THE DEVELOPMENT OF NUMBER CONCEPTS IN CHILDREN WITH DIFFERING DEGREES OF SPINA BIFIDA AND HYDROCEPHALUS.

THE DEVELOPMENT OF NUMBER CONCEPTS IN CHILDREN WITH DIFFERING DEGREES OF SPINA BIFIDA AND HYDROCEPHALUS

BY

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A Doctoral Thesis

submitted in partial fulfilment of the

requirements for the award of Doctor of Philosophy

of the Loughborough University of Technology, August, 1979

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ACKNOWLEDGEMENTS.

It is always a pleasure to acknowledge the help and support of those who have been involved in any undertaking; this is particularly true of the present work.

My first thanks are due to my supervisors. Firstly to Professor A. C. Bajpai whose contribution to mathematical education is held in high esteem and whose interest in physically handicapped children make him a most appropriate mentor. Secondly to Mr. David Green whose scrupulous sense of scholarship and meticulous attention have enabled me to focus my thoughts on the most pertinent issues.

I am grateful to the staff of the Medical Illustrations Department of the Leicester Royal Infirmary for their assistance and to the Leicestershire Education Authority for the permission to undertake this work. I am also grateful to medical colleagues in the Leicestershire Health Authority for their encouragement, interest and advice.

I owe particular thanks to the headteachers, teachers and para-medical staffs at Westbrook School, Long Eaton, Aspley Woods School, Nottingham and Thieves Wood School, Mansfield. This study would have been impossible without the tolerant support of my colleagues of all disciplines at Ash Field School, Leicester.

I am deeply grateful to the children whom I have tested in the schools mentioned above. It has been a privilege and delight to work with them.

Lastly my thanks are due to my wife who typed the work and collaborated throughout.

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CHAPTER I.

Introduction to the Research.

For several years the writer has been engaged in the education of children with various handicaps and has become particularly interested in the development of spina bifida children.

Most of these children are to be found in schools catering for the physically handicapped. They present a relatively new educational challenge since their long-term educational potential is as yet unfulfilled.

Due to either infection or the effects of hydrocephalus the mortality rate of infants born with this condition was hitherto high, but since the late 1950s, advances in surgical techniques, increased use of antibiotics and improved obstetric services have contributed to a much higher survival rate. Although for several reasons the pendulum has of late swung away from universal surgical intervention to a more stringent selective procedure which will inevitably reduce the number of such children entering schools in the future, there will still be many spina bifida pupils for whom appropriate educational provision needs to be made and teaching strategies devised. In the light of their physical disability it is natural that parents and teachers are concerned with the educational and intellectual potential of spina bifida children. Indeed, one has sympathy with the expression of concern voiced by the Association of Spina Bifida and Hydrocephalus (1975), a national body specifically interested in the education of these children, when they succintly ask (a) "Are spina bifida children intellectually impaired and if so in what ways?", (b)"What effects are these children's special learning difficulties likely to have along with their physical problems, on classroom performances?" and (c) "What can teachers do to help?". It might be too readily assumed that the effects of hydrocephalus, paraplegia, sensory loss, incontinence, hospitalization and deprivation of normal early learning experiences would combine to cause irreparable retardation. In the current controversy over whether or not to intervene surgically, comments made in The Times (1978) and the B.B.C. programme Tonight (1978) such as

"Many are going to be mentally retarded", "Within the spectrum of disability the majority will have mental handicap" and "Most cases are sufficiently handicapped both physically and mentally", combine to create an impression that spina bifida children will, by definition, be also mentally retarded and which in turn will determine educational placement and programmes.

As with any group of children caution must be exercised with respect to generalization in answering the questions posed by the above Association, particularly when it is considered that the very term 'spina bifida' covers a wide range of medical abnormalities with differing degrees of physical handicap and intellectual development. In Chapter 2, therefore, the writer has delineated the differing types of conditions which are covered by the generic term 'spina bifida' and also other factors such as its association with hydrocephalus, the incidence of the condition, ethnic variations, history of treatment, sex difference, social class and suspected causal factors. A glossary of medical terms not usually encountered by teachers is to be found on pages 223-225.

A review of literature which deals with the intellectual and educational development of spina bifida children is to be found in the first part of Chapter 3.

It became clear as the reports were studied that there were frequent conclusions drawn by researchers that spina bifida children had specific weaknesses in number, mathematics and logical reasoning, a view which is also shared by many experienced teachers of such pupils. In the light of this consensus it is therefore quite understandable if teachers assume that for various reasons spina bifida children have a 'blind spot' for mathematics in much the same way as some children are thought of as dyslexic. It also follows that if a label such as 'mathematical low-achievers' is applied to a group of children, the curriculum content and time spent on the subject are likely to be geared to the expected outcome. The teacher of the spina bifida child is thus faced with a dilemma; on the one hand limited mathematical goals, determined *a priori* in terms related to this particular handicap, may by careful educational programming be attained and also pupil-failure with its attendant side effects reduced. On the other hand, a curriculum based on limited mathematical goals can inhibit achievement and the child's true potential can remain unrealized. If, as is commonly thought, spina bifida children have a definite inability to develop mathematical skills, then the curriculum needs to be realistically designed with this in mind. If, however, the observed weakness is due to factors other than a specific deficit caused by the neurological implications of this condition, then it is necessary to diagnostically explore these reasons with the aim of planning appropriate remedial measures and curricula which will be relevant to a wide range of academic needs within the spina bifida population. To this end, therefore, the writer considers it necessary to investigate in depth some important and basic aspects of the number and mathematical development of spina bifida children. One method of investigation would be to measure the attainment of a group of such children on one of the published standardised mathematics tests. Alternatively an examination of the sample's development of basic structures upon which number, mathematics and logical reasoning are built could be initiated.

The writer suspects that the very nature of mathematical attainment tests is such that the real question would remain unanswered. Firstly, it is likely that the spina bifida child would not have been fully exposed to the normal educational programme on which such tests are based and so would neither demonstrate his own learning ability nor the quality of the teaching provided. No allowance could be made for the child's restricted school day, lack of specialist teaching and time spent unavoidably out of school. Secondly, since the spina bifida population required to form a sample of acceptable size is scattered over quite a wide geographical area it is likely that the teachers concerned will have differing views as to the content of their curriculum, because the prevailing attitude to mathematical education in the normal schools of one area will to some extent be reflected in the locality's own school for the physically handicapped. Even within the area of one local authority it is likely that different emphases and curriculum content will be found in adjacent schools. For example, <u>The School's</u>

Council's Working Paper 61 (1979) pinpoints the concern of mathematical educators who come across two very different types of schools; the one is the small hard-core of rigidly traditional schools and the other represented by the few progressive schools where too many ideas are taken up far too quickly. Howson (1973) reports the view of one group of scholars interested in the teaching of mathematics thus, "Mathematics is being taught to, and learned by a multitude of students in a bewildering variety of conditions"; to some extent this is also true in special schools. These schools may be traditionally orientated or committed to Nuffield, Dienes or Stern. They could even employ a mixture of all these approaches. Other schools may feel it more appropriate to restrict the curriculum to practical social arithmetic. Thirdly, participation in standardised tests is dependent upon the child being able to read, draw or write, the test may even demand a combination of all three; some handicapped children would be precluded by these criteria. Fourthly, attainment tests are exclusively concerned with content and consequently provide little useful information about the child's thinking and reasoning behind the answers. Finally a rigid and possibly timed testing situation would be unsuitable for handicapped children.

It is the writer's view therefore, that a study based on the first option would not materially help the investigation. The second option, which would explore basic number and mathematical concepts has much to commend it, particularly since it could throw light on any delayed or abnormal development. Such an exploration could be facilitated by reference to the contribution made by Piaget to the general problem of concept formation and particularly to the development of number concepts. For some years the writer has been interested in the implications for handicapped children arising out of Piaget's main work on the subject, The Child's Conception of Number (1952) and has made detailed studies of the development of number concepts in pupils of varying abilities (Parfitt, 1969, 1972).

There is considerable support for Piaget's view that the sequence of stages through which normal children pass in the development of these concepts is invariant. This sequence can be observed in children of different cultures, environments and even various handicaps. This invariance also applies to those who do not become fully operational. If an investigation of the stages of number development appear to operate normally in spina bifida children it seems reasonable to look beyond a specific intellectual malfunctioning in this particular area to other factors which may be influencing their number and eventual mathematical development.

Despite Piaget's work having been so well validated, many teachers although aware of this contribution to educational thinking, are uncertain about the precise implications of his theories as they apply to the handicapped.

Although there is a wealth of literature dealing with several of Piaget's experiments outlined in The Child's Conception of Number (1952) and subsequent teaching strategies which have been based on them, there is a lack of detailed reviews of the whole work. Sime (1973) and Copeland (1974) are examples of those who have reviewed some of Piaget's experiments and have made useful suggestions to teachers on their application. The present writer has reviewed the whole of this work of Piaget with respect to all the basic concepts considered essential in the development of number in Chapter 3. The practical situations based upon the ideas which have arisen from the approaches made by Piaget and his colleagues as outlined in the above work, are dealt with in Chapter 5.

There are basically two formats for testing number; group and individual. Both methods have advantages and disadvantages. Group testing takes less time. Individual testing, on the other hand, permits the examiner to evaluate the child's performance more carefully and thoroughly. Piaget's technique which is essentially concerned with the individual child, enables the researcher, on the basis of replies to various number situations, to evaluate the stage at which that particular child is operating. Piagetian tests, although demanding active, tactile involvement, do not require the child to be able to read, write or even draw. In assessing the child's responses to the

Piagetian situations the researcher is interested in correct and incorrect answers and in the reasoning behind them. Of significance also is the durability of the child's replies despite the pressure of counter-suggestions.

Teachers are generally aware of the changes which have taken place in mathematical education during the last two decades and many recognize Piaget's influence in this development. Those teachers involved with the education of physically handicapped children are vitally concerned with the ramifications of this development insofar as their own work is concerned. This is true with respect to the teaching of mathematics to spina bifida children, and those involved ask many pertinent questions, "What is the level of mathematical attainment which might be expected from such children?", "Is it a misuse of valuable teaching time to concentrate upon a subject in which these children in particular find extreme difficulty?", "Given that it is socially desirable to teach this subject, what should the curriculum content be?", are examples of such questions.

The writer considers it essential to highlight certain issues relating to the development of number concepts which apply particularly to children with spina bifida, with and without shunts; in addition, to examine other factors such as perceptual, language and reading skills which would materially affect mathematical competence. To this end, therefore, it is proposed to investigate these problems by studying the responses of all the spina bifida children who attend four special schools in the counties of Derby, Leicester and Nottingham on a battery of Piagetian number tests and certain other relevant standardised tests.

Chapters 4 and 5 amplify the design of the experiment, test details and the measurement technique. Chapter 6 is concerned with a tabulated statement of the results and the statistical analyses are described in Chapter 7.

The interpretation and discussion of results, together with a consideration of broader questions of implications for teachers of handicapped children, is to be found in Chapter 8. Finally, the principal results of the study are summarised and conclusions drawn in Chapter 9. In this same chapter directions of possible future research are indicated.

The main contributions of the work in this thesis are summarised in testing the following hypotheses :-

(i) Children with differing degrees of spina bifida and hydrocephalus pass through normal stages in the development of number concepts as postulated by Piaget.

(ii) Spina bifida children without a shunt are significantly more successful overall in Piagetian number tests than those with.

(iii) There is a significant negative correlation between operativity in the Piagetian number tests and degree of overall handicap as reflected by the Pultibec Scale.

(iv) Spina bifida boys are significantly more successful educationally, particularly with respect to the development of number concepts, than spina bifida girls.

(v) Spina bifida children have specific perceptual problems.

(vi) The well-attested progress in pre-school spina bifida children's acquisition of vocabulary skills is not maintained thereafter to the same extent.

(vii) The level of reading attainment of spina bifida children overall is below normal at each age-level.

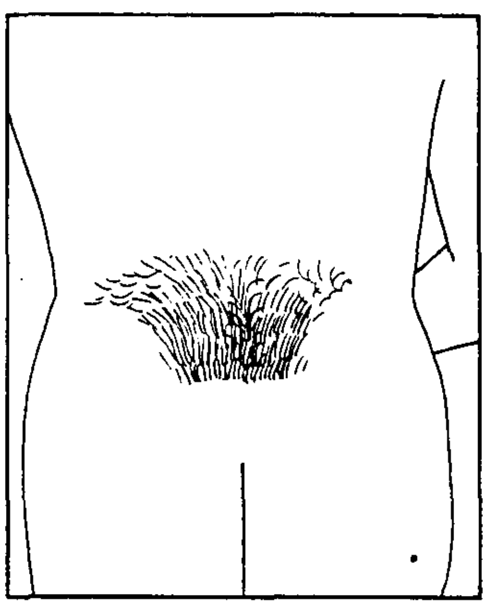
CHAPTER 2.

Medical Review.

Medical definition.

The term spina bifida* is used to denote part of a family of aetiologically related neural tube malformations. It is a congenital defect of the spinal cord, affecting the immediate coverings of the cord and of the backbone which encloses and protects these structures. If the lower end of the neural tube which develops within four weeks of conception fails to close, a variety of malformations ranging from spina bifida occulta to complete rachischisis can occur. The general term spina bifida includes these extremes and also the various degrees of meningocele and myelomeningocele. The main types are :-

(a) Spina bifida occulta.

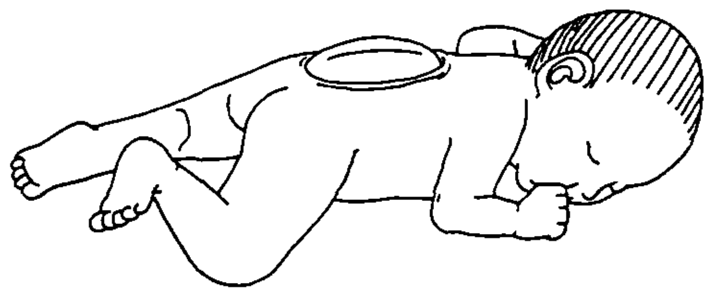


Spina bifida Occulta

Spina bifida occulta is a defect of the posterior wall of the spinal canal which is relatively common. It is of little importance unless the nervous system is involved. This defect may not be visible externally but its site is often marked by a pad of fat, pigmentation of the skin or a tuft of dark hair. In a small proportion of cases there is weakness or atrophy of one or both lower limbs. There may be urinary incontinence if the bladder is involved but this is rare. In many infants a small depression or sinus is seen in the lower sacral or coccygeal region, representing a remnant of the caudal end of the neural tube. While slight depressions are of no consequence, extensive ones are liable to infection and require surgical treatment.

* See glossary,pages.223-225.

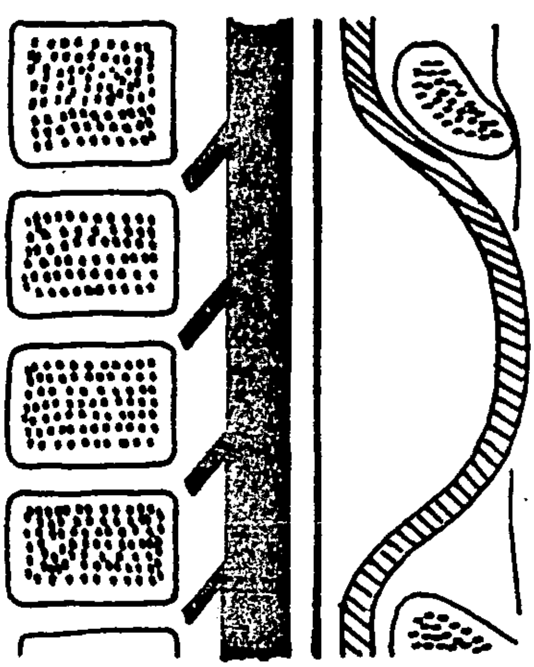
(b) Spina bifida cystica.



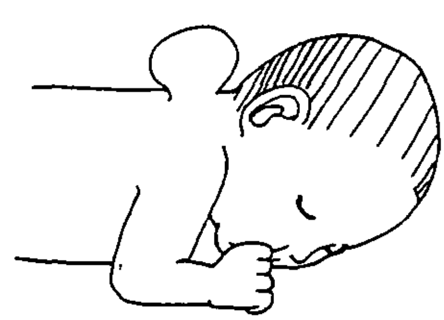
Spina bifida cystica denotes a more severe condition and is divided into two types :-

(i) Meningocele.

A meningocele is a tumour containing meninges and cerebro-spinal fluid but no spinal cord structures. It is covered by fatty and sub-cutaneous tissue and skin which may be considerably thinned. The spinal cord fortunately remains in its normal position. Since no nerve tissue is involved in the case of spina bifida with meningocele only, there is no paralysis and providing the tumour can be removed, the prognosis is good. Pevehouse, (1974) nevertheless warns that in what may appear to be a simple meningocele there may be some neurological deficit indicating that the lesion is in reality a myelomeningocele.



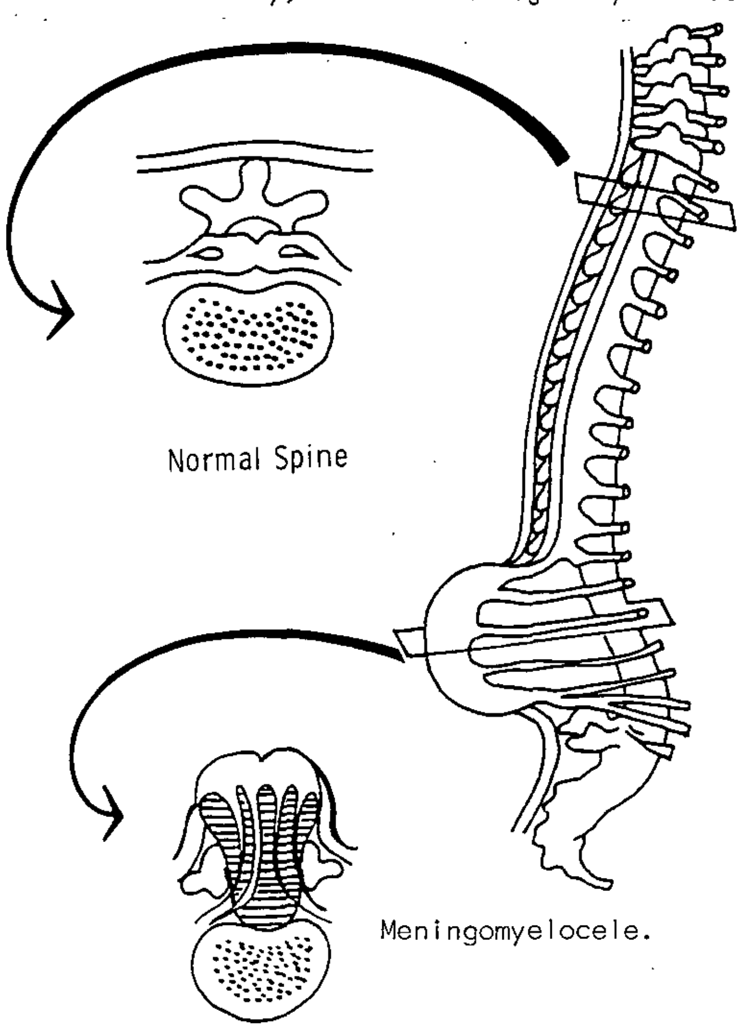
Meningocele



Cervical meningocele

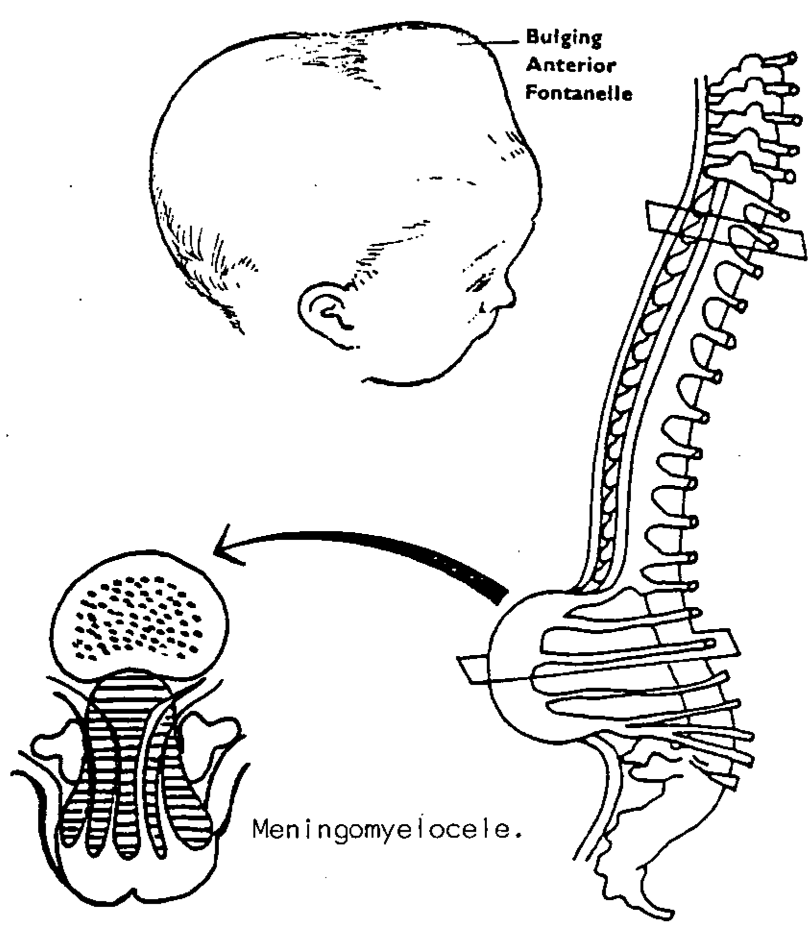
(ii) Meningomyelocele.

