31	0	7	1	97	29	16
32	7	6	1	110	45	19

Raw Scores

Control Group:- First Test.

Subject	Age	Test:- 1	2	3	4	5 T.	5 E.
1	157	4	9	1	87	36	9
2	162	4	8	5	93	33	14
3	160	2	8	1	104	40	7
4	157	0	7	1	114	44	4
5	161	0	5	1	100	42	12
6	165	0	8	3	96	37	5
7	157	5	8	4	100	33	12
8	167	2	5	1	107	34	4
9	166	5	4	1	107	50	0
10	159	0	5	2	113	42	21
11	162	5	8	2	94	53	2
12	167	6	9	0	92	44	12
13	157	7	8	12	87	39	17
14	161	7	8	2	108	43	16
15	160	4	2	2	107	39	16
16	157	2	5	0	118	42	17
17	164	3	6	0	103	34	12
18	165	2	6	5	101	36	16
19	157	8	7	3	94	44	27
20	165	0	1	0	129	38	8
21	160	5	5	1	106	58	15
22	158	8	7	0	118	44	4
23	167	3	3	0	100	45	6
24	161	2	8	3	83	50	5
25	162	12-	9	3	80	44	32
26	157	8	5	3	96	47	6
27	159	1	7	3	96	57	7
28	159	1	7	3	96	57	7
28	158	6	7	1	100	45	7
29	162	5	3	0	108	40	4
30	167	0	7	0	99	46	11

Control Group:- Second Test.

Subject	Test:- 1	2	3	4	5 T.	5 E.
1	2	8	1	100	30	14
2	9	5	2	94	33	20
3	3	7	2	104	34	15
4	0	5	0	122	34	13
5	0	7	1	103	34	18
6	0	8	0	101	33	10
7	3	7	0	101	43	11
8	2	6	0	110	41	6
9	3	4	0	103	55	1
10	0	4	0	113	36	17
11	6	7	3	100	40	0
12	3	6	0	92	35	15
13	8	9	7	99	32	13
14	6	5	1	103	36	20
15	2	5	0	121	36	16
16	1	5	1	122	46	5
17	4	3	2	94	31	16
18	0	7	3	100	37	8
19	7	7	2	98	42	25
20	2	1	0	133	36	11
21	8	5	0	108	50	6
22	6	5	0	113	54	3
23	3	6	0	104	41	4
24	3	8	0	89	45	3
25	12	9	5	83	61	13
26	9	7	4	97	37	18
27	0	5	5	96	42	15
28	4	6	1	107	34	19
29	5	3	2	110	36	9
30	0	3	1	101	41	3

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