The second type, which takes a number of forms and terminology, is generally grouped together and can be referred to as either meningomyelocele, myelomeningocele or myelocele. In this more common and serious type the spinal cord itself is maldeveloped, the cord and attached nervous tissue protruding into a cystic swelling or open wound. Here the imperfectly formed spinal cord reaches the surface, and consequently is exposed to injury, drying out and infection. It is rarely covered by skin. Spina bifida may occur anywhere along the spine, although it is most common in the lumbar region. The severity of the resulting handicaps varies with the level and extent of the lesion. At the best, with a very small, low sacral lesion there may be no disability, but in the majority of cases there is a marked weakness or complete paralysis and deformities of the lower limbs, often with talipes deformity of the feet, dislocation of the hips, skin insensitivity and bowel and bladder incontinence. Involvement of the nerve supply to the bladder results in continual urinary incontinence and the anal sphincter mechanism is often affected as well. The bladder disturbance leads to secondary disorders of the upper urinary tract, often with hydronephrosis and chronic urinary infection. If needed the myelomeningocele is repaired surgically as an urgent matter within the first twelve hours of birth and thereafter, if hydrocephalus is present, its extent is investigated radiologically.



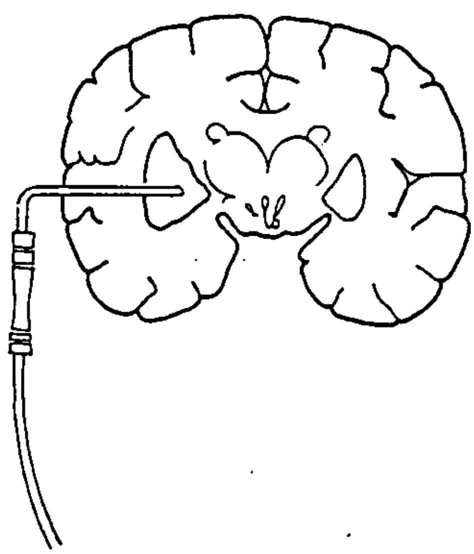
c) <u>Meningomyelocele with Hydrocephalus.</u>

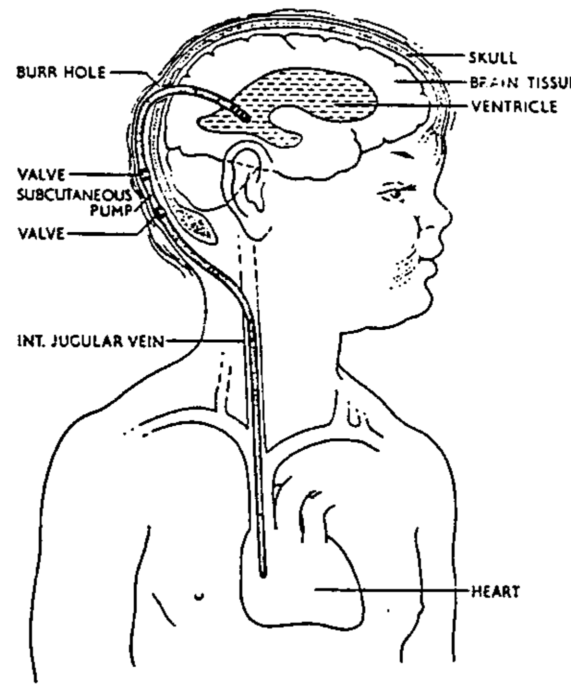
The high incidence of associated hydrocephalus with meningomyelocele adds to the severity of the problem. Hydrocephalus is a condition in which there is an excess of cerebral-spinal fluid, due to obstruction within the brain. The build-up of fluid results in enlargement of the head or, when the bony structure cannot extend at a sufficient rate, causes pressure on the brain. Lorber (1971) states that 75% of spina bifida children also suffer from hydrocephalus. In a paper given to the International Cerebral Palsy Society in Oxford (1973) Laurence writes that the head may be enlarged and may be frankly hydrocephalic; this condition being present in 80% of such children, even at birth. Pilling (1973) states that 85% of the children born with myelomeningocele are also hydrocephalic. Vulliamy (1972) observes that the hydrocephalus is sufficiently marked to require treatment in about 80% of cases. Vulliamy goes on to say that hydrocephalus of varying degree, due to the Arnold-Chiari malformation in the region of the foramen-magnum, is seldom entirely absent even though not sufficiently severe to need treatment.



Since 1958, it has become increasingly common practice where hydrocephalus is present or suspected and does not show early spontaneous arrest, to insert a valve mechanism into the head. This valve which is usually the Spitz-Holter or Pudenz-Heyer type, drains the excess fluid from the lateral ventricles into a silicone pump through a catheter into the venous system, and is ultimately reabsorbed by the body.

<u>The Shunt Valve.</u>





The Shunt Valve
for relieving excessive ventricular pressure in the brain

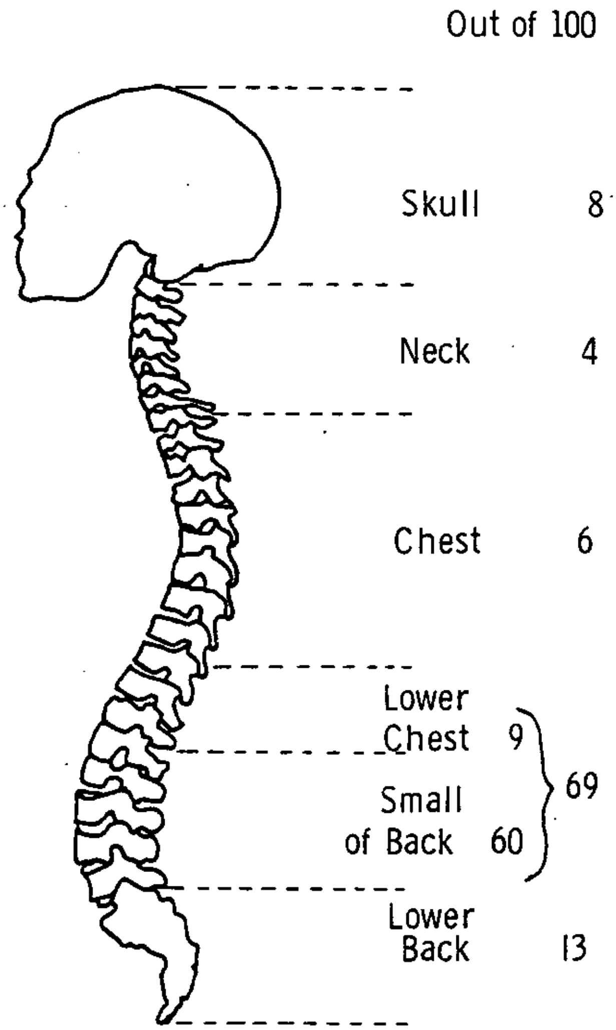
d) <u>Encephalocele (cranium bifidum).</u>

This is a closely related condition of children with spina bifida. Here the defect occurs higher up the spine and involves the back of the skull where the bone is defective. There is a protrusion and cystic swelling often including cerebral tissue through the defective skull bone. The most common handicaps are blindness, spasticity and convulsions with hydrocephalus frequently occurring. Lorber (1974) states that encephalocele accounts for about one-tenth of all cases.

Encephalocele

The diagram below shows the number of positions on the spine where the spina bifida lesion may occur. (Nettles, 1974). Children with spina bifida thus vary considerably in the extent of their handicaps, from those with no or minimal handicap, to those who are severely handicapped both physically and mentally.

<u>Distribution of the spina bifida "fault".</u>



Incidence of spina bifida.

The incidence in the British Isles is most usually reported as in the region of 3 per 1,000 births of whom 2.5 per 1,000 survive, 'Smithells (1965) and Vulliamy (1972). Laurence (1966) gives a figure of 4 per 1,000 for the mining area of Glamorgan and estimates the national average to be about half this number. Spain (1970) estimates 1.5 per 1,000 for the Greater London area and Lorber (1974) having given the figure of 2 out of every 1,000 born as suffering from this malformation, adds that about 1 out of every 4 is still-born or dies soon after birth. It can be assumed therefore from these reports that of 2,000 spina bifida babies who are born in Great Britain annually, some 1,500 survive. There is a consensus indicating that since approximately half these children will survive to school age, their numbers can be expected to approach those of cerebral palsy. A recent estimate given to the writer of the number of spina bifida children currently attending school in England and Wales is just below 4,000, most of whom are in special schools, (Newman, 1978).

Ethnic variations.

The ethnic differences are well documented; for example, the high birth frequency in the United Kingdom, especially the North and West, in North India, in Egypt, the intermediate frequency in much of Europe and the low frequency in Mongolian people. It is particularly common in those of Celtic extraction such as the Welsh and Irish. Spina bifida is rare in negroes and Ashkenazi Jews regardless of whether the overall rate in the place where they reside is low or high. On the other hand, Field and Kerr (1973) show that the rates among white Australians are much lower than in the English, despite a largely common ancestry. Leck (1974) states that the incidence of spina bifida in immigrant groups whose families originated in areas where the condition is prevalent lies somewhere between the rate found in the original and present areas of residence. Examples of this are the Japanese who have emigrated to Hawaii and children of non-Welsh ancestry who now live in Wales. Investigators have found, according to Buchan and Morrisey (1976), that the mortality rate of spina bifida children was two to three times greater on the Atlantic than the Pacific coast both in Canada and the United States. Carter (1974) observes that when these differences persist after migration they are not necessarily genetic. Cultural difference, for example that of diet, may be maintained for several generations. However, the negro populations have a low birth frequency of neural-tube malformations whether in West Africa, the United States, the West Indies or in Britain via the West Indies, Leck (1972). There are, however, also indications that an ethnic group may change its birth frequency of neural-tube malformations after migrations, implying an environmental influence. For example as Morton et al. (1967) have demonstrated, among Japanese in Hawaii the incidence is higher than in Japan itself. In Israel, the immigrants from Iran, Iraq and the Yemen have relatively high rates but these disappear in the next generation when the parents are born in Israel, (Naggan 1971). The causes of such changes are not clear. In the case of British migrants to Australia an improvement in the general standard of living is associated with a fall in the incidence; on the other hand with respect to migrant Japanese in Hawaii, there is an increase in the incidence as well as an improvement in the living standard. Carter (1974) has reported from existing statistics the frequency of neural-tube malformations in cities in England, Hungary, Japan and Nigeria.

City	Total Births	Spina bifida
Birmingham	94,476	2.5 per 1,000 births
Budapest	94,900	1.9 " " "
Hiroshima and Nagasaki	44,109	0.3 " " "
Lagos	16,720	0.2 " " "

Field (1970) summing up the puzzling variations between races and stressing the uncertainty of this factor, poses the problem of the differences even within a race, as for example a comparison between the babies born in one Welsh valley with those in another.

Social Class.

Laurence et al. (1968) and Leck (1972) show that recent regional studies in the U.K. indicate that there is a two-fold higher rate in the children of men in classes 3, 4 and 5 than in 1 and 2. A recorded negative correlation between anencephaly, a closely associated condition with spina bifida and social class has been shown by Anderson and Spain (1977), the incidence being higher among the lower social classes. Lorber (1974) agreeing that this condition is more common among the poorest members of the community also points to the fact that the rich and the highly educated are not exempt from the risk. Allum (1975) seriously questions however the connection between spina bifida and social classification contending that apart from the evident cases of exceptional hardship it is difficult to see any difference in the various socio-economic classes that might affect an embryo baby, and this is true with respect to eating, drinking and the use of pharmaceutical products. Furthermore, Allum asserts that many spina bifida babies come from very comfortable well-run homes where there seems to be no important material shortage whatever the socio-economic groupings of the parents. Carter (1969) suggests that it would be interesting to investigate whether it is the social class in which the mother herself grew up which is the more important factor or the one into which she married. It would therefore appear that although spina bifida is relatively rare in the children of men in occupations of high socio-economic status, the observed trends have been of variable extent.

Sex difference.

In western countries neural-tube defects affect more girls than boys; this being particularly true of encephalocele where, according to Lorber, the proportion is of the order of 7 to 3. Leck (1974) reports that most recent studies with respect to spina bifida show a ratio of girls to boys of 10 to 8.

Parental age.

Allum (1975) and Anderson and Spain (1977) report that the incidence of spina bifida is highest in babies born to the youngest and the oldest group of mothers. Leck also emphasizes that there is a widely observed tendency for rates of spina bifida to rise toward the end of reproductive life. Allum asserts that the age of the father seems to have no independent effect.

Birth order.

Most researchers observe that although spina bifida can occur at each birth rank there is a much higher incidence in first-borns than in subsequent births. A common finding is that the condition is low in second and third-born children but the incidence increases in later births. Leck notes that unlike Britain and North America, the trend of spina bifida is seen only among first-births in Israel.

Future risk.

Studies of the incidence of neural-tube malformations in the siblings of affected children indicate that the proportion affected is around 1 in 25. Lorber (1974) stresses that if a mother was sufficiently unfortunate to have first and second-born spina bifida babies then the chance of having a third child similarly affected increases to between 1 in 8 and 1 in 12. Anderson and Spain (1977) note a general finding that a child with spina bifida or anencephaly is more likely to have a sibling with either type of malformation. There is also, according to these researchers, some indication that the risk to cousins is almost twice as high as it is for the general population.

Seasonal trends.

Long term trends have been observed in many studies of neural-tube defects including spina bifida. In the more extensive series these trends have been observed in the form of epidemics during which the rate for these defects gradually rose by two-thirds or more and then fell to their original level. For example Leck reports such an epidemic occurring in Birmingham between 1950 and 1965. National mortality statistics with respect to spina bifida suggest a similar pattern throughout England and Wales as that which occurred in Birmingham.

Most British studies of the sixties suggest that spina bifida continues to vary in prevalence between a peak and a trough affecting

Spring and Autumn conceptions.

Both anencephaly and spina bifida have peak seasons of incidence, the rates being higher than average in winter births and lower in summer births. The high-rate months for conception of babies with neural-tube malformations in England are during the spring. It appears however that this relationship with the seasons is reversed in Australia.

Elwood and Nevin (1973) and Carter and Evans (1973) discuss consistent trends for the incidence of neural-tube malformations for years at a time. For example the incidence of spina bifida rose in the decade preceding 1961, between 1961 and 1968 it decreased steadily rising again between 1968 and 1972. It is interesting to note in this connection that Lorber observes the incidence of spina bifida to be more common during economic depression and war than during prosperity and peace.

Causes of spina bifida and associated disorders.

There has been considerable research into causal factors of these conditions. Geneticists, on the basis of family studies and marked ethnic differences conclude that although it is likely to be a hereditary causal factor, considerations should also be given to environmental factors. They take this view because the incidence is not nearly as high as would be expected if the factors involved were solely hereditary.

Several attempts have been made to identify environmental influences by correlating the prevalence of neural-tube defects with the intake of various minerals, for example, the intake of tea, potatoes affected by blight, nitrates and nitrites in cured meats and magnesium salts in canned peas. The influence of drugs and infections on neural-tube defects has also been examined. As yet there is also no evidence that the taking of any drug or particular foods in pregnancy has any specific bearing on the problem. What has emerged from the increasing literature upon the subject is that these neural-tube abnormalities are familial, the predisposition tends to be polygenically determined, the malformation as Ellis and Mitchell (1973) sum up, is precipitated by an unfortunate combination of geographical location, social class, maternal age and other as yet unknown factors.

Historical treatment of spina bifida.

Spina bifida, although presenting a relatively modern problem within schools, is a condition which has existed throughout history. Ferenbach (1963) states that malformations of the lumbo-sacral vertebrae were evident in skeletons which are at least 12,000 years old. McWhirr's (1978) archaeological excavations of a Roman cemetery in Cirencester provided details which show that of the 421 burials 5 had suffered from spina bifida. The spina bifida condition which was known to Hippocrates was also recognized by mediaeval Arab physicians, who, according to Denuce (1906) specifically discerned the spinuous processes in the affected area. The teacher-physician Nicolai Tulp, who is portrayed in Rembrand's painting "The Anatomy Lesson" (1632) was the first to write a concise description of spina bifida. Tulp's graphic illustrations of spina bifida which are found in 'Observations Medicae' (1652) indicate his clear recognition of the involvement of the central nervous system in the swelling on the infant's back. It is clear also that Tulp appreciated the serious consequence of incising the tumour. There were sporadic reports of the treatment of spina bifida, usually with fatal results during the two centuries following Tulp. Differentiation between paralytic and non-paralytic types of spina bifida was described by Von Ruysch in 1714 and in 1761 Morgagni, who had studied different aspects of hydrocephalus, linked this condition with spina bifida. Cooke (1822) in his translation of Morgagni's work, describes "a spina bifida patient as being killed by the knife." Sir Astley Cooper is quoted by Morgagni, as stating that the treatment of spina bifida was either palliative by pressure or curative by puncture.

Lorber (1975) delineates several distinct historical phases in the classification and treatment of spina bifida. The first period commenced at the beginning of recorded history and lasted until the end of the 19th century. The next phase commenced with a renewal of interest in the subject by the medical profession, for example Virchow observed in 1863 that the cystic lesions of both the lumbar and sacral spina patients had a central pit and in 1881 Lebedeff emphasised that spina bifida was caused by a failure of the neural-tube to close during embryological development. A new method for the treatment of spina bifida by the injection into the cyst of a solution of iodine in glycerine began to be practised in 1877 by Morton, a surgeon in Glasgow; reports of such treatment were quite frequent by about 1880. One such report records that in a series of fifty patients treated by the iodine in glycerine injection, forty-one were said to have been cured. The committee set up by the Clinical Society of London in 1882 to investigate spina bifida and its treatment, advised in its report three years later against both ligation and excision favouring Morton's iodo-glycerine injection treatment. With the development of antiseptic treatment at the turn of the twentieth century excision of the sac became an orthodox treatment.

The third phase, namely the period between the start of World War2 and 1958, was, in Lorber's view, of special significance in the history of spina bifida. One of the factors in this resurgence of interest was the publication of a paper by Penfield and Coburn (1938) on the Arnold-Chiari malformation and its operative treatment; the result of which produced a far greater emphasis on the need to energetically explore the possibilities of surgery to alleviate these conditions. Lichtenstein (1940, 1942) also made a significant contribution to the body of knowledge concerned with various examples of spinal dysraphism. Lichtenstein considered that this condition was due to the neural-tube failing to close normally and was complicated by brain-stem malformations and hydrocephalus.

Since the late fifties there has been a marked rise in the number of spina bifida infants who have survived. One important factor contributing to this development was the invention by an American engineer named Holter of a shunt system to treat hydrocephalus. The first use of such a system was on Holter's own child, Casey.

This trend in the increase in the number of surviving spina bifida children has had obvious ramifications for schools and the related fields of educational theory and methodology particularly as they affect teachers of the physically handicapped.

It may be fairly said that 1971 can be regarded as the most recent significant date within the area under discussion. At the 1971 conference held in Freiberg of the Society for Research into Hydrocephalus and Spina Bifida, Lorber presented a detailed analysis of the progress of a group of 524 patients. Following this discussion an attempt was made to establish certain criteria which could be internationally observed in order to help in the selection or rejection of certain infants for treatment and possible survival. The criteria which emerged included the size of the spinal defect, the neurological level, the degree of paralysis, the presence of vertebral abnormalities and the degree of hydrocephalus. The implication of the consideration of such criteria being that the untreated infants would be expected to die. At the present time there is a marked decrease in the number of spina bifida babies who survive in those areas where Lorber's criteria are carefully observed. The future however, may see an improvement in quality of those children who are selected for surgery but the possibility of survival for some of those not selected must not be overlooked. Such infants could be expected to add to the number of severely handicapped children in the spina bifida population.

The writer has reviewed the literature concerned with the development of spina bifida children and has briefly outlined the relevant findings in the first part of the next chapter.

CHAPTER 3.

Review of the Relevant Literature.

The first part of this chapter is concerned with the intellectual and educational development of spina bifida hydrocephalic children and considers intelligence, language development, perceptual maturity and reading; factors which are clearly important in the development of number and mathematical skills. The section concludes with studies which refer particularly to number. The second part deals specifically with a detailed consideration of the number concepts necessary to mathematical logical development as outlined by Piaget in his major work on the subject. Attention has been given in the third section to the literature emanating from Piagetian theory which applies to children with varying handicaps. Finally, studies which concentrate upon Piagetian learning programmes are discussed.

I. Intellectual and educational development.

Lorber (1976), an acknowledged expert in the treatment of spina bifida children,states in a personal communication that although there are vast data on this aspect, he having at least a thousand serial I.Qs, the situation is complex. He affirms that most of the major medical units agree that spina bifida children who are not also hydrocephalic have a normal pattern of intellecutal development. When the writer compared the relevant studies it became increasingly evident that the term 'spina bifida' has wide connotations, and therefore reference to a clinical diagnosis would be helpful. This is due to the various ways in which the researchers describe their sample as, for example Merrill et al. (1962) who introduce their study of one hundred spina bifida children thus, "In this paper meningocele is used for both meningocele and myelocele". Anderson and Spain (1977) support the present writer's concern about the loose ways in which the terms meningocele and myelomeningocele are often used and warn teachers that they should not make assumptions about the likelihood of intellectual impairment simply because a child's medical records describe him as having a meningocele or myelomeningocele. Some researchers have graded their samples of spina bifida children into groups according to the severity of their handicap rather than to a fine clinical diagnosis. To some extent therefore, the category of spina bifida children with the least physical handicaps to which reference is made in some studies, may be synonymous with the clinical category of children with meningoceles.

ii. Children with meningoceles.

The studies which specifically refer to children with meningoceles indicate that their intellectual development is within normal limits. Doran and Guthkelch (1961) for example, found in their general survey of spina bifida cystica, that the sixty-four children suffering from what they describe as 'simple meningocele' showed no sign of intellectual deficit. This view is largely supported by Laurence and Tew's (1966, 1974) succession of follow-up studies of spina bifida children born in South Wales between 1956 and 1962. The mean I.Q. of the children diagnosed as meningocele and having relatively little physical disability was 94, which as the researchers observe, is closer to the average for a normal population than the mean I.Q. of those in the sample who had myeloceles. In a report by Krahe (1973) which indicates a significant correlation between motor defect and I.Q. the mean I.Q. of the twenty-two children who were least handicapped and who were able to walk without aids was 102. Badell-Ribera's (1966) analysis of the development of seventy-five patients with varying degrees of spinal cord dysfunction secondary to spina bifida cystica showed the mean I.Q. of the spina bifida children with the least physical handicap to be 108 with a range of 87 to 142.

ii. Children with meningomyelocele.

The following findings from relevant research indicate a consensus that the intelligence of children with meningomyelocele although within normal limits is skewed towards the lower end of the range.

Table I.

Research findings related to I.Q. of meningomyeloceles.

Researchers	Date	I.Q.
Eckstein & MacNab	1966	80% of sample are normal.
Shulman & Ames	1968	62% are within academic competitive range.
Mawdsley & Rickman	1969	80% normal.
Richings & Eckstein	1970	66% normal.
Scherzer & Gardner	1970	88
Kolin et al.	1971	88
Meijer	1971	90
Laurence & Tew	1971	90
Lorber	1971	87
Herren et al.	1972	normal
Levin	1974	97

Laurence and Tew, observing that the cases of myelocele in their sample were more physically handicapped than mentally, also noted that there seemed little correlation between the site of the lesion and intellectual performance. An interesting comment made by Levin was that his sample of myelomeningoceles were functioning at a much higher level than would have been predicted for them at birth, despite less optimal management by today's standards.

iii. Children with meningomyelocele and hydrocephalus.

Many researchers recognize that hydrocephalus represents a most serious early complication for children born with meningomyelocele, particularly with respect to intellectual development. Badell-Ribera et al. (1966) studied the relationship of non-progressive hydrocephalus to intellectual functioning of children with varying degrees of meningomyelocele. The hydrocephalic sub-group scored lower on the W.I.S.C. and presented a significant discrepancy between verbal and performance scores, which, the authors suggest, could be considered a characteristic sign of brain damage. It is of interest to note that the scores of the subjects having similar severe physical defect but without hydrocephalus were essentially normal. The results of the early treatment of extreme hydrocephalus associated with meningomyelocele was studied in detail by Lorber (1968); of sixteen such children only four had an I.Q. exceeding 80. Lorber's long experience of children with these associated conditions enables him to assert that the proportion of children with superior intelligence in children treated for extreme hydrocephalus in infancy is not less than that in the general population, as long as their hydrocephalus was not associated with meningomyelocele and their operation was not delayed beyond six months of age. Laurence and Tew (1971) who, reporting from a long experience of working with such children, observe that hydrocephalus can be a damaging condition and are of the view that resolute early surgery ought to reduce the number of cases of severe hydrocephalus which is so clearly related to intellectual deficit. A rather more extreme picture is given by Kilfoyle (1967) who, referring to the effects of delay in treating hydrocephalus says that when, later on in life, the correlation of facts and reasoning is demanded, "The light does not come on", and adds, "intellectual potential is literally squeezed out". In a rather complicated evaluation, Krahe (1973) found that hydrocephalus had clearly influenced the intellectual development of his sample; practically all those with I.Qs below 90 being hydrocephalic. It is interesting to note Krahe's observation however that those who had shunt operations, and particularly those with valve revisions had average or above average I.Qs. Lorber (1971), Parsons (1972) and Levin (1974) report mean I.Qs for their samples of 79, 69 and 84.

Several researchers have reported their findings in rather more general terms. For example, Lonton's (1975) analysis of a large group of spina bifida, hydrocephalic children show that 62% had I.Qs below normal. In a survey of the educational problems of spina bifida children Henderson (1968) suggests that the reason for those with meningomyelocele being of normal intelligence was the fact that hydrocephalus with consequent mental retardation had been prevented by ventriculocardiac drainage. Heimburger (1970)as a result of a long term follow-up study, expresses the view that the most disabling handicap of spina bifida children is the intellectual impairment usually associated with hydrocephalus. A similar view is held by Selder et al. (1971) whose research indicated that the sustained increase in intercranial pressure which occurs between meningocele repair and shunt insertion has an effect on the future intellectual development of the spina bifida child and also that shunt malfunction of longer than twenty-four hours duration adversely affects the child's future intellectual development.

Spain (1969, 1970) investigated in the London area the mental development of 151 spina bifida children who were classified according to whether or not a shunt had been inserted. Most of the children showing serious signs of hydrocephalus had received very early surgical treatment. Intelligence tests indicated a poorer prognosis for those children who needed surgical treatment for hydrocephalus than for those who did not. Upon reassessment,Spain observed that those children with shunts still had lower scores on all tests than those without and only one-third of the shunts appeared to be developing normally. Hunt et al. (1970) in a follow-up study of eighty meningocele children born with hydrocephalus, found they had a greater overall disability and a lower range of intelligence than those who had no hydrocephalus.

Having discussed the misleading nature of the term 'hydrocephalic' because unless otherwise indicated it might include both children with an initially mild degree of hydrocephalus which has arrested spontaneously as well as children whose hydrocephalus is severe and progressive, Anderson and Spain (1977) prefer the distinction to be made on whether or not a shunt had been inserted; that is, spina bifida children should be classified as with or without a shunt, the implication being that the shunt is a good indicator of severe hydrocephalus. Looking at spina bifida children in these terms these researchers conclude that there is clearly a strong association between the presence of hydrocephalus and impairment of intellectual functioning.

Herren et al's study (1972) of spina bifida children in France indicated that those with hydrocephalus were of lower intelligence than those without. Smith and Smith (1973) found in their sample of

88 myelomeningoceles that almost all of those who had not developed hydrocephalus or whose hydrocephalus was clinically insignificant and did not require a 'shunt', were of normal intelligence. Of those with shunts, two-thirds were in the normal range and almost one-third were retarded but educable. They concluded, therefore, that there was a significant difference in the intellectual outlook of children who required shunts.

Shulman and Ames (1968) reporting a study into the competitiveness of hydrocephalic spina bifida children show that 62% had a Developmental Quotient of 80 or above. These researchers add that an extreme degree of hydrocephalus at the outset of life is a poor prognostic sign for spina bifida children.

Eckstein and MacNab (1966) having reviewed the impact of modern treatment on 396 children with myelomeningocele and hydrocephalus concluded that the large majority of the survivors were mentally normal and, on the whole, the mental development had been better in children with hydrocephalus associated with myelomeningocele than in those with hydrocephalus only. These researchers suggest that this result is due to the fact that the condition causing hydrocephalus in the group not also affected by myelomeningocele has often caused severe brain damage which is reflected in subsequent mental retardation. Some investigators however have observed that the onset of hydrocephalus has not always been accompanied by mental deterioration; for example Hagberg and Sjorgen (1966) state that the intellectual faculties have been preserved despite quite advanced hydrocephalus. This view is echoed by Lorber (1973) who refers to some who in spite of considerable hydrocephalus grew up into normally intelligent adults becoming doctors, lawyers and so on.

<u>Summary.</u>

Although it is unwise to make generalizations about the intellectual development of spina bifida children since, as discussed previously, the term 'spina bifida' applies to a wide range of abnormalities, research does reflect the following observations :-

a) Although children with myelomeningoceles may fall into the normal range of intelligence, there is a tendency for the distribution curve to be skewed towards lower scores.

b) Children with simple meningoceles are likely to fall within the normal range of intelligence.

c) There is evidence that children with myelomeningocele and associated hydrocephalus, particularly where shunts have been inserted have on average lower intelligence than those without, although some are of high intelligence.

It is generally recognized that although the outlook for those children with a simple meningocele is better than for those with myelomeningocele, there is some evidence that the reason for the difference lies in the greater risk of hydrocephalus associated with the latter condition rather than in the details of the spinal defect itself.

Verbal ability.

Several investigators have observed that spina bifida children have a relatively high degree of verbal ability. Clinical observations of hydrocephalic children and impressions of parents and teachers suggest that they are more talkative than other children of their own age, that they have an advanced vocabulary and a good short-term memory, being able to repeat rhymes and jingles with ease. For example, it has been shown by Purkhiser (1965) that hydrocephalic children are superior to their non-hydrocephalic peers in a digit repetition test. The speech of hydrocephalic children has also been described as superficial, lacking in appropriateness to the situation, and that they misunderstand the words they use. Other researchers confirm that hydrocephalic children are also hyperverbal in clinical situations.

Diller et al's (1966) study shows that 28% of their spina bifida sample who were rated as hyperverbal, were characterised by a tendency to make irrelevant answers and guesses, particularly in stressful situations. It was noted also that this group, as well as tending to be more severely disabled, had a higher incidence of hydrocephalus. Fleming (1968) also observed that although the hydrocephalic children studied were not more verbose than the controls, they nevertheless did make a higher percentage of inappropriate responses, particularly conversational remarks about either the general testing situation or the examiner and in many instances unrelated either to the test or the situation. The percentage of appropriate responses, Fleming noted, increased with age. Buchan and Morrissy (1976) in reference to the spina bifida child's use of words which he cannot define, echo Fleming's observation that this type of speech declines as the child gets older.

An explanation given by Parsons (1969) for the discrepancy between clinical observations and the result of his study with respect to 'short-term' verbal memory of hydrocephalic spina bifida children is that their verbal ability seems good when compared with their other intellectual weaknesses and is therefore particularly noticed by parents and teachers. Swisher and Pinsker's (1971) findings also support the clinical impression that hydrocephalic spina bifida children are more talkative, use significantly more words, sentences and initiate more conversations than their non-handicapped peers.

Spain (1972) investigating the verbal ability of 145 spina bifida children found that those who had hydrocephalus sufficiently severely for a shunt to be inserted, did less well on all the tests than those without shunts; only a third of the children with shunts indicating normal development.

Several studies have been concerned with the observation that spina bifida children are sociable, pseudo-bright and display a trait frequently referred to as 'a cocktail party syndrome'. For example, Sadell-Ribera et al. (1966) having found that the hydrocephalic sub-group of their sample presented a significant discrepancy between verbal and performance scores on the W.I.S.C. test, state that this relatively high verbal score which is indicative of a sign of brain damage, supports the view of others that these children have this 'cocktail party syndrome'.

Smith and Smith's (1973) finding with respect to the same syndrome was similar to that of Hagberg and Sjorgen who had noticed that there was poor understanding of the words used and that other educational abilities were below the levels of the verbal scores. An important educational point made by Smith and Smith is that the hydrocephalic spina bifida children, especially those with borderline or mild mental retardation, who are sociable, have alert personalities and good speech, are apt to mislead parents and consequently the parents are not easily convinced of the child's true educational potential. Also the high verbal scoring in testing and functioning in the pre-school and early years may give an over-estimate of the child's ultimate educational ability as he moves to more abstract and formal thinking.

Laurence (1973) states that the so called 'cocktail party syndrome' is a learning disability almost specific to hydrocephalic children and consists of a particularly mature type of speech which appears on first hearing to be meaningful but with increasing familiarity is found to be no more than mere verbosity. As this syndrome is commonly associated with brain damage, difficulties in maintaining attention and concentration also combine to affect the learning process. Laurence and Coates (1962) state that brain-damaged children tend to retain the ability to acquire a vocabulary and this ability is greater than their general intelligence. Woodburn (1975) observing that some of the parents of the children in her sample had noticed a verbal facility in their own children suggests that the apparent acuity of hearing and verbal facility might be due to the more constant association with adults which spina bifida children have imposed upon them by their limited ability to play, frequent hospitalisation and concentration of intellectual function on unimpaired senses.

Spatial relationship.

Smith and Smith (1973) have observed that many spina bifida children have impairment of body image and spatial disorientation, such as confusion between right and left and which becomes evident in dressing and positioning. They also noted a lack of appreciation of the body in space, for example in standing and walking, and state that teachers have also reported the increased tendency for such children to reverse letters and words and also to be confused with respect to lines of print or diagrams. Hood (1975), having found a tendency for hydrocephalic children to make the same type of errors as normal children in the discrimination of letter-like forms, takes the view that the visuo-motor co-ordination skills of hydrocephalic children are inferior to those of normal children.

During 1969 and 1970, Miller and Sethi (1971) investigated children who had hydrocephalus with or without spina bifida by using the Bender Gestalt Test and the Frostig Developmental Test of Visual Perception. They found that the hydrocephalic children had extremely poor visuo-spatial perception compared to the controls. In fact no subject in their sample obtained an age-equivalent score within eighteen months of his chronological age on the Bender Gestalt test. Laurence (1973) in a reference to the work of Wallace in Cardiff, supports the view that the Arnold-Chiari malformation which is frequently present in spina bifida children, can produce upper limb dysfunction in the form of paralysis and inco-ordination, which, in turn, causes lateral confusion and loss of fine finger control. Parsons (1972) suspects that weak hand-eye co-ordination and visual perceptual impairment could have been partly responsible for the under-performance of spina bifida teenagers on tests of spatial ability and manual dexterity.

Sands and Rawlings' (1973) study of the visual-perceptual functioning of spina bifida children, showed that 59% fall below the criterion for normal performance on the Frostig Developmental Test. Those who showed age-appropriate visual functioning tended to be without hydrocephalus, had higher I.Qs and lower spinal-cord lesions.

Sands et al's (1974) study supported their view that an assumption of unimpaired hand function in spina bifida children, with and without hydrocephalus is unwarranted. The deviant performance of the meningomyelocele children occurred more uniformly, and was of greater magnitude for those with associated hydrocephalus, or with an I.Q. of less than or equal to 79. This last observation of Sands et al. finds an echo in the study of Tew and Laurence (1975) who, having examined the visual perceptual functioning of spina bifida children suggest that impairment of such ability is strongly associated with low intelligence and is in all probability an expression of it. Tew and Laurence, observing that the children with shunts had most problems, found that two-thirds of those without hydrocephalus were normal.

Spain (1970) having tested young spina bifida children, and finding that those with hydrocephalus did poorly on a test involving hand-eye co-ordination, suggests that this result may imply some kind of cortical or brain-stem damage which specifically affects finer hand movements, perception of shape and concentration. Herren et al. (1972) also found a tendency for an appreciable incidence of failure in perceptual tests.

In a recent study of the perceptual processes of children with myelomeningocele and hydrocephalus, Gressang (1974) found, contrary to expectation, that there was no significant difference between the scores of the myelomeningocele with hydrocephalus children and the myelomeningoceles without hydrocephalus on perceptual -motor tests. Surprisingly, the hydrocephalic children tended to score more highly. Hood also found little difference between hydrocephalic and non-hydrocephalic children on tests involving visual perceptual skills. Scherzer and Gardner (1971) reporting on a study of the fourteen children with meningomyelocele on the Bender Gestalt Visual Test, found that no child scored better than age expectation. The four children who showed significant perceptual motor dysfunctioning using the Koppitz' norms, had I.Qs below 70.

In a recent interesting study concerned with the handwriting abilities of spina bifida children aged 7½ to 10½ years, with a mean I.Q. of 88, Anderson (1976) observed that the children varied in their ability compared with the controls; the latter wrote significantly faster whilst the spina bifida children's writing, apart from being slower, was also significantly poorer, less accurate and with some clear evidence of ataxia and tremor.

Rothstein et al. (1974) studied the ocular abnormalities of children with myelomeningocele, some of whom were also hydrocephalic. Rothstein concludes that since strabismus occurs in 2% to 4% of the general population, the incidence of strabismus, 34% in this sample, is significant. It was particularly noticeable, Rothstein adds, that no strabismus was found in the pure meningomyeloceles while the incidence in those with associated hydrocephalus was 44%. Woodburn's (1975) survey of spina bifida children in Scotland shows that 55% of her sample had visual problems ranging from minor squints to major eye defects. Jones and Long (1976) state that spina bifida children may suffer severe visual impairment as a complication of their hydrocephalus. It is suggested by these researchers that such children have specific learning difficulties due to associated brain damage caused by raised intra-cerebral pressure either in early infancy or later as a result of valve failure.

A most useful booklet published by the Association for Spina Bifida and Hydrocephalus (1975) sums up the findings of many researchers in this way, "The term perceptually handicapped may be applied to these children. They may have problems in figure-ground discrimination and in spatial judgement". Sand and Rawlings (1973) present the teacher with the problem of speculating whether the increased occurrences of visual perceptual dysfunctioning which is characteristic of spina bifida children, is due to their lower extremity motor dysfunctioning restricting early opportunities for motor and perceptual learning, or the extent of brain damage.

A similar problem is posed by Anderson and Spain (1977) who say that it is difficult to decide whether poor pattern copying ability is largely the result of neuro-muscular impairment or whether it is related to the child's difficulties in organizing hand movements. Three important factors for consideration are put forward by these researchers :-

a) The associated condition of the cerebellum, namely the Arnold-Chiari malformation.
b) Possible damage to the motor cortex resulting from hydrocephalus which can affect upper limb functioning.
c) The greatly restricted mobility of pre-school spina bifida children.

Reading.

Although there are several large scale studies concerned with the reading ability of children it is difficult to specifically isolate the performance of spina bifida children and consequently make an overall judgement as to their ability in this respect.

An example from these studies is that of the Isle of Wight Survey reported in detail by Rutter et al (1970) in which, although there is a group designated as neurologically impaired, those with spina bifida, with or without a shunt, are not referred to as a specific sub-group.

The findings of the Isle of Wight Survey which were based upon teachers' ratings and performance on Neale's Analysis of Reading Ability, showed that the neurologically impaired group were retarded in reading on both counts when compared to the normal. The teachers' ratings indicated that 30% of the neurologically impaired group were average readers, 50% poor readers and 17% non-readers. The group's attainment on Neale's Test reflected overall reading retardation of fifteen months. Anderson's (1973) study of the reading ability of physically handicapped children showed that on average the spina bifida children's reading age approximated to their chronological age while the cerebral-palsied and non-handicapped children were, on average, seven and twelve months behind respectively. 41% of the spina bifida children, 28% of those with cerebral palsy and 14% of the non-handicapped children were reading at or above their chronological age. Anderson emphasizes the point, which emerged from her study, that whereas the poor and non-readers, who were either spina bifida or cerebral palsy tended to be those of low I.Qs, those in the non-handicapped control group had I.Qs in excess of 90. The results in subsequent tests of reading comprehension led Anderson to conclude that spina bifida children's grasp of the mechanics of reading is better than their comprehension.

Segal's (1971) study of the academic progress of children in one special school showed, as did Anderson's investigation, that despite a weakness in word recognition the spina bifida children were better readers than those with either cerebral palsy or muscular dystrophy. An analysis of the reading standard of thirty-five spina bifida children with a mean chronological age of 12.6 years by Pearse (1977) shows the group to have a mean reading age of 9.4 years thus reflecting a three-year reading lag.

One of the earliest studies specifically concerned with the reading ability of spina bifida children was conducted by Diller et al. (1969). In this study hydrocephalic spina bifida children were compared with those having spina bifida only and also with another group of children with congenital limb deformities. The findings of this particular study showed that whereas those with hydrocephalus were retarded by some eighteen months in reading, the other groups had no unusual problem.

Tew and Laurence's (1972) study of spina bifida children in South Wales shows 37.5% of those with myelocele to be retarded by between one and four years in reading when tested on the Neale Analysis of Reading ability; 47% of those with meningocele were also retarded in reading despite having higher intellectual level and less physical handicap. An important observation made by Tew and Laurence was that whereas in a previous paper (1971) reasonable agreement between measured intelligence and reading quotients had been noticed, there was now a marked deterioration in performance in the series as a whole. They observed also despite substantial differences in the degree of disability, higher levels of intelligence and, on the whole, uninterrupted school attendance, there was little difference in the degree of retardation between those having myeloceles and those with meningoceles.

Another study by Tew and Laurence (1975) in which data had been collected on seven-year old spina bifida children who had been born later than those in the previous study to which reference has been made, showed that whilst the spina bifida children without shunts tended to do less well than the controls on the Vernon Reading Test, those with shunts were <u>much</u> less successful. Those without shunts were retarded by six months whereas those with shunts by sixteen months.

The G.L.C. Survey of spina bifida children conducted and reported by Spain (1970) reflects early differences in the reading potential of those with and those without a shunt. Although caution should be exercised before making a judgement based on this particular survey of six-year old children because it relies on teachers' assessments only, there is nevertheless a tendency observed in this study for those with shunts to have more problems in the early stages of learning to read. It is also interesting to note in the G.L.C. Survey that whereas 55.6% of the shunts attending normal schools were classified as readers only 14.5% of those who attended day special schools for the physically handicapped were assessed to be readers. When the non-shunts were considered, it was found that 70% of those attending normal schools were classified as readers and 28.5% of those in day special schools were also assessed as readers. It is important to note that the normal children used as controls in the survey and the spina bifida children without shunts had higher I.Q. scores than those with shunts, this being particularly noticeable with respect to those with shunts who attended the day special schools.

Anderson and Spain (1977) cite interesting data prepared by Cope and Anderson (1977) from a comparison of the reading ability of physically handicapped children of junior age attending special units for the physically handicapped in ordinary schools with that of those attending special schools. The results showed a measure of reading retardation in both groups, 50% of the shunts attending the special units and 75% of the shunts in the day special schools being retarded by over eighteen months. Four of the unit children and none of those in the special schools were reading at a level above their chronological age.

Although Anderson and Spain rightly emphasize that there is insufficient research on the reading ability of spina bifida children to allow for firm conclusions to be drawn the research findings which the writer has studied indicate certain trends. Firstly, there is quite a large group which includes most children without shunts and the more able with shunts, who are unlikely to have any serious difficulty in learning to read, secondly there is a tendency for those spina bifida children who are in normal schools to do slightly better than those in special schools and thirdly, those with a low I.Q. who also have a shunt, are likely to be slow in reading.

Number development.

The view of many experienced teachers of physically handicapped children is that spina bifida children, particularly those with a shunt, have weaknesses in number and mathematics, and this is supported by research findings. Several head teachers such as Bakehouse, Pearse, Statham, Williams (1977) in personal communications have expressed the opinion that overall spina bifida children have specific problems in number and mathematics. Lorber (1975) has also strongly expressed the opinion in the B.B.C. Television programme Controversy that spina bifida children have particular weakness in mathematics. Tew and Laurence (1972) investigated the performance on Vernon's Graded Arithmetic-Mathematics Test of a group of children aged between nine and fifteen years diagnosed as either meningoceles or myeloceles. They found that 78% of the sample as a whole were retarded by more than a year on this particular test and they also noted that 65% of the meningoceles were retarded even though they were less handicapped physically and more intelligent.

A later investigation by Laurence and Tew (1975) of the mathematical development of seven-year old spina bifida children who were tested on the N.F.E.R. 'Mathematics Attainment Test' showed that even those children with no shunt had lower arithmetic scores than the controls. The children who did the least well were those having shunts, 46% being unable to score at all on the scale. Tew and Laurence having noted that "about one-third of the spina bifida cases were wholly incapable of simple counting at the age of seven", conclude that overall arithmetic is the weakest school subject for spina bifida children.

A comparison was made by Anderson (1973) of the number ability of a group of physically handicapped children with and without neurological abnormalities. Teachers were asked to assess these children on the same five-point scale as was used by Pringle et al. (1966) and Davie et al. (1972) in the National Child Development Study. The physically handicapped children on the whole performed less well than the controls and also less well than the original large sample reported by Davie et al. It is noticeable that when the physically handicapped group was classified into sub-groups according to their neurological state the children with no neurological abnormalities corresponded more closely to the controls and were very similar to the 'national' group and those who were neurologically affected gave evidence of poor arithmetical ability. 78% of the neurologically abnormal group, which would include spina bifida children with a shunt, were rated by teachers as being well below average ability in number work compared to 29.5% of those without such abnormalities, 31% of the controls and 35.5% of the 'national group'. It is important to notice however that when the results of this particular study were subjected to an analysis of co-variance and the I.Qs taken into account the difference between the groups was no longer statistically significant.

A recent study of the development of certain mathematical concepts of ordination, cardination and seriation in spina bifida children conducted by Jenkins (1977) indicated that with respect to seriation three of the twenty-two spina bifida children tested were rated as non-functional, seven were at a transitional stage and twelve were fully functional. When ordination and cardination was considered only one child was assessed as being non-functional, five as transitional and sixteen fully functional.

Diller et al. (1969) comparing the performance in arithmetic of spina bifida children with and without hydrocephalus found that the former lagged behind the latter by two years and six months. Hood (1975) however, albeit on a small sample, found no significant difference between the scores of the children with and without hydrocephalus on the arithmetic sub-tests of the W.I.S.C.

The existing research findings, coupled with the consensus of teachers, indicate that spina bifida children, particularly those with shunts, find even more problems with number than with reading. Haskell (1972) investigated possible reasons for this characteristic weakness of physically handicapped. Concluding that the attempts to correlate relationships between neurological disorders and mathematical difficulties were generally contradictory and inconclusive, Haskell suggests that the best strategy would be to look at factors such as early experiential deprivation, lengthy periods in hospital, perceptual problems all of which combine to affect subsequent competence.

Other than the small pilot study by Jenkins (1977) to which reference has been made, the writer has not found any investigation into the number concept formation of spina bifida children. It is true however that there is a growing volume of literature which deals with this aspect of concept formation as it applies to handicapped children in general. Many of these studies have been briefly summarised by Lunzer (1973), Modgil (1974), Suppes (1974) and Modgil and Modgil (1976). Recognizing the overlapping nature of handicap the writer considers that very much of this literature has relevance for the teacher of the spina bifida child.

Most of the reported studies are based upon Piaget's theories and it is therefore appropriate that the present writer should consider the implications of these and other supporting investigations.

During a seminar (1975) organized by the local Association of Teachers of Mathematics in which the writer participated, Fletcher, an H.M.I.concerned with mathematical education in schools, complained "The theories which underline Piaget's work are of the greatest importance, but we do not study them. Piaget's view is that structural ideas of modern mathematics are more in tune with children's natural ways of thinking than in the ideas traditionally regarded as elementary mathematics". The writer is of the view that Piaget has much to offer the researcher anxious to discover root causes to learning disabilities and therefore in the next section of this chapter outlines Piaget's theory of the genesis of number concept formation. The final part of the chapter concludes with Piaget's work as it relates to the handicapped in particular.

2. Piaget's theory of the development of number concept.

Piaget made an extensive study of the development of number, beginning with relatively simple conservation of continuous and discrete quantity, and proceeding through cardinal and ordinal one-one correspondence to additive and multiplicative compositions. The wide range of subjects which were investigated by Piaget in his extensive study can be found in The Child's Conception of Number (1952).This work gives a comprehensive insight into the scope of Piaget's findings in this field. The technique Piaget employed was to give each subject a task to perform; questions were then asked about the reasons for the subject's actions and responses, and the results recorded in a series of protocols. The procedure was not standardised in the accepted sense, but varied slightly from child to child, so that the conclusions were drawn from well-founded but still subjective impressions. The frequency with which certain phenomena emerged, even with the fluctuations in presentation, are extremely convincing making it difficult not to accept Piaget's major finding of the existence of three definable stages in the development of the particular notion concerned. Piaget demonstrates that the concept of natural number is acquired only when the child has reached the stage of concrete operations . This is a fact of great importance in the orientation of teaching practice.

Although teachers may not be fully conversant with Piaget's theory of number, they are nevertheless, most interested in demonstrations of the types of number situations and the child's reactions to them which are outlined by Piaget in The Child's Conception of Number. This is particularly true of teachers of handicapped children who are frequently uncertain of what might be expected of their pupils with respect to concept formation.

It seems likely that such teachers feel that Piaget has something new and helpful to say on this important subject of number and are concerned to know what fresh ideas he has added to their knowledge of the child's number thinking. It is no coincidence that the first published volume of the Nuffield Mathematics Project (1967) is dedicated with gratitude to Jean Piaget, and it is also interesting to note the special position with which his theories were held at the Second International Congress on Mathematical Education (Howson 1973).

Piaget is not primarily concerned with the computational aspects of mathematics in themselves, but is rather concerned with a far more subtle and fundamental aspect of number, namely, the properties of number relationships and the corresponding mental operation needed to comprehend and manipulate them. If these are clearly understood, from both the objective and subjective points of view, the teaching of arithmetic and mathematics can be related to the operational level of the child enabling him to gradually build up a sound structure of number concepts which, in turn, can form a basis of still higher mathematical instruction. The concept of number readiness, as used by Churchill (1961), whilst not wholly adequate, is probably a useful description of the basic aim in Piaget's study in the realm of number. Piaget is attempting to diagnose what levels of number readiness are essential at each phase of number education, and although it is difficult to define and determine the exact nature of a child's preparedness to begin a new aspect of work, some such notion is useful. Piaget suggests the following factors that influence the changes in the child's intellectual capabilities during his formative years:-

(i) The effects of heredity and internal maturation which cannot be separated from those that result from experience and learning.

(ii) The effects of experiences acquired in interaction with the physical environment.

(iii) The influence of the social milieu which embraces education in its widest sense.

(iv) The effect of that which Piaget calls equilibrium and which he feels is the most important factor. Equilibrium, in Piaget's terms, describes the way in which a child seeks to bring about a balance of two complementary processes, namely assimilation and accommodation. The teacher can only teach successfully that which can be assimilated and which the child can accommodate. Piaget points out that the equilibration process obtains its drive from a child's need for it.

Piaget demonstrated the great gulf which exists between the young child's being able to count and even the most rudimentary real numerical idea. Counting, for Piaget, does not generate number. The child, who, when he enters the reception class at five years of age, can count by rote, or even rationally to ten or fifteen has, according to Piaget, little or no idea of number. Piaget showed in his research that concepts are developed gradually. Greco (1959) quoted by Laurendeau and Pinard concluded, after certain ingenious experiments, that "Learning may give rise to the acquisition of empirical knowledge consisting in the ungrounded acceptance of observed facts, a knowledge which is accepted but not understood, which is limited to the situation being considered, and moreover rapidly lost. The child may count a group of objects and label them six to his teacher's satisfaction. He can do the same with a second group of objects. But the first six may be more or less than the second six, as the teacher lengthens or shortens the lines of objects. The child may even prefer to keep for himself a long line of four sweets rather than a short line of five. Six, to a child of four or five is not the stable, unchanging quantity that it is to an adult." Piaget, having found this result in all his experiments, writes that the child at this stage of development has little idea of the constancy of a quantity of liquid, or a number of beads, or of how to correspond objects or how to make a series. Each experiment confirmed Piaget's view that the younger children tested have no concept of number or quantity in any of the aspects he has discussed.

Ironside and Roberts (1965) agree that Piaget's experiments have shown that we can easily be misled by an acquired skill such as counting, as to the stage of development the child has reached. Other investigators such as Churchill (1961), Lovell (1961), Kruteskii (1965), Wheatley (1968), Charles (1974) and McNally (1974) support Piaget's contention that a knowledge of number names and counting as a rote operation is not a guarantee of the existence of a genuine set of number concepts.

Russell (1961) argues that the operation of counting in fact, can only be intelligently performed by a person who has already some idea of what the numbers are; and from this it follows that counting does not give the logical basis of number.

Piaget hypothesizes that the construction of number goes hand-in-hand with the development of logic, and that a pre-numerical period corresponds to the pre-logical level. Laws of logic are elaborated by children in the course of their development.

Translating this into more specific terms, Piaget maintains that before an individual can build up a true comprehension of number, he must be able to appreciate several basic properties of number. For example, just as a very young child has to acquire the notion that objects in his environment have a stable existence of their own, so an older child has to build up a notion of the stability of a quantity before beginning to comprehend number. That is, the child has to accept that a number will remain identical with itself, has to appreciate that quantity is a property independent of his own perception, and has a stable existence of its own, no matter what divisions are made in it. This he does through the ability to reverse his mental processes. At the same time as the notion of invariance or identity is being acquired, a child has to build up both cardinal and ordinal aspects of number. The cardinal aspect is, for Piaget, akin to the notion of classes. Before it can be enumerated, a collection of objects has to be conceived of as a class of objects, the logical operation of classification coming in here. Out of this classification grows the ability to appreciate correspondence with like objects in another group which is the beginning of one to one correspondence in its simplest form. Invariance of quantity is also a requisite for a true understanding of one to one correspondence especially when the correspondence is arithmetical rather than perceptual.

The ordinal aspect of number develops at the same time as the cardinal aspect. A collection of objects to be enumerated must also be arranged in some form of series for the enumeration to be accurate. At first it is probably a series based on spatial ordering so that systematic counting can be done. Later a realization of the serial nature of numbers themselves develops from the acceptance of the relationship between them. Therefore, in both cardinal and ordinal number correct enumeration is the end product of the ability to see classificatory and serial relationships and cannot precede it, despite the fact that many children at quite an early age learn the number names and may appear to use them correctly. For Piaget, the test of true number understanding is the child's level of ability to accept the invariance of quantity, to classify, to seriate and to appreciate one to one correspondence; all of which imply a fairly advanced degree of mental flexibility. A child is ready to learn the number processes more formally after he has achieved the general notions associated with them. But even here there is a hierarchy in the various aspects of these number processes. The notion of conservation of discrete quantity, for example, does not imply that the child is ready to understand the conservation of volume and weight.

Piaget theorises that the development of notions essential to an understanding of number, that is, invariance of quantity, conservation, one to one correspondence, classification and seriation, takes place in the period of pre-operational thought and more specifically in the sub-period of intuitive operations. The ages generally given are from five to seven or eight years, but in fact the higher refinements and applications of these operations continue to develop through to the age of eleven or so in normal children. However, the crucial ages are the earlier ones and much of Piaget's empirical research is devoted to tracing the development during these periods. His experiments suggested to him that each of the crucial operations develops in recognizable stages. It is necessary to make a distinction between the larger stages in the development of intelligence as postulated by Piaget and the stages of development of a particular notion. Any stage is characterised by a certain type of coherence but the nature of this coherence may vary. With respect to the general development of intelligence the stages are defined by a general operational structure, although in this case Piaget (1947) sometimes refers to 'periods'. On the other hand, in the case of a particular notion the stages are defined by the absence of contradiction in fields of growing dimension and complexity. Sometimes Piaget uses the term 'level' either as a synonym for stage or to differentiate successive moments within a stage. His tests elicit three distinct types of responses :-

(i) There is the stage where the operation in the specific situation does not exist at all.

(ii) There is a transitional stage, where the operation is sometimes seen, especially when perceptual criteria are strongly contrasted, but the child is not very secure in his judgements and is easily dissuaded. In this stage he may make a correct judgement but be unable to explain adequately why it is so.

(iii) The operation is fully acquired. The child is convinced that his judgement is correct and is able to give adequate reasons for it. Piaget considers such a child to have reached a concrete, operational level in that specific situation.

At the beginning of his experimental work, Piaget set out the course his experiments were to take. They were to be conducted as play situations using commonplace materials such as eggs, plasticine, beads, flowers, dolls and lemonade in the tests. Hyde (1970), agrees that one of the main features of Piaget's tests was the simplicity and familiarity of the materials used. Hyde adds that it is this use of familiar material which makes the tests suitable for repetition with children of varying backgrounds and environments. Even the most primitive peoples are likely to be familiar with clay, water and simple containers.

The children were interviewed separately, each child being allowed to manipulate the material for himself, to work at his own rate in a play atmosphere and to express his ideas to the best of his ability.

Conservation.

Quantity, according to Piaget, begins as quality, and is apprehended initially in terms of the perceptual dimensions of the quantity. As such, the idea of quantity is liable to fluctuate with changes in the perceptual organization. The abstract idea of number comes about as a result of the understanding of the conservation of quantity. Piaget stresses that the principle of the conservation of quantity or a set is fundamental to the child's development in the understanding of the invariance of number and quantity.

Piaget's theory of conservation of number requires that the child understands the use of two processes in order to conserve quantity; firstly, the notion of the unit or the understanding that a quantity is divisible, and secondly multiplication of relations whereby the child can relate the perceptual dimensions in order to compensate for apparent changes in quantity. Although Piaget has not explained how intuitive conservation is related to the conservation of quantity, he affirms that small aggregates of less than five in number may be intuitively conserved. In a later work, Piaget (1968) affirms that a child who is capable of conservation has by definition attained the stage of concrete operations. Since number is among the first dimensions a child conserves, such development can be an indicator of the onset of concrete operations. Piaget stresses the importance of knowing if a child is capable of conservation for two reasons :-

(i) Since learning is dependent upon a child's level of cognitive functioning, teachers can utilise the knowledge of the pupil's level to determine appropriate curricula.

(ii) Only when a child can conserve does he possess the skills necessary to rational activity.

As a result of his tests, Piaget concluded that the young child does not necessarily assume conservation of either discrete or continuous quantities. The judgements of the child are based initially on the perceptual dimensions of the quantities and when these differ thus obscuring the equality of the two quantities, the child judges the amount in terms of the perceptual dimensions. Gradually, through a growing understanding of logical operations, the child discovers, provided there is no addition or subtraction, that a quantity is conserved whatever may be the nature of the change. Throughout the experiments Piaget found that the children tended not to count, but where they did, this did not help them to conserve. Dodwell (1960, 1961) and Parfitt (1972) having used Piagetian tests in their investigations, also confirm Piaget's view that counting did not seem to help the child.

Piaget recognized three stages in the development of the understanding of conservation. The responses of the first stage showed that the child thought the quantity increased or decreased according to either the level which the discrete or continuous quantities reached in the particular container used, or the differing length of the configurations of the elements in other test situations.

The second stage contained responses which showed intermediary solutions, for example, the child often hesitated a long time before answering, or perhaps changed his mind, sometimes accepted equivalence because of an original one-one correspondence, and sometimes rejected it when distracted by perceptual criteria. There seemed to be a conflict between the earlier global judgement and the beginning of intellectual judgement based on what the child knew the original quantities to be. Piaget observed that there were individual differences of attainment within the transitional period, some appearing to have proceeded further through the stage than others.

The third stage contained responses which, without doubt, showed the attainment of a true notion of the invariance of quantity. The obvious difference between these and transitional responses lay in the fact that the child's answer was immediate and decisive as well as being correct. Many of them showed that not only were they able to co-ordinate differences in height and diameter to arrive at an estimate of relative quantity, but also to prove it mathematically. As Piaget says, "The conflict between the one-one correspondence and the perceptual relationships comes to an end only during the third stage, with the triumph of correspondence over perception." Thus the achievement of conservation marks the changeover from perceptually based ideas of number to a logical concept of number. Conservation provides the basic test as to whether a child has understood the invariance of number, that <u>two</u> means an invariant concept of two, and <u>thirteen</u> an invariant concept of thirteen. Thus he understands that the numbers are not merely names such as <u>cat</u> and <u>dog</u> but rather refer to a pervasive quantity. This, asserts Piaget, is a pre-requisite for an understanding of the early arithmetical operation.

One-one Correspondence.

Piaget stresses the importance of one-one correspondence in the development of the child's concept of number. Lovell (1961) takes a similar view and suggests that the perceptions involved in one-one correspondence and the actions required in this construction are important for the later concept of number.

Piaget describes in detail two types of correspondence. The first, 'spontaneous correspondence', arises when the child is required to assess the value of two equal sets of similar objects. Piaget's example of this is drawn from the child's everyday life. If two children are playing marbles, and one of them puts four or six on the ground, his companion will want to put one opposite each of them and so will produce an equivalent set, without needing to be able to count. Children so frequently use this method in the interest of 'fair play' in their games that it is surprising to find a lack of conservation.

Piaget referes to the second type of correspondence as 'provoked correspondence'; this occurs when objects are heterogeneously complementary. Again, Piaget uses everyday illustrations to make his point. The child is asked at meal times to put some eggs in egg-cups, or to put glasses by the side of bottles or flowers in vases. Piaget's view is that a correspondence is engendered by the very nature of the objects in question, an egg cup for example 'provokes' an immediate one-one relationship with the egg. Piaget says that although the child is able to make such a correspondence, with or without help, this does not necessarily mean that he has the idea of lasting equivalence. To support his theory Piaget devised a series of situations using familiar, everyday objects to test both types of one-one correspondence. Piaget was also interested in the child's ability to construct a one-one correspondence between two and then several sets and simultaneously to conserve the sets. Piaget asserts that as soon as the two-one relationship is grasped the notion can become generalized to three, four and five sets.

Provoked Correspondence.

Having used eggs and egg-cups, flowers and vases, bottles and glasses, coins and sweets in test situations, Piaget observed a similar evidence of three definable stages. The children who were assessed as being at the first stage included those who needed help in establishing the correspondence and who also denied its existence once the perceptual matching was destroyed. For example, these children thought that when the bottles were moved closer together in the row, this action made them less. Thus equivalence for the child at this stage depended on variable factors such as the length of the rows. In fact, Piaget suggests that the child may doubt whether a return to the original position will restore the correspondence. Children who were at the second stage included those who could make the original correspondence, but who accepted correspondence and equivalence only on the global appearance of the set. Piaget found that some children who used numbers to express the original equivalence, for example, six bottles and six glasses, still denied correspondence when the pattern was upset. Piaget says, "There is a discrepancy between the labelling with numbers and visual intuition." Nevertheless, there was evidence at this stage that the child was moving towards an acceptance of equivalence. It was clear from the decisive responses of the children at stage three that they accepted correspondence and equivalence irrespective of the spatial arrangements of the objects. The difference between children at this stage and the previous stages is an essential one because the triumph of the operation properly so called, over perception is clearly indicated. These children were considered to have a true idea of number, divorced from space and time, even though they may not have known the actual number names. It is clear that once the sets had become equivalent through a one-one correspondence, these children remained convinced of the equivalence irrespective of the arrangement of their elements. Piaget also concluded from these tests that the verbal factor played little part in the development of correspondence and equivalence. He concedes that at the point in which correspondence becomes quantifying giving rise to equivalence, counting may have assisted but contends the process was not begun by numerals as such. Piaget adds, "If the child has not reached a certain level of understanding, counting aloud has no effect on the mechanism of numerical thought".

Spontaneous Correspondence.

Piaget continued to analyse the child's use of spontaneous correspondence, that is, where the child is required to find the correspondence between two sets of like objects which do not possess the common bond which the sets had in the tests of provoked correspondence. To investigate this problem, Piaget and his colleagues presented children with a succession of figures made up from counters. These figures were composed of random shapes, open ended parallel rows, closed figures such as circles and a rather more complex rhombus. The child was asked to take from a box the same number of counters as there were in each of the models. Piaget was particularly interested in observing the child's actual procedure in each of the test situations. Again Piaget found that the tests elicited three stages of response.

During the first stage, the child uses only global comparison, imitating the configuration of the model without being too concerned with the exactness of the number of counters he used.

Piaget feels that the reactions of this first stage are of great importance to the psychology of number, since they show that the only quantification of which the child at this stage is capable, takes place through the relationship 'more' or 'less'. The child concentrates upon a 'one at a time' method in comparing his copy with the model. His co-ordination has not yet become operational or logical but is still intuitive, consisting in merely attempting to produce the general resemblance between the model and the copy. As yet, the child is unable to logically compose the relationships which constitute its qualities.

In the second stage there is one-one correspondence which is always based on the particular properties of the figure, for without the figure, the child no longer thinks the two sets are equivalent.

The third stage is recognized when the correspondence no longer depends upon the intuitive figure and the child begins to use spontaneous arrangements. Piaget, although detecting a fourth stage in which practical correspondence is replaced by the ability to use numeration correctly, suggests that this stage is not relevant to his main study of the genesis of number.

Piaget also studied the effects of spontaneous correspondence when the child is presented with single rows to copy rather than complex figures. In this investigation Piaget observed that for children at the first stage, the criterion of the evaluation is not the number of elements or the one-one correspondence, but perception of the global quantity, which could be either the length of the row or the density of the elements used. When the children at the second stage are asked to pick out a number of elements equal to those in a model row, they react by making an optical spatial correspondence with the model, but no longer accept the equivalence of the two rows when the correspondence cannot actually be perceived. At the third stage on the contrary, Piaget affirms that correspondence is freed from both spatial and perceptual limitations, and will continue even when the elements are displaced.

Ordination, Cardination and Seriation.

Piaget holds that the child's notion of ordinal number develops in the closest relation with his cardinal number ideas, and in fact, each depends upon the growth of the other, in the same way as both inter-depend upon the child's growth of logic. The child's concept of number results from a synthesis of these two processes, that is, when one has a number in mind both the cardinal and ordinal aspects are considered. When thinking of 'three', it is both a set of three objects and the third in the series. It is third in the series by virtue of the fact that it contains one element more than the second in the series, and one less than the fourth.

Piaget suggests that a child is not able to use numbers until he has fully understood the serial significance of sets. Piaget and his co-workers carried out a sequence of experiments based first on ordinal numbers and series as such, and then on to their relations as cardinals. In the first experiment the child had to seriate a set of ten wooden dolls, a set of ten sticks and a set of ten plasticene balls of distinctly different sizes. Piaget describes three methods which the children use in dealing with the problem posed :-

(i) Double seriation. The child firstly seriates the dolls, then makes a separate series of balls or sticks, making each term of the first series correspond with the term having the same position in the second series.

(ii) Simple seriation with correspondence. This method consists of forming one of the sets into a series and then putting the elements of the other set directly in correspondence with them by taking them one by one according to their position and in the same order.

(iii) Direct correspondence. By this method there is immediate one to one correspondence between balls and dolls without previous seriation; the seriation taking place either in fact or by visual judgement simultaneously with the correspondence itself.

The results were very similar to those found in the previous tests and Piaget again observed three distinct stages. The children who were at stage one were neither able to use the 'double-seriation method, nor were capable of exact spontaneous seriation when they used 'simple-seriation'. Piaget says that the child's correspondence at this stage is still global and pre-serial. He also affirms that correspondence pre-supposes seriation and that when spontaneous seriation is not possible, neither is serial correspondence and vice versa.

Although Piaget observed progress at the second stage, he confessed a difficulty in distinguishing it from the third stage. The appearance of correct and spontaneous seriation and serial correspondence was apparent. The obvious difference between the second and third stages is that seriation and serial correspondence are still intuitive and perceptual at the second stage, whereas they become operational in the third when the correspondence is truly ordinal, that is, numerical. As an outcome of his investigations into ordination and cardination Piaget postulated that there is no more difficulty for the child in making a one-one correspondence between two series that have to be constructed simultaneously, than in ordering a single series.

The first stage of cardination corresponds to the first stage in seriation. The common factors in both are their global nature, and immediate perceptual experience prevailing over operational logical composition.

Similarly the second stage in ordination and cardination corresponds in similarity of mechanism. The child no longer reacts globally; he is now capable of analysis although the analysis is limited to perceptual data and as yet is not operational

In the third stage Piaget found the results and structure the same for ordination and for cardination, both giving evidence of the child's triumph of operation over intuition.

Class inclusion.

The concluding chapters of 'The Child's Conception of Number' demonstrate how Piaget investigated the relationship between number, class and relations, through the child's use of numerical operations. Piaget observed the child's response to the inclusion of partial classes in a wider class. To investigate class inclusion, Piaget firstly used a box of wooden beads, most of which were brown only two being white. The question asked was, "Can the child use the mental process of logic to conclude that if the class or set of wooden beads included the set of brown beads and the set of white beads, then the set of wooden beads must then be larger than either the set of brown or the set of white beads?"

At the first stage the child cannot visualize the whole as being larger than its parts. Shown a set of wooden beads in a box, nine of which are brown and only two white, and asked, "Are there more wooden beads or more brown beads?", the child replies, "More brown ones." Asked if the brown ones are made of wood the child replies, "Yes", and asked, "Are the white ones made of wood?" replies, "Yes." Yet when the question is repeated, "Well, then, are there more brown beads or wooden beads?", he again says, "More brown ones." When asked which would make a longer necklace, the wooden beads or the brown beads, the child replies that the brown beads would.

At this first stage the child is unable to consider quantity of wooden beads because the idea of the wooden or whole is lost when the parts, brown and white, are considered. Piaget feels that there is systematic difficulty for children less than seven or eight years of age in comprehending the inclusion relation; the idea of the three classes in the example, wooden beads, brown beads and white beads could not be considered simultaneously. Piaget however, recognized a dual objection, firstly in the case of the beads there is not a single word to define the general class and the particular classes but only combinations of words, wooden beads, brown beads, white beads, in each of which beads occurs. Secondly Piaget felt that the fact of putting, for example, some forty brown beads with only two white beads might create a systematic illusion in the child's mind. To reply to the objections, Piaget tested this concept by using experiments in which the classes were designated by a single word, for example in the first instance flowers, twenty of which were poppies and three of which were bluebells. He then used a set of beads defined by their colour and not by their material, the partial classes being defined by their shape - round, square etc. This was followed by an experiment using about 20 brown beads and 15-17 white or green ones. As a result of these and other similar experiments, Piaget concluded that the inclusion relation appears to be a stumbling block for children. Qualitatively the child understands that one bead can be both brown and wooden, but quantitatively, he cannot place the beads in two sets such as brown and wooden, simultaneously. As soon as the child's attention is directed to the part, the whole is forgotten. All the subjects to whom Piaget referred understood the nature of inclusion, they had grasped the fact that all the beads were wooden or blue and so on. Piaget stresses that all of his subjects possessed the notion of total class required by the questions and were capable of the general statements defining the class <u>all the beads are wooden</u>.

In the second or transitional stage of development the idea is grasped at the intuitive level, that is by trial and error. The child responds at first as if he were at stage one, saying for example, that there are more boys than children. Prompted by the question, "Are the girls children?", the child realizes his mistake and is able to correct it.

In stage three, the discovery is spontaneous and immediate. The child understands the logic of the inclusion relation. If the set of children includes a set of boys and a set of girls then there must be more children than either boys or girls. The problem is solved at the logical or intellectual level rather than by trial and error as in stage two.

Piaget concludes that the real problem is that children at the first stage are still on the plane of perceptual intuition which is immediate and irreversible. In moving their thought from the whole to the part, the whole is forgotten. When faced with the situation which demands transference of thought from <u>beads</u> to <u>brown beads</u> then <u>white beads</u> the child is unable to reverse his thoughts back to whole again, that is, back to the class of beads which includes both brown and white. It is, according to Piaget, the achieving of reversibility of thought, from whole to parts to whole again that constitutes a logical or intellectual action as contrasted to the perceptual or pre-logical, which is based on sensory experience.

Relations between parts and wholes.

Piaget considered it of vital importance to ascertain whether additive composition of parts into a whole gives rise, in the case of number, to difficulties comparable to those of the inclusion of classes in a total class, or whether the difficulties of inclusion are exclusively logical. To investigate whether a child is capable of understanding that a whole remains constant irrespective of the various additive composition of its parts for example, 4+4=1+7=2+6=3+5, Piaget constructed the following situation; the child is told that he is to have four sweets for 'elevenses' and four for tea-time. The next day he is to have the same number, but as he will be less hungry at eleven-o-clock than at tea time, he will only eat one sweet in the morning and all the others in the afternoon. The verbal situation is demonstrated by using beans. The child is then asked to compare the two sets, that is 4+4 and 1+7, and to say whether he will eat the same number of sweets on both days.

Piaget found that the child at the first stage did not regard the two sets as equal. The reason why the child fails to recognize the equality of the sets is, affirms Piaget, because he is guided by the perceptual relationships. At the second stage, the child who begins by showing the same kind of reactions as the child at the first stage, gradually comes to see, or can be made to see, that although $7 > 4$, this inequality is compensated by $1 < 4$.

The child at the third stage sees each sub-set in relation to the other and both are seen in relation to their sum.

Equating of quantities.

i. Unequal sets.

Piaget questioned what would happen if the child is asked to make a transfer from one set to another in order to establish the equivalence between them. For this purpose Piaget gave the child two unequal sets of counters, for example, one set of eight, and the other set of fourteen counters.

During the first stage Piaget observed, the child does not understand that the subtractions and additions necessarily complèment each other, that is, when he adds a number of elements to one set, he does not expect the set from which they were taken to decrease by the same amount. At the second stage, the child is aware that this is what occurs, but only on the intuitive plane, and therefore, apart from the figures, he is incapable of judging the equality and foreseeing the results of adding and subtracting.. The child at the third stage establishes the equivalence by means of a decomposition of the sets and reconstructing equivalent sets.

ii. Equal sets.

Piaget was concerned in this experiment with the process by which the child transforms the logical operation, $B = A + A'$ into a numerical operation, namely, $A_1 + A'_2 = 2A = B$. The child is asked to divide a number of counters, eighteen, into two sets, each having exactly the same number. As a result of the experiment Piaget found that the child at the first stage could not grasp the fact that the sum of the parts is equal to the whole, nor does he recognize the lasting equivalence of the two halves, even when he has obtained them by distributing the elements, term for term, in two corresponding sets. The child at the second stage, although Piaget does not explain fully why the child is transitional, does not conserve the whole nor is indicating that he is aware of lasting equivalence. At the third stage the child is capable of constructing two equal sets and that the sum of the sets is equal to the whole.

Development of the notion of measure.

In the final chapter of the book Piaget returns to the question already discussed, namely conservation of continuous quantity; but as an extension observes the child's readiness to use measures.

The child is given quantities of liquid in three vessels which, because of their different shapes, preclude an estimation of their ratio by direct perception. He is asked to say whether one of the quantities is equal to, greater than or less than, one or both of the others and is given some empty containers which he can use to solve the problem. Piaget found that the child at the first stage was influenced by the immediate perception, did not conserve and had no notion of common measure. The child at the second stage was able to conserve in certain cases, that is, when the changes were slight and not too easily perceptible but did not conserve when the changes were more obvious. Unlike the first stage, the transitional child spontaneously made use of measuring glasses, but did not always choose the correct one. At the third stage, the child grasped the fact of conservation and was capable of correct spontaneous measurement.

Summary of Piaget's number theory.

(i) For Piaget, the development of the child's concept of number occurs in stages which can be diagnosed through various tasks.
(ii) The stages are traversed by all normal children with individual differences depending on chronological age, mental age and cultural background.
(iii) The attainment of each stage is preceded by a period of transition which is most clearly seen at the five to seven or eight year old level, when the stage of concrete operations is being approached. Developing in this transitional period, are those logical operations which are essential for manipulating and extending concepts which, in turn, will be structured into a

'working model of the world.'

(iv) In Piaget's theory the attainment and development of the concepts of number are a microcosm of general intellectual development, consequently much of his theory on this development is based on his research in number and scientific concepts. Piaget maintains that certain mental operations must be available to the child before a true concept of number can be attained, the most important manifestation of which is the child's ability to accept invariance, or conservation of quantity. Number itself can have no logical meaning for the child without the understanding that no matter how a quantitiy is arranged and sub-divided, its total still remains the same.

(v) Closely related to the concept of conservation is the understanding of one-one correspondence which the child needs to mentally retain even when the elements of the sets are spatially unmatched. Piaget insists that the child can neither see the relationship which exists between sub-classes and total groups nor can he accept that there can be overlapping sub-classes based on qualities other than number, for example, attributes of colour, shape and size, without the attribute of the number being altered unless he has this notion of invariance.

(vi) Another Piagetian criterion for the true attainment of number is the ability to classify sub-groups. A child who cannot distinguish between an inherent quality and an overall quantity has neither a true notion of cardination nor ordination. Ordinal number depends ultimately on the ability to understand graded difference. In the first instance, it is essential to accept some form of ordering of the objects to be enumerated before even cardinal or class qualities can be arrived at.

These four notions, namely, invariance, one-one correspondence, classification and seriation to some extent overlap but are easily diagnosed in practical situations. Although no exact age can be given, Piaget found that most of his subjects had begun to develop these notions somewhere between the ages of five and eight years of age, and in many instances had reached operational levels. The following section of this review is concerned with studies of Piagetian theory as they apply to handicapped children.

3. Research into the development of number with special reference to handicapped children.

The primary aim of many researchers has been to test whether Piaget's theory of stages still remains valid when the test procedures are carefully standardised and the subjects chosen from more typical populations than those which Piaget used. Some of the secondary aims have been to relate conceptual development to chronological age, mental age and cultural difference. Latterly, there has been an interest in the possibility of accelerating concept formations. Lunzer (1973) points out that much of the research reported testifies to the value of the type of situation devised by Piaget for its diagnostic value, when this is adopted to bring about educational re-orientations. In view of this it is natural that teachers of handicapped children will wish to know the value of Piaget as far as their own work is concerned. Most studies in this area are concerned with children who comprise the largest group, namely those designated as slow learners, retarded, mentally handicapped or educationally subnormal. Some studies are devoted to the deaf, children with partial hearing, the blind and those with other visual handicaps. Although some investigations have been made into the development of number concept in Piagetian terms with cerebral palsied children, the writer has found none with respect to spina bifida children. There is value however, in studying the available research into the conceptual development of children having different learning problems because the frequent overlapping of handicap is now widely recognized.

Intellectual handicap.

A considerable body of research by Inhelder (1968), Stephens et al. (1972), Woodward (1959, 1961, 1962) has indicated that except for the tendency for retarded children not to achieve Piaget's level of formal thought and their generally slower rate of cognition, their developmental sequence does not differ fundamentally or qualitatively from that of normal children. Woodward concluded that it was possible for subnormal children to reach an operational level for some aspects of number concept, but not for others. Woodward's conclusion is supported by a study by Parfitt (1972) of the responses of secondary age E.S.N. boys to Piagetian number situations. Parfitt's study showed that the older E.S.N. children in his sample did not differ significantly in their responses from younger, normal children equated by mental age. Problems were observed however, with respect to tests of seriation. Lovell and Ogilvie (1960) found that the conservation of quantity varied with the type of material used. In a later study, Lovell, Mitchell and Everett (1962) investigating the growth of logical structure in educationally subnormal children, concluded that their results agreed fairly well with Piaget and also demonstrated the limited ability of these children to develop logical structures. Lovell (1971) observes that in the case of some retarded pupils the onset of concrete operational thought may be delayed until fourteen or fifteen years of age, and then it may be available only in rather specific situations.

Mannix (1960) investigating a group of forty-eight E.S.N. children, found evidence of similar stages to those which Piaget states are traversed by normal children in the development of number concepts. Although there was wide variation in the mental age at which these children demonstrated the use of concrete operation, no child below a mental age of 6.8 years achieved concrete operations on all eight of the tests used. Of interest to the teacher of handicapped children is Mannix's emphasis on the value of Piaget's clinical method. Hood (1962) observed that mental age was related to the performance of retarded children on tasks of seriation, classification and conservation. He also found qualitative differences in the manner and speed of responding and noticed distractability; their slowness, Hood observed, was due in part to poor receptiveness to language. Kirk's (1968) study with retarded children also indicated a closer correlation with mental than chronological age. Kelly (1967) administered a series of Piagetian number and 'handling of money' tests to E.S.N. and younger children equated for mental age. The results showed that the younger, normal children performed equally as well as the older E.S.N. children on the money tests, were better on tests of mechanical ability, problem solving and basic understanding of number. She also found that E.S.N. children may be at the concrete operational level for some aspects of number and not for others, and that the mental age at which they pass from one stage to another, varies widely from child to child. Stressing the importance of providing concrete materials for slow learning children up to ten or eleven years of age or even longer, Lovell (1961) warns teachers not to over-estimate their pupils' capacity for number operations. He adds that such children may well acquire concepts of sufficient width and depth for what is often termed 'real-life' arithmetic but may never be able use numbers in operational fashion.

Lovell (1961) has also evaluated some of the basic concepts involved in the child's development of an understanding of numbers, space, volume, time and substance with particular emphasis on the concepts as applied to a teaching situation. He reiterates Piaget's emphasis that abstractions are derived through the transformations which take place when the child classifies objects, rearranges and puts them in serial order. Lovell stresses that concepts and their reversibility in the mind are built up from using materials and advocates activities as suggested by Dewey and Froebel and the use of materials as suggested by Cuisenaire and Dienes.

Lovell also raises the question of whether slow learning children should be exposed to such activities in a more structured and directed manner since, even with normal young children, acquisition of these concepts is 'patchy' and 'uncertain' and occurs fitfully.

A number of tests based on the work of Piaget, constructed by Williams (1958) to assess 'number readiness', were firstly given to a group of educationally subnormal children and secondly to a group of normal children. Williams found that some of the children who scored reasonably on mechanical tests of arithmetic had no real idea of number relationships. He found that some children who had reached the operational stage on some of the Piaget tests had not reached it on others. He also observed a fairly close relationship between the understanding of number concepts and the ability to appreciate the complementary nature of addition and subtraction. Experience with both groups suggested to Williams the value of using such a battery of tests to assess number readiness.

Tansley and Gulliford (1965) having had considerable experience in the teaching of handicapped children, affirm with special reference to Piaget's work the importance of appreciating that number readiness is fundamental to sound arithmetic teaching. They stress the value of understanding how the child's ideas of quantity develop; consequently the curriculum should be so devised as to make apparent to the child from the beginning the importance of number relationships. It is essential to appreciate that retarded children are slow to see the relationship, particularly when expressed in symbolic terms rather than in concrete ways.

Childs (1963) has also investigated the possibility of using a series of Piagetian tests as a predictor of number readiness and as an individual diagnostic number test with retarded children of primary school age. As a result of this study, Childs concluded that numbers held no meaning for the retarded children in his sample and very few of them could, in fact, enumerate twenty objects. He adds that the children had no idea of the concepts of conservation and seriation and were unable to establish a one to one correspondence between sets.. Childs acknowledges that although his test is an imperfect instrument, it could well provide a starting point for number work and activities suited to individual needs and requirements. Woodward points out that Piaget's approach to the study of number concepts has applications to clinical psychology and education. She suggests that his approach might usefully be applied to children who are being considered for education in schools for the educationally subnormal and, in addition, may be a useful supplement to the few techniques available for the assessment of the educability of children with severe or multiple physical handicaps. Wolinsky (1962) has also attempted to demonstrate how some of the principles underlying Piaget's work are applicable to the devising of educational programmes for the sub-normal.

The available literature indicates differences of opinion amongst investigators as to the role of counting for the retarded child. Childs for example says that apparatus based upon the counting aspect of number teaching may tend to cause the teacher to over-teach the dull child and mask the processes of number thinking and meaningful learning. Wheatley (1968) states as a result of his research using Piagetian tests of conservation, cardination and counting, that the last is a poor base for judging potential in arithmetic. Counting is often a meaningless set of responses, on the other hand the unrecognized ability to conserve is a pre-requisite for understanding number and a very useful concept for predicting success in number. Parfitt observed that although E.S.N. children frequently counted in conservation tasks, this did not seem to greatly assist the non-conserver in making an operational judgement. Kruteskii (1965), reminding us that retarded children perceive relationships between symbols very badly, preferring concrete to abstract reasoning, states that memory for natural numbers does not imply mathematical ability. On the other hand, Mannix says counting appears to be the method preferred by E.S.N. children when dealing with number problems; correspondence being substituted if the test situation makes counting difficult and Kelly observed in her investigation that the retarded children of all ages in her sample preferred to count wherever possible.

Petrie (1972) who has worked for many years with retarded, disturbed children says that in her experience every child except a low grade mental defective counts, even though this may only be a little, because he handles money from earliest childhood. Lunzer, in a review of recent British studies based on the works of Piaget, questions whether Piaget has underestimated the importance of <u>quantificatory</u> counting as opposed to a mere verbal drill.

Gruen and Vore (1972) wished to establish whether differences between retarded and normal children became more evident as comparison tasks increase in difficulty. The authors concluded that differences in performance were primarily attributable to mental age but not I.Q. Conservation of number was less difficult for the retarded children than conservation of liquid. There were however, exceptions to this order. Some investigators, for example Suppes (1974) and Field (1974) have observed that language problems are central to the number difficulties of retarded children.

Visual handicap.

Nash (1969) demonstrated that children with visual perceptual difficulties functioned at the lower levels of spatial reasoning and 'those with figure-ground difficulties were significantly poorer on number conservation tasks'. This study is of particular interest to the teacher of spina bifida and hydrocephalic children who may have visual perceptual problems.

The overall results of an investigation by Hughes (1969) support the view that although the sequential development of children with visual problems is similar to that of normal children, the rate of development is slower. The evaluation of Piagetian type tests to be used diagnostically by teachers of visually handicapped was examined by Tobin (1972). His investigation indicates that 'conservation responses increased with age'. Also, 'while the best of the visually handicapped attain conservation as early as six or seven years of age, there is a wide spread, with a substantial number not conserving until beyond the age of nine or ten'. Frostig (1975), writing on visual perception, indicates the importance which Piaget's theory places on the child's perceptual development, particularly in the development of mathematical skills. Mathematics is difficult, asserts Frostig, for children with poor visual perceptual skills, a view supported by Cruickshank (1975).

Canning (1957)administered one of Piaget's tests to a group of children who were either blind or partially sighted. The test involved comparing liquid in two equal glasses and then emptying one of these into two glasses which were half the size. It appeared to Canning that the children in question did not reach an operational level of reasoning until much later than normal children; in some cases their judgements were perceptual as late as the age of ten. As Lunzer (1973) states, this exploratory study of Canning provides an important pointer to the possibility of Piaget's work in relation to the attainment of concepts by children with sensory handicaps.

Gottesman (1971) analysed the performance of blind and sighted children on Piagetian tasks. The sighted children were not allowed to use vision and Gottesman found that the level of operativitiy achieved by both groups substantiated the Piagetian developmental stages. The abilities of the blind and sighted children were very similar on Piagetian tests of haptic perception.

Deaf and partial hearing.

Oleron and Herren (1961), in an investigation of conservation found a retardation of six years among the deaf children when compared with normal children. Furth's (1964, 1966, 1970) researches into the concept development of deaf children led him to assert that 'the kind of experience with the physical world' rather than language or formal training determines, in part, the age at which children pass from a perceptual to a logical judgement on many Piaget-type experiments. Both Oleron and Furth's studies show similar results indicating that deaf children acquire elementary logical operations with only a slight retardation as compared to normal children. The same stages of development are found as those established by Piaget on a normal population. Both Oleron and Furth, observing that there were differing reactions by their deaf subjects, particularly in the conservation of liquids suggest that certain difficulties in the presentation of the test may have been the reason. Sinclair (1969) observes that the distinction between the quantity of liquid and the volume of the container is difficult to convey to the deaf child.

Furth notes an interesting difference in the comparative performance of deaf and hearing on 'logical symbol discovery' versus 'symbol use' tasks. While the deaf are inferior to the hearing on the former, they show equal ability on the use of logical symbols in a structured task. Furth points to several factors that could explain the results; among others, a different approach on the part of the deaf toward problems that call for invention, which may be due to a general lack of social contact. Oleron finds that seriation-tests are only very slightly retarded; that spatial operations are normal, and that classifications possess the same general structure and appear at the same age as with normals, but seem slightly less mobile or flexible. Sinclair questions if the cause may be more due to a general lack of social exchange and stimulation than to operational retardation.

Physically handicapped.

Mogdil and Mogdil (1976) report the result of several investigations into the effects of physical handicap on the development of certain concepts. In one instance conservation of weight problems were used with eighty-seven subjects whose ages ranged from seven to twenty-two years, and whose I.Q. ranged from 46 to 120. The data clearly indicated that the motorically handicapped children conserved at a much later chronological age than the controls. They also report an investigation by Melcer (1966) into sensory-motor experience and concept formation in early childhood. Melcer reported a difference between motorically handicapped children and normal young children in tactile and motion perception and concluded that the deficits of cerebral-palsied children were attributable to the variable of motor disability.

Haskell (1972) investigated the development of number concepts in cerebral-palsied and other physically handicapped children. He observes that where attempts have been made to explore the relationship between neurological disorders and number concepts the findings are occasionally contradictory and generally inconclusive and considers that the best strategy is to look at the factors which are thought to affect concept development.

Of particular interest to the teacher of the physically handicapped, many of whom have perceptual problems, is the study of Cohn-Jones and Seim (1978) of perceptual and intellectual factors affecting number concept development in retarded and non-retarded children. These researchers, using Piagetian type number tests and the Frostig Developmental Test of Visual Perception, found that in all cases lower perceptual ability resulted in greater reliance on irrelevant perceptual cues in number judgement and in poorer performance on tasks of number concept. Allowing that mental age and level of perceptual ability may be important indicators in predicting levels of competence on Piaget's cognitive developmental tasks, Cohn-Jones and Seim stress the necessity of further research to pinpoint the specific perceptual skills which are important to number concept development with the aim of providing more precise indicators of level of cognitive skill and possible areas of remediation in cases of cognitive deficit.

Summary.

Suppes (1974),in his general survey of cognition in handicapped children but with particular reference to the visually impaired, the deaf and those who are retarded,warns against too simple generalizations about the number skills of the retarded. While acknowledging the wealth of quantitative and mathematical models of learning, several of which apply to concept formation tasks existing in general psychology, Suppes stresses that 'the most important work lies ahead'. Lunzer expresses a similar view in that further work with handicapped children might not only yield suggestions as to their own special needs in the cognitive sphere, but also help in our understanding of the processes underlying various kinds of reasoning in normal children. Inhelder (1963) a close associate of Piaget, expresses her awareness that since the development of the normal child is rapid and complex, the study of pathological troubles which exclude certain modes of activity is of interest in permitting the researcher to arrive at some relatively homogeneous, stable stages. The final section of this review relates to the effects of teaching programmes based upon Piagetian theory.

4. The effects of Piagetian teaching programmes.

A number of studies have been undertaken to see if intensive periods of specific training can speed up the growth of the understanding of specific number concepts. Such research will clearly be of interest to teachers who work with retarded children, even though most of these studies are concerned with younger, normal children. Churchill (1958) for example, repeated a number of Piaget's tests. She was mainly concerned with finding out to what extent, and in what ways, a planned educational programme could influence the growth of numerical ideas among a group of five-year old children. Sixteen children were tested and then divided into two groups. During a period of four weeks one of these groups was given a special programme of number experiences. The control group was not seen at all until the end of the month. Both groups were then re-tested and the advantage gained by the experimental group was found to be statistically significant. Churchill concludes that educational factors can influence the rate of concept development to a considerable extent.

Phemister (1962) indicated that through a programme of free play which extended over five months, conservation of number might have been helped forward. She suggests that progress through Piagetian number stages can be accelerated by experimental means. However, the number of children in this study was very small and Phemister acknowledges that a larger experiment is necessary before firm conclusions are drawn.

Wohlwill and Lowe (1962) studied the development of conservation of number in seventy-two children who had been divided into four groups. They were required to recognize the principle that a numerical value did not alter because of some change in the grouping of the objects concerned. One group was given counting practice before and after each change in configuration. The second group was given the same practice and also shown that adding items to the configuration or taking them away, did alter the numerical value. The third group was given practice aimed at disassociating the perception of a configuration from its numerical value. In particular the children in this group were shown that when a line of objects was made shorter or longer by spreading them or contracting them the cardinal value of each one did not change. Non-verbal methods of practising were used as far as possible with these three groups. The fourth group, which acted as a control, was given no organized practice. As judged by non-verbal measures of conservation there was an overall improvement from the beginning to the end of the experimental period, although there was no significant improvement when conservation was measured by conventional verbal means.

Wallach and Sprott (1964) attempted to induce conservation of number by showing children the reversibility of re-arrangements which they, prior to conservation, regarded as implying changes in number. They affirm from their results that the training procedure was effective in inducing conservation, and supported the hypothesis that conservation may be acquired by experiencing situations involving reversibility.

Another report of success in inducing conservation by training in logical operations was that of Siegel, Roeper and Hooper (1966). In their first experiment the subjects were two groups of five pre-school children, the groups being of comparable I.Q. and social background, and the ages between 4.9 and 5.0 years. Tasks involving conservation of substance of a liquid were given as pre and post training tests. It was concluded from the study that the probability of conservation developing was increased by the training in logical operation which had been given. Uzgiris (1964) and Kahn (1975) have studied how varying stimuli differentially affect performance on conservation tasks. Both of these studies support the authors' contention that the use of meaningful stimuli provides greater attention and motivation which will, in turn lead to more rapid cognitive growth and academic success.

Lister (1969, 1970) who has investigated the possibility of accelerating the development of concept of weight and volume with retarded children, found that they were successful in the post tests. She states that the children learned more than a verbal response and were able to generalize to different situations.

Lovell (1969) however, is of the view that the overall effect of these training programmes has been small. Piaget's view in this context is that although the child may learn something from a particular situation, this will have no effect on the child's general level of understanding since the specific attack is too trivial. In a relatively recent work, Piaget (1971) whilst favouring experiences which would influence the child's development, deprecated specific attempts at artificial acceleration of concept formation. In a similar context Elkind (1971) writes "The longer we delay formal instruction, up to certain limits, the greater the period of plasticity and the higher the ultimate level of achievement" and Wadsworth (1978) summarises his view thus "Blind attempts at acceleration are fraught with a variety of potential problems that can make children less efficient in the long run than if children were not encouraged to try to make adaptations before they were optimally ready to make that adaptation".

The question then as to the best method of assisting the child's development of number concept is very far from being answered. The overall impression left by reviewing much of the relevant literature is that there is some evidence that certain experience does aid concept formation if only within limits. These limits seem to be determined by the type of experience and the child's point of development when exposed to it. Smedslund's (1961) hypothesis that the possibility of inducing concept development is high if the child is at a stage approaching the notion, but low if at a stage which is still far from it, seems very reasonable and persuasive. According to his interpretations the impact of experience can hasten the natural development of thought processes but not radically change the rate or order of their appearance.

One of Piaget's closest colleagues, Inhelder (1971) supports the view that since cognitive development proceeds when the child is active, the teacher should be both an arranger of the physical and social environment of the teaching area and an organizer of school experiences. She advises that if the young school child is prepared fairly early on, for example in the handling of materials conducive to ordering and classification, it is possible that the child's later construction of number will have been helped. Also, Inhelder's own success in the use of diagnostic and remedial methods which are the results of her work with Piaget gives confidence to teachers of children with learning problems that Piaget does have something useful to say to them.

In conclusion, although it is evident that the volume of practical and theoretical studies based upon Piagetian theory is on the increase there are still large areas of uncertainty in our knowledge of child development and more particularly the ways in which learning takes place. There is however, a wealth of practical findings which has emerged from the work of Piaget already at hand which can be a source of inspiration and help to the teacher of the spina bifida child.

Chapter 4 outlines some general considerations with respect to the development of number concepts in a sample of spina bifida children and chapter 5 amplifies a series of number tests which are replications of those reported by Piaget and his colleagues and outlined in 'The Child's Conception of Number' (1953).

CHAPTER 4

Design of the Experiment.

1. General considerations.

The nature of the problem discussed in Chapter 1 called for an experimental design which would assist in determining whether spina bifida children have a specific cognitive weakness in the early stages of number development. It was considered appropriate to study this aspect of conceptual development in the light of the expressed view of practising teachers, psychologists and medical researchers that spina bifida children in general find number and mathematics particularly difficult. If it could be seen that such children do indeed reflect abnormal conceptual development with respect to number, then weakness in associated subjects later on in school could be rightly expected. However, if it appeared that the number development of children with spina bifida largely followed the same well attested pattern as that of normal children and those with other handicaps, it might lead those interested to look at other possible reasons for their evident weaknesses.

Other considerations were to compare the performance in Piagetian number tests of spina bifida children whose hydrocephalus had necessitated a shunt with those without and to compare the performance of boys with that of girls. It was also considered necessary to investigate other factors in the educational progress of spina bifida children which could affect the development of mathematical skills such as perceptual-motor ability, reading levels and vocabulary skills.

2. Types of schools used.

The four schools used in the study are referred to as schools A, B, C and D. These schools are designated by the Department of Education and Science as Special Schools for the Physically Handicapped. The population of each school comprised children with a variety of physical abnormalities, approximately one-third of whom had spina bifida. The four schools share similar admission procedures which take the form of discussions between medical officers, educational psychologists, headteachers and representatives of the directors of education. The schools are situated in the administrative local authority areas of Derbyshire, Leicestershire and Nottinghamshire.

School A, which is a modern purpose built school catering for up to 150 physically handicapped children aged five to sixteen plus, takes children from the City and County of Leicester. The school has a small residential wing in which children can stay for a five day week but most children travel daily to school. The main criterion for admission to this school is whether or not the child is sufficiently handicapped to be unable to cope in the normal school.

School B which is more recently built, is sited in Long Eaton and caters for children from Derbyshire. Most children are resident with relatively few children coming to school daily.

School C is also a recently built school which caters for children from the City of Nottingham. Since there are no residential facilities all the children travel to school daily.

School D, which is the oldest of the four can be thought of as a pioneer school in the whole geographical area covered by the four. Although the school was originally fully residential for the whole of the school year there is now a tendency for some children to be admitted on a day basis. School D caters mostly for children from Derbyshire and Nottinghamshire but there are some who come from Leicestershire, Lincolnshire and Northamptonshire.

Each school is equipped with hydrotherapy, physiotherapy and nursing areas, these facilities being used during the school day.

3. The sample.

All the spina bifida children in each school with the exception of one blind infant child were tested. The headteacher of each school readily provided medical and intellectual data to assist in preparing individual profiles. The number of children in each school is shown in Table 2.

Table 2.

School	A	B	C	D
Boys	16	15	12	21
Girls	12	12	17	25
Total	28	27	29	46

Following discussion with the medical staff and having made reference to the medical files the writer classified the children into two groups depending on whether or not a shunt had been fitted, Table 3 below presents a summary of the data.

Table 3.

Medical classification.

	With shunt	Without shunt
Boys	40	24
Girls	50	16
All	90	40

The sample was also classified by physical disability as shown in Figure (i) below.* Table 4 details the number and percentage in each category. Full details are to be found in Appendix A page 267.

Figure (i). Illustrations of physical disability

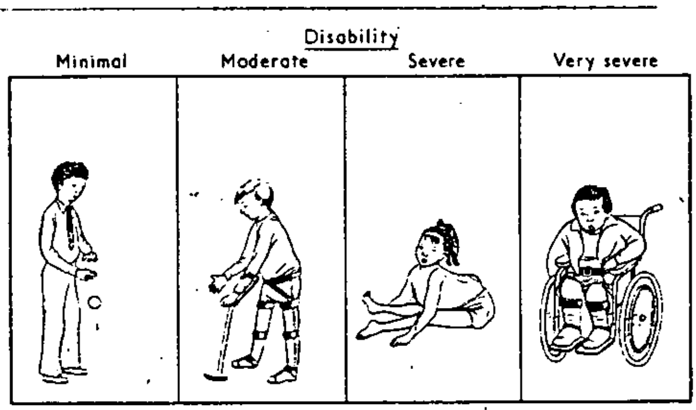


Table 4.

Minimal		Moderate		Severe		Very severe	
n.	%	n.	%	n.	%	n.	%
15	11.5	44	33.9	25	19.2	46	35.4

Chronological age.

Complete details of the chronological ages of the 130 children are to be found in Appendix A pages 268-274. Table 5 presents a summary of the data.

* The diagram is based on Hunt et al's (1973) reference but the classification criteria are the author's own. See also Lorber (1971a, 1972) for a similar classification.

Table 5.

Chronological age. Distribution with reference to schools.

School	Boys n.	Boys m.	Boys s.d.	Girls n.	Girls m.	Girls s.d.	All n.	All m.	All s.d.
A	16	8.4 yrs.	2.5	12	8.5 yrs.	2.9	28	8.4 yrs.	2.6
B	15	8.9 "	3.2	12	8.6 "	2.2	27	8.8 "	2.8
C	12	7.7 "	2.4	17	7.7 "	2.8	29	7.7 "	2.6
D	21	11.8 "	3.3	25	11.7 "	2.9	46	11.7 "	3.0
All	64	9.5 "	3.3	66	9.5 "	3.2	130	9.5 "	3.2

Means and standard deviations of the sample with respect to one aspect of medical classification, namely whether or not a shunt system was fitted were computed.

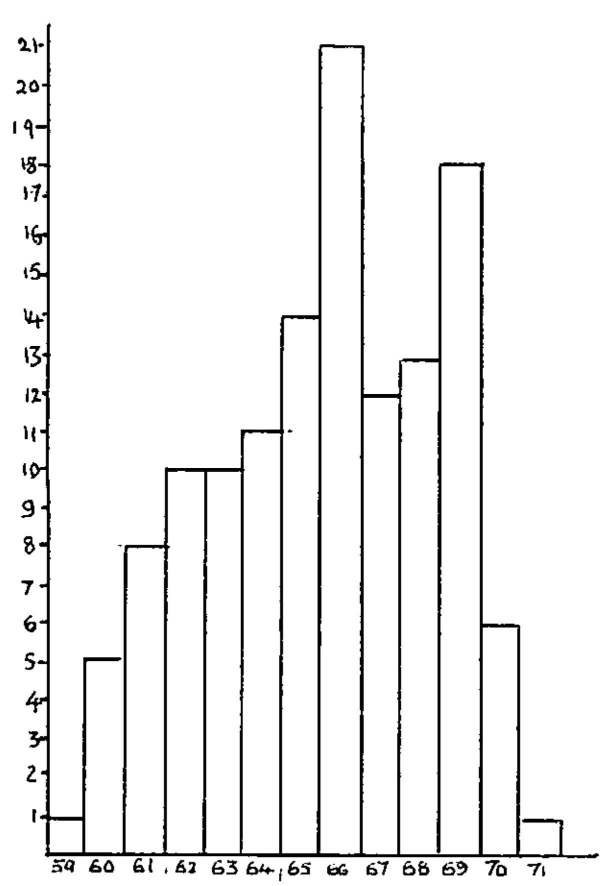
Table 6.

Chronological age. Distribution with reference to medical classification.

	Without a shunt n.	Without a shunt m.	Without a shunt s.d.	With a shunt n.	With a shunt m.	With a shunt s.d.
Boys	24	8.7 yrs.	3.8	40	9.6 yrs.	3.2
Girls	16	9.9 "	3.7	50	9.4 "	3.1
All	40	9.6 "	3.6	90	9.5 "	3.1

Figure (ii) below illustrates the number of children from the sample born in each of the years between 1959 and 1971.

Figure (ii) Year of birth.



Intelligence.

Each child had been tested by either the local medical officer or educational psychologist as part of the assessment procedure prior to admission to schools for the physically handicapped and at frequent intervals thereafter; details of I.Q. tests, usually Stanford Binet, were therefore available.

Table 7 is a summary of the I.Qs of the sample, full details of which are to be found in Appendix A pages 275-279.

Table 7.

Intelligence.

Boys (n = 64)		Girls(n = 66)		All(n = 130)	
m.	s.d.	m.	s.d.	m.	s.d.
81.6	16.9	80.1	15.2	80.9	16.0

Table 8.

Intelligence (medical classification).

	Without shunt			With shunt		
	n.	m.	s.d.	n.	m.	s.d.
Boys	24	89.7	16.1	40	76.7	15.7
Girls	16	85.7	14.4	50	78.4	15.1
All	40	88.1	15.4	90	77.7	15.3

The range of I.Qs of the sample was from 47 to 132.
Figures (iii) to (vii) summarise the number of children in I.Q. bands.

Figure (iii) - boys

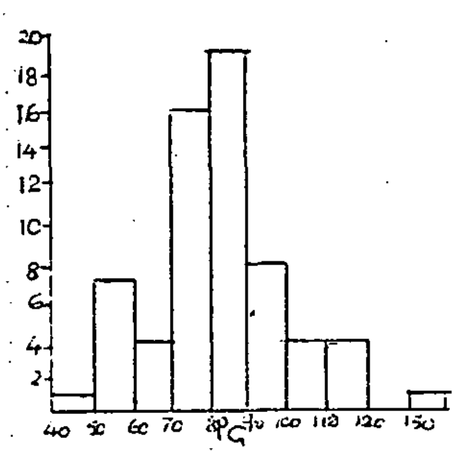


Figure (iv) - girls

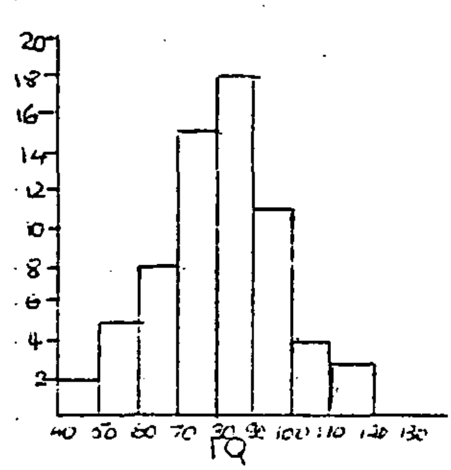


Fig. (v) Whole sample.

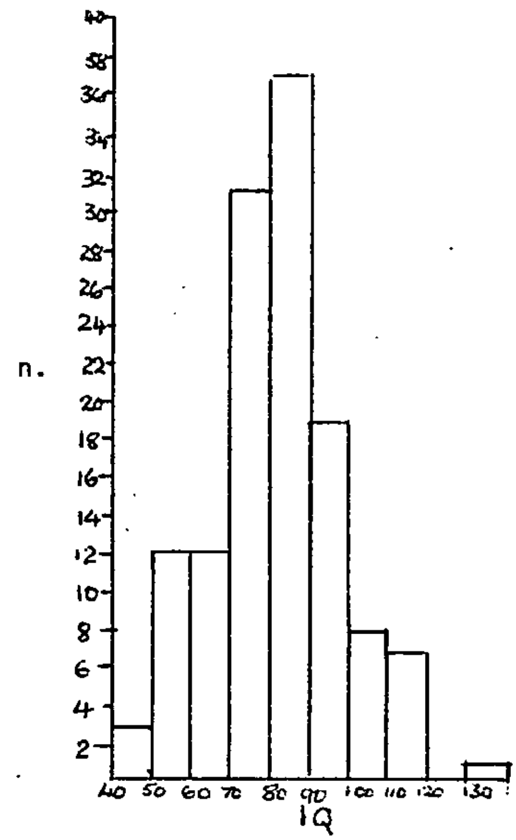


Fig.(vi) With shunt

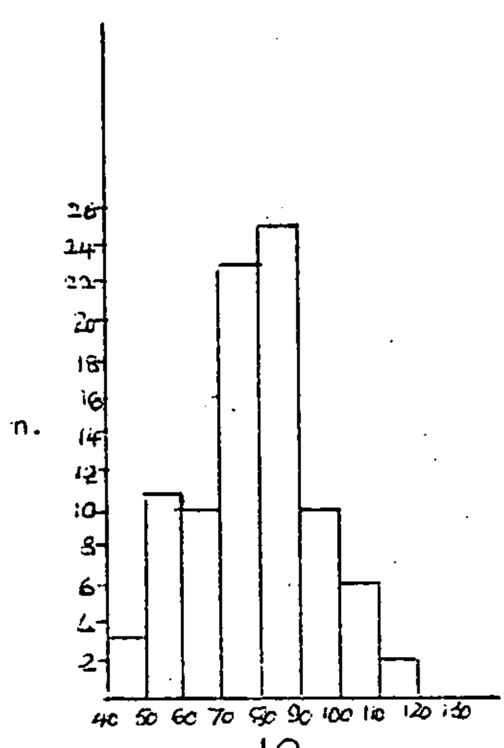
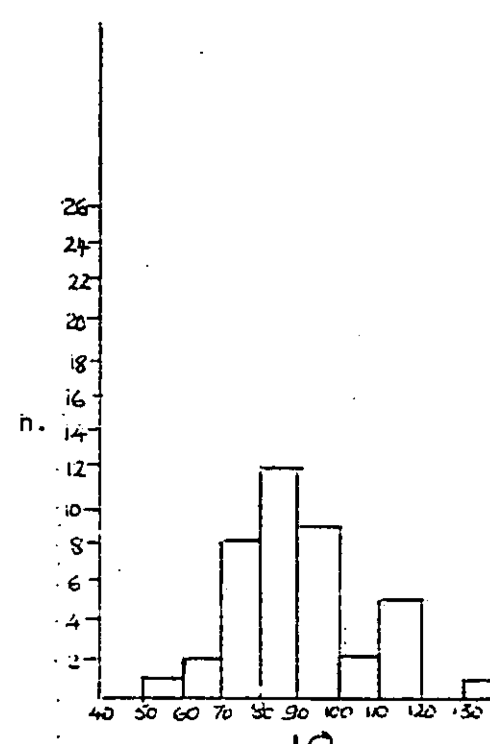


Fig.(vii) Without shunt



4. Methods of investigation.

Prior to the individual testing session, time was spent in looking around schools B, C and D. During this period the writer was introduced to all the children in their classroom situations, and it was possible to observe the spina bifida children at work, discuss their progress with the teachers concerned, and become generally known and accepted. Rapport with all the children was spontaneous and a friendly relationship was quickly and easily established. The apparatus and questions asked were the same for each child. The time taken to perform the tasks, particularly the Piagetian tests, varied from child to child, depending upon age, concentration span and external stimuli. Conversation, as might be expected from a spina bifida child, was readily forthcoming with little need of encouragement. Space was made available so that the tests could be carried out with the minimum of disturbance, such space being near the teaching area of the child concerned. The standardized tests enumerated below followed by the Piagetian tests were individually administered to each child. The children were not made aware of incorrect answers and responses. Since the Piagetian tests would only reflect the stage at which the child was operating at that particular time the author decided to re-test all the children in School A after a period of three years so that development could be assessed.

5. Tests.

A. Standardized measures.

- (i) Raven's Coloured Progressive Matrices.
- (ii) Crichton Vocabulary Scale.
- (iii) English Picture Vocabulary Test.
- (iv) Burt's Word Reading Test (1974 Revision).
- (v) Bender Gestalt Visuo-Motor Perceptual Test.
- (vi) Young's Group Mathematics Test (1974)

B. Piagetian Number Tests.

The tests used were based upon those described by Piaget (1952) in 'The Child's Conception of Number'. Full details of the tests are given in the next chapter.

Test 1a and 1b	Provoked Correspondence (pp. 41-67).
" 2a	Correspondence between several sets (pp. 203-213).
" 2b	Multiple Correspondence (pp. 213-220). (a) One to one correspondence between 'n' sets. (b) Two to one correspondence.
" 3a and 3b	Spontaneous Correspondence (pp. 65-85).
" 4	Development of the notion of measurement (pp. 223-243).
" 5a and 5b	Equating of quantities (pp. 190-198).
" 6 and 7	Conservation of continuous and discontinuous quantities (pp. 3, 38 and 222).
" 8	Relations between parts and wholes (pp. 187-190).
" 9 and 10	Seriation, Ordination and Cardination (pp. 96-147).
" 11	Class inclusion (pp. 161-184).

6. Assessment.

a. Additional tests.

These additional standardized tests enumerated above, were objectively scored in accordance with the norms detailed in the respective handbooks. Means, standard deviations and modal ages were calculated where applicable. Although several scoring systems are available for the Bender Gestalt Test, the Koppitz Scale (1964) which according to Kanaguchi (1970) reaches a plateau at about the age of nine, which almost equates with the mean average of the sample in this study, was used.

b. Piagetian tests.

The child, depending upon his response to the test situation, was placed at one of Piaget's three stages, examples of which are frequently given in "The Child's Conception of Number'. A weighting score of two points for a stage 3 (fully operational) response, one point for a stage 2 (transitional) and nil for a stage 1 (non-operational) was given to facilitate statistical analysis of data. An exception to the weighting score based upon stage response was necessary in Test 11 'Inclusion', where the responses were marked as being either correct or incorrect.

c. Young's Group Mathematics Test (1974).

A group of children from the main sample, mainly in School A were also tested at the end of the three-year interval on Young's Group Mathematics Test (1974). Each correct answer is given one mark; the total number of marks being the raw score from which the mathematical age can be calculated.

CHAPTER 5.

Description of the Measurement Technique.

The Piagetian Number Tests.

A series of tests related to the development of the concept of number, Piaget (1952) were broken down into a series of subtests. The child's reactions to the situations posed were observed, brief notes recorded of the ensuing dialogue and a judgement made as to the Piagetian stage at which the child was functioning.

Test (Ia). Provoked Correspondence (pp. 41-67).

Subtest (i).

Apparatus :- A rectangular piece of wood with ten evenly drilled holes and a set of ten wooden peg-men.

The child was asked, "Are there enough men to place in all the holes?", the reply was recorded and the child was invited to place the men in the holes to make quite sure. When agreement was reached that there were enough the men were removed by the tester and placed in a row which was visibly longer than the row of holes. Conservation was then tested by posing the question "Are there as many men as holes?". The men were then tightly grouped and conservation again tested.

Subtest (ii).

Apparatus :- A square of wood with ten holes drilled in a random configuration.

The child was asked "Are there enough men to place in all the holes?" The child was then invited to fit the men into the holes to make quite sure. When agreement was reached that there were enough the men were removed and firstly placed in a much longer line than the holes and afterwards tightly grouped, conservation being tested after each situation.

Subtest (iii).

Apparatus :- A toy vehicle and trailer and a set of peg-men. The vehicle and trailer each has four drilled holes which represent seats.

The child is presented with the set of men and asked "Are there enough men to fill all the seats in the truck and trailer?". Having demonstrated to the child's satisfaction that there were enough, the men were removed from the seats and placed in an extended row which exceeded the length of the truck and trailer. Conservation was then tested as in previous tests. The men were then grouped and conservation again tested.

Subtest (iv).

Apparatus :- A brightly coloured 'bus with seats for driver and passengers and a set of wooden passengers and driver.

The child was asked "Are there enough seats for all the people?" Having noted the reply and verified experimentally with the child that there were sufficient seats, the tester removed the people, placed them in a longer line than the length of the 'bus and tested conservation as previously. The men were then tightly grouped and conservation again tested.

Test (Ib). Provoked Correspondence.

This series of subtests were based upon situations in which the child could readily discover a one-to-one correspondence which was provoked by the very nature of two complementary sets. The essential difference between this and the previous series of subtests being that in Test (Ia) the configuration of only one of the two complementary sets could be altered whereas in Test (Ib) the shape of one or both sets could be altered at will.

Subtest (i).

Apparatus :- A set of white pot eggs and a set of egg-cups.

The child was asked "Are there enough egg-cups for all the eggs?" The child was then prompted, if necessary, to place the eggs in the egg-cups to make sure. When agreement that there were enough was reached, the tester removed the eggs and placed them in a long line which was longer than that of the egg-cups. Conservation was tested by asking "Are there as many eggs as egg-cups?" Having recorded the response the configuration of each set was reversed, and conservation again tested.

Subtest (ii).

Apparatus:- A set of purple plastic flowers and a set of flower pots.

The pots are placed in a line and the flowers in a bunch before the child was asked "Are there enough flowers to put into the flower pots?". Encouragement was then given to actually make the correspondence after which the flowers were removed and placed in a longer row than the flower pots. Conservation was then tested by asking "Are there as many flowers as flower pots?" The configuration of each set was then reversed and conservation again tested.

Subtest (iii).

Apparatus:- Ten beakers and ten bottles.

The beakers were grouped and the bottles placed in a line. The child was asked, "Are there enough beakers for all the bottles?" Encouragement was then given to make a one-to-one correspondence after which the beakers were again grouped and conservation tested by posing the question "Are there as many beakers as bottles?" The configuration of each set was then reversed and conservation again tested.

Subtest (iv).

Apparatus:- Ten pennies and ten sweets.

The child is given the money and told that the pennies can be used to buy sweets from the tester, the price being one penny for one sweet. Every time the tester is handed a penny the child is given a sweet. At the conclusion of each exchange a one-to-one correspondence is constructed between sweet and penny. When the final exchange has been made, the sweets are grouped and the pennies left in a line. The child is then asked, "Are there as many sweets as pennies?". The configuration of each set is then reversed and conservation again tested.

Subtest (v).

Apparatus:- Sweets and pennies.

This subtest reflects Piaget's concern with two important factors, the first of which is whether overt counting would assist the child in conserving in a situation similar to that envisaged in subtest (iv) and secondly how would the child react when the perceptual cue of one set was hidden. The child was told "I have some sweets costing one penny each which you can buy. Every time you give me a penny I will give you a sweet". The child was encouraged to audibly count whenever the exchange was made. When all the sweets were purchased, the child was asked, "How many sweets do you have?" and "How many pennies have you given me?" Conservation was tested when the sweets were placed in a line and the pennies grouped under the tester's hand.

Test (2a). Co-ordination of relations of equivalence;
<u>Correspondence between several sets (pp. 203-213).</u>

<u>Subtest (i).</u>

Apparatus :- Equal sets of white and brown pot eggs and egg-cups.

The child was asked to place the set of white eggs into the egg cups. When agreement was reached that there were enough, the white eggs were removed and placed in a group in front of the line of egg cups. The child was then asked to place the brown eggs into the egg cups. When agreement was reached that there were enough, the brown eggs were removed and placed behind the egg cups in a clearly longer row. Conservation was tested by asking "Are there as many brown as white eggs?".

<u>Subtest (ii).</u>

Apparatus :- Equal sets of purple flowers, yellow flowers and flower pots.

The child was asked to place the purple flowers into the row of pots. When agreement was reached that there were enough, the purple flowers were removed and bunched in front of the row of pots. The child was then asked to place the yellow flowers into the pots. The yellow flowers were then removed and placed behind the pots in a visibly longer row. Conservation of the sets of flowere was tested.

<u>Subtest (iii).</u>

Apparatus :- As in subtest (ii) but with an additional set of pence.

The child was told "Here are some pennies with which you can buy these yellow flowers, they cost one penny each". The yellow flowers were then exchanged for pennies in a 'one penny for one flower' method and placed in a row in front of the child. The pennies were returned to the child who was then able to purchase the purple flowers in the same manner. The purple flowers were bunched, and the pennies placed in a row near the child. Conservation of the sets of flowers was tested.

Test (2b). Multiple Correspondence (213-220).

(a) One to one correspondence between 'n' sets, subtests (i) and (ii).

(b) Two to one correspondence; subtest (iii).

Subtest (i).

Apparatus :- Equal sets of toy soldiers, white eggs, brown eggs and egg cups.

The child made the following one to one construction:- toy soldiers and egg cups, white eggs and egg cups and finally brown eggs and egg cups. The white eggs were subsequently grouped, and the brown eggs placed in a visibly longer row than the egg cups. The child was asked, "If the soldiers were given the brown and white eggs for breakfast, how many eggs would each soldier have?". Generalization beyond the two sets of eggs was then tested.

Subtest (ii).

Apparatus:- Equal sets of purple flowers, yellow flowers, flower pots.

Following the child's construction of a one to one correspondence with the sets described above, the purple flowers were bunched and the yellow flowers extended in a longer row than the flower pots. The child was asked, "If I placed all the flowers, that is, the purple and yellow ones, into the pots, how many would be in each one?" The child was then asked, "If I had another bunch of red flowers containing the same number of flowers as there are in the purple bunch or the yellow bunch and I placed all the flowers, that is the red, purple and yellow ones, into the flower pots, how many flowers would be in each pot?" Subsequently, more sets of flowers were suggested.

Subtest (iii).

Apparatus:- As for subtest (ii) plus a quantity of single flower holders.

The child was shown a quantity of single flower holders. The tester explained and demonstrated that each holder was designed to hold one flower only. The child was asked to take sufficient single flower holders for all the yellow and purple flowers. Piaget, in a similar test, wished to investigate whether the child who grasps that when 'n' purple flowers correspond to 'n' pots and 'n' yellow flowers similarly correspond to the same 'n' pots, has also developed the notion that there is a similar correspondence with 'n' pairs. The child who does understand this notion has moved from successful one to one to two to one correspondence and has, in Piaget's view, taken an important step toward multiplication.

Test (3a). Spontaneous Correspondence. Reproduction of figures (65-74).

The aim of the following series of subtests was to investigate the type of correspondence a child uses in situations which Piaget calls 'spontaneous', that is, in situations in which the child is compelled to find the correspondence of his own accord and to make what use of it he can. Piaget envisaged the type of situation in which the child spontaneously attempts to estimate the cardinal value of a set in such a way that the observer could discover what type of correspondence is used, and what methods are adopted before, and immediately after, one to one correspondence.

Apparatus:- Model tiles on which counters had been glued, a practice tile and supply of counters and sticks.

Subtest	(i)	15 counters in a random configuration
"	(ii)	16 counters in two parallel rows of eight.
"	(iii)	12 counters in a 'closed figure' which in this instance was a circle.
"	(iv)	9 sticks forming radii of a circle.
"	(v)	Counters in a series of figures:- a square of 4, a square of 5, i.e. one counter at each corner and one in the centre, a triangle of 6 and a square of 8.
"	(vi)	12 counters in a 'closed complex figure, in this instance a rhombus.

Test (3b) Spontaneous Correspondence...single rows (74-85).

Piaget's original test (p.75) was designed to discover whether similar results are achieved when single rows are used instead of complex figures as in 3a above.

Apparatus:- Sets of pennies, counters, buttons, matches, sweets, wooden men.

Subtests (i) to (vi) were similarly constructed, using the above objects. A model row of elements was constructed by the tester in view of the child who was asked to construct a similar row by using the same number of elements. When the construction of the one to one correspondence was satisfactorily completed and the child had agreed that both sets had exactly the same number, conservation was tested.

Test 4. Development of the notion of measurement (pp. 223-243).

Apparatus:- Transparent containers of differing shape, measuring beakers, water and culinary dye.

Subtest (i)

Two containers of different shape into which had been poured coloured water, were shown to the child. Care was taken that it was not possible to estimate their ratio by direct perception.

The child's attention was directed to nearby similarly sized measuring beakers and a brief discussion initiated as to their use. Following this the child was asked whether there was more, less or the same amount of coloured water in one of the two containers.

Subtest (ii).

The same quantity of coloured water was poured from a measuring beaker into three containers, the first wide and tall, the second wider but shorter and the third the narrowest and tallest. The child was then asked whether the three quantities were the same. As in subtest (i), the child's attention was drawn to the use of the nearby measuring beakers.

Test (5a)..Equating of quantities...unequal sets (pp. 190 - 195.)

Piaget's aim was to discover the child's reaction to a problem which required the equalization of unequal parts. No reference was made to the whole as such, the child being free to construct it or not in making his additive composition. Piaget wanted to observe, whether in equating two sets, the child was aware that when one set was increased the other was automatically decreased.

Apparatus:- Counters.

The child was shown the model constructions of unequal sets throughout the following subtests and asked to make both sets exactly the same, that is, to have the same number of counters in each set, without using any from the reserve pile.

Subtest (i).

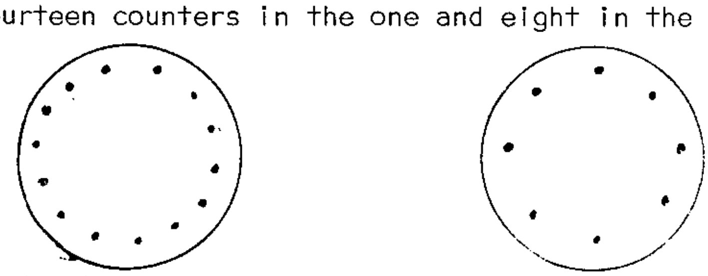
The investigator placed one set of eight counters and one of fourteen in parallel rows of dissimilar lengths as indicated below.

o o o o o o o o

o o o o o o o o o o o o o o

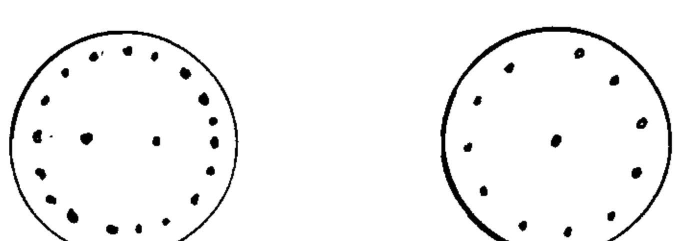
Subtest (ii).

Two circles of approximately the same diameter were constructed with fourteen counters in the one and eight in the other.



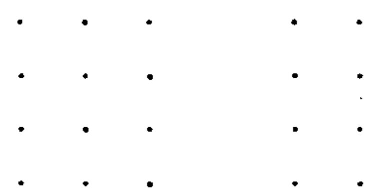
Subtest (iii).

Two circles of approximately the same diameter were constructed, the one having a circumference of eighteen counters and two extra counters completing the diameter, and the second with a circumference of eleven counters and one counter used to complete the diameter.



Subtest (iv).

One set of twelve counters constructed into three vertical parallel lines each having four equally spaced counters and one set of eight counters made into vertical, parallel lines with four equally spaced counters in each.



Test (5b). Equating of quantities. (pp. 195-198).

Piaget's aim was to investigate the child's ability to divide an even number of objects into equal parts and to conserve the initial equality of the sets when their configuration is altered.

Apparatus:- Equal sets of pennies, counters, buttons, matches, sweets and two dolls.

Subtests (i) to (v) were similarly constructed. In each instance the child was asked to share the pennies, counters, buttons, matches and sweets equally between the dolls. The tester stressed that each doll must have the same number. The dolls were placed in such a position as to make a one to one correspondence clearly possible. Conservation was tested after the division had been successfully concluded.

Test 6. Conservation of continuous quantity. (pp. 3-17 and p. 222).

Apparatus :- A variety of transparent and opaque containers, some of which are similar in size and shape, culinary dyes and a jug of water.

Subtest (i).

The child was asked to pour the same amount of water into two identical measuring containers. The situation posed by Piaget (p. 6) was replicated by use of the culinary dyes. When the child was satisfied that both containers held exactly the same amount, he was asked to pour the water from one container into an opaque beaker and to pour the water from the other into a transparent beaker of the same size and shape as the opaque one. Conservation was then tested.

Subtest (ii).

This subtest was developed similarly to subtest (i), the difference being that the water from one of the measuring beakers was poured into a tall, narrow container and the other into a shallow wide container. Conservation was tested.

Subtest (iii).

The child was shown a container into which the tester poured a quantity of coloured water. Nearby was a taller, narrower container. The child was asked to pour the same amount of water into this second container. The child's reactions to this stiuation were noted.

Test 7. Conservation of discontinuous quantities (pp. 25-38).

Piaget was concerned in this test to investigate conservation of quantities which could be evaluated globally when the elements were massed and counted when they were separated.

Apparatus:- Transparent and opaque containers as used in Test 6, coloured wooden beads and laces.

Subtest (i).

The child was asked to fill two similar transparent containers by placing the same number of beads in each; red beads being placed in one and green in the other. Tall, narrow containers which assisted the child visually in recognizing equality were used. When the task was completed the child was asked if there were as many red as green beads in the containers. When satisfied that the child appreciated that there was exactly the same number, the writer pointed to two empty containers, one of which was opaque and asked the child to put the red beads into it whilst the writer placed the green beads into the transparent container. Conservation was tested. The child's response to this situation in which the perceptual cue was removed was noted.

Subtest (ii).

The initial stages of subtest (i) were repeated. Having established equality the child was asked to place his red beads into a taller, narrower container whilst the writer poured his green beads into a shorter, wider one. Conservation was tested.

Subtest (iii).

The child was asked to put a red bead into his container whenever the tester dropped a green bead into his. The tester interrupted the procedure at frequent intervals by asking if there was the same number of beads in each container at that point. When the containers were both filled the child was asked "Is there the same number of beads in each container?" When the tester was confident of the child's certainty he asked him to place his beads into a taller, narrower container whilst the tester placed his into a shorter, wider one. Conservation was tested.

Subtest (iv).

After repeating the procedure in subtest (iii) the tester pointed to a red lace and a green one and asked "If we made two strings of beads, a red one for you and a green one for me, would there be the same number in each?"

Test 8. Relations between Parts and Wholes. (pp. 187-190).

Piaget's aims in this test were to discover if the child was able to, (a) make an even distribution of sweets between two dolls, (b) to observe if the child was able to construct a one to one relationship between the dolls, (c) to see if the child understood that a whole remains constant irrespective of the various additive composition of its parts, e.g., (4 + 4) = (1 + 7) = (2 + 6) = (3 + 5) = (8).

Apparatus :- Even number of sweets and two miniature dolls.

The child was asked to share the sweets between the two dolls. Having constructed two rows of an equal number of sweets in a one to one correspondence, the child was asked "Have the dolls the same number of sweets to eat?" When the child agreed the tester suggested that the 'mother' of the dolls, not wishing all the sweets to be eaten at once, requested that doll 'A' should eat two of her sweets in the morning and six in the afternoon. Doll 'B' should eat three sweets in the morning and five in the afternoon. This was visually demonstrated by the tester who reconstructed doll A's row of sweets from a set of 8 to a 2 + 6 construction and doll B's row of sweets from the set of

8 to a 3 + 5 construction. The child was then asked "Has each doll the same number of sweets to eat today?" If the child's response was correct the various relations which exist in the set of eight were demonstrated and the child's response noted.

Test 9. Seriation. (pp. 96-121).

Apparatus:- Sets of dolls, wooden balls, sticks and straws of various sizes.

Subtest (i).

The child was asked to place the dolls in order of size.

Subtest (ii).

When the dolls had been placed in order, the tester explained that each doll could have a ball with which to play, the biggest doll having the biggest ball. The tester observed the child's placing of the balls in a one-to-one situation with the dolls.

Subtest (iii).

The tester suggesting firstly that each doll would need a stick of appropriate size with which to hit her ball, asked the child to place the right stick by the side of each doll and ball, the biggest doll having the longest stick with which to hit the biggest ball.

Subtest (iv).

In this subtest the orders of the series constructed in subtests (i) and (ii) above were disarranged. The tester firstly displaced the set of dolls by altering their position in the series, and then, indicating one of the balls, asked, "Which doll does this ball belong to?" The same question is asked in turn with respect to the other balls in the series. The order of the balls was then disarrayed and the tester asked the child, indicating one of the dolls, "Where is the ball belonging to this doll?" and so on.

Subtest (v).

The third seriation of sticks was disturbed and a succession of questions asked which were similar in character to those in subtest (iv) but concerned with sticks, dolls and balls.

Subtest (vi).

The child was asked to place some of the set of straws in order of size. The tester deliberately kept the remainder of straws aside until the child had completed the seriation. When the task was completed, the child was shown the remainder of the straws and asked to fit them into the order.

Test 10. Ordination and Cardination. (pp. 122-147).

Subtest (i).

Piaget, in the light of his experiments with seriation and serial correspondence states that ordination always involves cardination and vice-versa. To support this view, Piaget devised a series of tests using concrete materials which could be seriated and evaluated cardinally.

Apparatus:- Set of wooden cylinders having the same diameter but of differing lengths and one miniature doll.

The child was asked to make a staircase with the set of wooden cylinders. The tester, having suggested a 'going to bed' situation for the doll, placed it on one of the stairs and asked, "How many stairs has the doll climbed?" and "How many stairs will it need to climb to reach the top?" This pattern of questions was repeated with the doll being placed on different stairs.

Subtest (ii).

The doll was placed on different stairs as in subtest (i) but the questions posed explored the child's terms used for the ordinal position of the stair, for example, "Which stair (the tester pointing to the fourth) is the doll on now?"

Test 11. Inclusion. (pp. 161-184).

This test was based on Piaget's series of experiments in which 'B' was a set of objects forming a logical class and 'A' a part of that set. The problem put to the child was whether there were more elements in 'B' than 'A' or in other words, whether class 'B' was wider than its sub-class 'A'.

Apparatus:- Set of wild animal models.
Set of farm animal models.
Set of large, wooden red, black and natural beads.
9 visually illustrated cards comprising:-
Things that fly...aeroplanes, birds, kites.
Things worn...trousers, jumpers, coats.
Animals...horses, rabbits, squirrels.
Things in which one can ride...cars, engines, prams.
Children...boys, girls.
Things to eat...cakes, pears, cherries.
Things with which to eat...forks, knives.
Grown-ups...men, women.
Flowers...tulips, hyacinths.

The child was shown the models and cards in sequence, and was asked to describe in each instance the attribute of the set. For example, when the child had examined the set of model wild animals, the question "What kind of animals are these?" was asked. Where the child delineated each subset in reply, a supplementary question was asked. "And what kind of animals do we call kangaroos, lions and bears?" The visually illustrated cards were shown in turn and the child asked, "What can you tell me about all these things?"

When the tester was satisfied that the child possessed the notion of total class required by the questions and was capable of the general statement defining that class, for example, "They all fly" asked, "Are there as many birds as things that fly?"

Standardised Tests.

A. Pultibec rating.

The Pultibec System (Lindon 1963) was evolved as an attempt to fulfil the recognized need for a global, yet concise system for coding the difficulties in functional terms of children with multiple handicaps.

The child's individual functional capacities are placed under eight main headings which embrace four mainly physical qualities, namely:-

P = Physical capacity (endurance and general health).

U = Upper limbs (classified as Hand = H, Arm = A, right and left).

L = Locomotion (classified as right and left lower limbs).

T = Toilet.

and four qualities mainly of behaviour and communication:-

I = Intelligence

B = Behaviour

E = Vision (Eyes classified as right eye and left eye).

C = Communication (classified as Hearing = H and Speech = S).

Each of the above qualities and their subsidiaries is divided into six main grades, but in relation to hand, arm and lower limb, five additional intermediate grades are necessary. Generally speaking, grade one denotes complete normality, grades two to five progressively poorer function and finally grade six which denotes that function in that quality is virtually absent.

When completing the Pultibec there are 114 possible grades under the fourteen qualities to be considered during a medical examination. In practice, the appropriate grade is often obvious and the system is much quicker than it would first appear to be on paper.

The Pultibec system is an attempt to translate the complexities of medical terminology and case note-taking, into a common language which is concise and easily understood in functional terms as between medical practitioners, nurses, physiotherapists, education officers, teachers, psychologists, youth employment officers, employers and last, but by no means least, the parents of the handicapped child.

B. Raven's Coloured Progressive Matrices.

The test, which was standardised over an age range of five and a half to eleven years by Raven (1974), can be used in book or block form and is possible to be administered as a group or individual test. Although many writers warn against over reliance upon the C.P.M. as a measure of general intelligence the consensus of opinion is that it is a useful clinical aid. Heaton-Ward (1970), for example writes "This is a perceptual test of intelligence and is claimed to give a good assessment of general native intellectual ability without invoking either social training, educational status or muscular co-ordination and speed." McArthur (1960) concludes from his study, that the C.P.M. can be employed as an economical indicator of general intellectual ability for children for whom group or individual intelligence tests may be considered educationally or culturally biased". McArthur and Elley (1963) say, "The R.P.M. is the nearest we have to a culture-reduced test, it has a high element of general intelligence and a low correlation with socio-economic status". They agree that the matrices' scale has relevant application for slow learners.

Harris (1959) observed after testing children aged 5.1 to 6.1 years, that the test proved difficult for five to six year olds, especially those in the average reaches of ability and below. He reported considerable waning of interest and enthusiasm especially in the B series. It is interesting also to note, in view of the nature of the present experiment, that Harris found a tendency for the R.P.M. to correlate more highly with arithmetic than with comprehension.

If an estimate of general intelligence is required Raven advises using the Crighton Vocabulary Test to supplement the Matrices Test.

Since the problems can be attempted with very little verbal instruction, and there is no speed limit, it is obviously a useful test to use with handicapped children.

On each page of the text book there is a large coloured design or 'matrix' from which a part has been removed, the subject being required after careful examination to choose the missing piece from among six possible choices on the lower part of the page. The brightly coloured background was designed to hold the attention of young children and also to make the nature of the problem to be solved more obvious without contributing to its solution in any way.

The first problem in each of the three sets is intended to be self evident to the subject, subsequently the designs in each set becoming increasingly more difficult. The order of the problem in each set provides the standard training in the method of working and the three sets are arranged to cover many of the perceptual reasoning processes of which children are thought to be capable. Scoring is a quick procedure, the manual providing tables for converting raw scores to percentiles.

The most satisfactory method of interpreting the significance of a child's total score is to consider it in terms of the percentage frequency with which a similar score is found to occur amongst people of his own age. Raven's classifies the scores into five grades, ranging from the 'intellectually superior' in Grade I to the 'intellectually defective' in Grade V.

C. English Picture Vocabulary Test.

The full range edition of the English Picture Vocabulary Test has been developed from the American Peabody Picture Vocabulary Test to assess levels of verbal ability between the ages of three to eighteen plus years.

The test is functionally independent in measurement of reading skills although related to the integration of auditory and visual symbols and gives the tester an opportunity to observe behaviour in standardised circumstances. Unlike most verbal tests it can be used effectively with most physically handicapped, inarticulate and retarded as well as with normal subjects. It imposes a task which appears to the subjects so different from problem solving that they seem under much less strain than in the case of conventional testing. Although the test operates by seeking to have a child identify a picture corresponding with a spoken word and may be considered as a measure of range of vocabulary, it also is an indication of the level of semantic reference which the child is capable of comprehending. The pictures are line drawings which focus on the concept suggested by a particular word and present minimal perceptual difficulties. Each task is restricted to a choice among four pictures so that, throughout its range, the amount of perceptual scanning required to determine the limits of choice is even within the capability of the average child of three years of age.

There is no time limit for the test as a whole, or for the individual items. Testing proceeds at the rate set by the subject. Age is calculated in years and completed months at the time of testing and is used in determining the derived scores. Physically handicapped children who cannot respond either by pointing or giving the number of the selected picture, may respond with any signal of which they are capable. This problem is not envisaged with respect to spina bifida and hydrocephalic children since almost without exception they are capable of an adequate signal to denote their response.

The personal data section of the record sheet is filled in by the tester who takes time to establish an easy relationship with the child and notices any characteristics which may subsequently prove significant during test performance.

The test booklet is placed in such a position that the child has a complete view from either the wheel-chair, normal seating if able, or 'standing with calipers' position. The tester turns the pages ensuring that no more than one page is turned over at a time.

The number of pictures correctly identified up to and including a ceiling score can be converted objectively and quickly to standardised scores, percentile equivalents or modal ages.

D. Crichton Vocabulary Test.

The Crichton Vocabulary Scale is designed for used with the Raven's Coloured Progressive Matrices. Raven (1961) writes that it is constructed to cover as nearly as possible the same range of intellectual development as the Coloured Progressive Matrices and to be suitable for use with persons of defective or impaired intelligence as well as for normal children. It is a useful supporting test for the matrices providing an index of a subject's general cultural attainments.

Raven felt that using the Matrices and Vocabulary tests together instead of a single verbal test of general intelligence, would enable a subject's present capacity for intellectual activity and his store of verbal information to be assessed separately.

The scale contains eighty words arranged in two sets of forty words each. The order of the words are based on the frequency with which children were able to explain their meaning. The introductory words are initially and intentionally easier for young children to explain. The test is very easily administered, the child simply being asked to explain in his own words the meaning of each word in turn. Recording and marking is very straight-forward, the tester simply recording the child's response to each word. The child, on the result of his score, can be classified in one of five grades, similarly to Raven's C.P.M. classification, ranging from verbally superior at, or above, the 95th percentile for his age group to verbally defective if his score lies at or below the 5th percentile for his age group.

E. The Bender Gestalt Visual Motor Test.

The Bender Gestalt Test, or Visual Motor Gestalt Test, as developed by Bender (1936) consists of test cards on which are designs adapted from figures used in perceptual experiments by Wertheimer (1923). Bender (1938) observes that the visual motor gestalt function is fundamentally associated with such aspects of intelligence as visual perception, manual motor ability, memory, spatial concepts and organization of representation. Werner (1957) stated that the method of copying figures is extremely important to the observer in assessing the child's functioning at a primitive perceptual level. The use of this scale with children, including the provision of norms has been discussed by Koppitz (1960, 1964, 1975).

Since visual perception, maturation, temporal and spatial concepts seem to be essential in the successful performance in the Piagetian tests envisaged in this experiment, it was considered useful to view the performance of spina bifida children in the light of the norms detailed by Koppitz (1975). Rimmer and Weiss (1972) are also of the view that the aspects of conceptual development in Bender Gestalt performance have close links with Piaget's work. These authors conclude that the task of copying the Bender Gestalt figures may be expressed formally as mathematical tasks suggested by Piaget (1952, 1956, 1960), the first aspect being the correct copying of the number of elements and the second the development of the ability to correctly copy figures based on the principles of geometric concept formation. The test comprises a series of nine cards, a different design being on each one. The child is given a pencil and a sheet of white unlined paper, size $8\frac{1}{2}$" x 11" and is requested to copy each card. The cards are presented one at a time, being laid on the paper correctly orientated. The directions are very simple, for example, "Here are some shapes for you to copy, just copy as you see them." Evaluation of the test depends on the form of the figures reproduced, their relationship to each other, the spatial background and the temporal patterning.

The following factors, orientation, distortion of shape, number, perseveration and integration are analysed and can be marked by a comparison with the norms drawn up by Koppitz (1964, 1975). The drawings are marked with error scores if they do not compare reasonably well with the norms.

F. The Burt Reading Test (1974)Revision).

The test, originally devised by Burt in 1921, revised by Vernon (1938), Thomson (1952) and the Scottish Council for Educational Research (1974) is being currently used according to the Bullock Report (1975) in one-third of primary schools and fifteen per cent of secondary schools. The test is also frequently used by educational psychologists and research workers.

It consists of 110 words graded in approximate order of difficulty which are shown individually to the child who is asked to read as many words as he can at his own speed. He continues until he has attempted and failed at least ten consecutive words; it is then presumed that the remainder is too difficult for him, but he is allowed to look ahead and pick out any other words he thinks he can manage. The reading age which can be readily assessed by reference to the norms, is based on the total number of words which the child has read correctly.

G. Young's Group Mathematics Test (1970).

This is a test of mathematical understanding at a simple level. It is suitable for children of a wide range of ability aged between 6.5 and 8.5 years and for less able children up to the age of 12.9 years. The test which is based upon a combination of oral questions with pictures or other visually presented material, although intended primarily as a group test, can also be used as an individual test. Raw scores can be readily converted into mathematics quotients by reference to the table of norms (1974).

Examples of the standardised tests are to be found in Appendix B, pages 287-291.

CHAPTER 6

Statement of the Results.

Each child, after consultation with the relevant para-medical staff in each school, was given a rating based on the Pultibec system for the medical assessment of handicapped children. Full details of the ratings are to be found in Appendix A pages 281-285. Means and standard deviations of the Pultibec scores were calculated and are summarised in Table 9 below. It needs to be noted that the higher the Pultibec score, the greater the degree of overall handicap.

Table 9.

Pultibec. Distribution of sample with reference to schools.

	Boys			Girls			All		
School	n.	m.	s.d.	n.	m.	s.d.	n.	m.	s.d.
A	16	31.5	8.4	12	33.4	6.4	28	32.2	7.6
B	15	33.9	5.2	12	33.4	8.1	27	33.7	6.5
C	12	31.3	7.0	17	29.5	6.8	29	30.3	6.8
D	21	33.3	6.3	25	35.6	5.3	46	34.5	5.8
All	64	32.6	6.7	66	33.2	6.7	130	32.9	6.7

The Pultibec scores were also analysed with respect to shunts and non-shunts. Table below summarises the results.

Table 10

Pultibec. Shunts and non-shunts.

	Without shunt			With shunt		
	n.	m.	s.d.	n.	m.	s.d.
Boys	24	30.1	5.6	40	34.1	6.9
Girls	16	29.1	6.8	50	34.5	6.2
All	40	29.7	6.0	90	34.3	6.5

The two tests given to investigate the perceptual development of the sample were the Bender Gestalt Visuo-motor and Raven's Coloured Progressive Matrices; the former being specifically designed to test perceptual maturity and the latter, observation and clear thinking. The results on both tests are tabulated and full details are to be found in Appendix C pages 310-312 and 319-340.

Means and standard deviations are summarised for both tests in tables 11 to 14 below.

Table 11.

Raven's Coloured Progressive Matrices. By school and whole sample.

	n.	m.raw score	s.d.	m.matrices age	m.chron. age.
Boys	64	18.6	7.8	8.3 yrs.	9.5 yrs.
Girls	66	16.9	6.1	7.5 "	9.5 "
All	130	17.7	7.1	7.8 "	9.5 "

Table 12.

Raven's Coloured Progressive Matrices. By medical classification.

	Without shunt					With shunt				
	n.	m.raw score	s.d.	Mat. age.	C.A.	n.	m.raw score	s.d.	Mat. age.	C.A.
Boys	24	19.2	7.5	8.3	8.7	40	18.1	8.1	8.0	9.6
Girls	16	18.3	6.1	8.1	9.9	50	16.5	6.1	7.2	9.4
All	40	18.9	6.9	8.2	9.6	90	17.2	7.1	7.6	9.5

The scores on the Bender Gestalt are error scores and have been assessed by reference to the Koppitz scale (1964) and the perceptual ages calculated from Furr's (1970) standard scores table.

Table 13.

Bender Gestalt.

	n.	mean error score	s.d.	perceptual age	chron. age.
Boys	64	12.2	8.5	5.0 - 5.6	9.5
Girls	66	11.3	7.2	5.0 - 5.6	9.5
All	130	11.6	7.8	5.0 - 5.6	9.5

Table 14.

Bender Gestalt. By medical classification.

	Without shunt.					With shunt.				
	n.	m.error score	s.d.	percept. age	C.A.	n.	m.error score	s.d.	percept. age	C.A.
Boys	24	9.6	7.4	5.6-6.0	8.7	40	13.8	8.8	5.0	9.6
Girls	16	7.8	6.0	6.0-6.6	9.9	50	12.4	7.2	5.1	9.4
All	40	8.9	6.8	5.6-6.0	9.6	90	13.0	7.9	5.0	9.5

It will be seen from Tables 11 - 14 above that the derived perceptual ages indicate a marked retardation when compared with chronological age, the measure of perceptual immaturity being seen more clearly in the results on the Bender Gestalt than in Raven's Coloured Progressive Matrices.

Standardized Vocabulary Tests.

(a) The English Picture Vocabulary Test.

Complete details of the results are to be found in the Appendix C page 314. Summaries of the data with respect to schools, sex and physical conditions are found in Tables 15 - 17 below. The mean modal ages for the sample are calculated from the administrative manual for the E.P.V.T. (Brimer and Dunn 1973).

Table 15.

English Picture Vocabulary Test.

	n.	Mean raw score	s.d.	Mean vocab. age.	Mean chron. age
Boys	64	57.7	29.9	8.1	9.5
Girls	66	52.2	23.3	7.3	9.5
All	130	54.9	26.8	7.7	9.5

Table 16.

English Picture Vocabulary Test.
Results by medical classification.

	Without shunt.					With shunt.				
	n.	m.raw score	s.d.	m.voc. age	m.chron. age	n.	m.raw score	s.d.	m.voc. age	m.chron. age.
Boys	24	61.9	29.1	8.5	8.7	40	55.2	30.5	7.8	9.6
Girls	16	52.9	26.5	7.5	7.5	50	52.0	22.4	7.3	9.4
All	40	58.3	28.1	8.1	9.6	90	53.4	26.2	7.6	9.5

(b) Crichton Vocabulary Scale.

Complete details of the results are to be found in the Appendix C page 317. Summaries of the data with respect to schools, sex and physical categories are to be found in tables below.

The mean vocabulary age has been calculated from Raven's Guide to using the C.V.S (1974)

Table 17.

Means, standard deviations, vocabulary and chronological ages by sample and sex.

	n.	m.raw score	s.d.	Vocab. age.	Chron. age.
Boys	64	35.3	20.3	8.7	9.5
Girls	66	31.9	16.8	8.3	9.5
All	130	33.6	18.6	8.6	9.5

Table 18.

Crichton Vocabulary Scale
by reference to medical classification.

	Without shunt					With shunt				
	n.	m.raw score	s.d.	m.voc. age	m.chron. age	n.	m.raw score	s.d.	m.voc. age	m.chron. age
Boys	24	35.2	19.6	8.7	8.7	40	35.4	21.0	8.7	9.6
Girls	16	34.8	16.7	8.6	9.9	50	31.0	16.9	8.1	9.4
All	40	35.0	18.2	8.6	9.6	90	33.0	18.8	8.5	9.5

There was as might be expected a high correlation indicating a marked relationship between the two vocabulary tests.

Reading.

(i) Each child was tested on the Burt's Word Reading Test (1974 Revision). Complete details are to be found in Appendix C pages 341-345.

(ii) In addition children from School A were re-tested after a three-year interval. Details of the second testing are to be found in Appendix G pages 408-414. Tables 19-20 summarise the data with respect to (i).

Table 19.

Reading. Means and s.d. of raw scores, reading and chronological ages by reference to overall sample.

	n.	m.raw score	s.d.	m.read. age	m.chron. age
Boys	64	35.7	38.8	7.0	9.5
Girls	66	28.7	34.7	6.5	9.5
All	130	32.1	36.8	6.8	9.5

Table 20.

Reading and chronological ages with respect to school department.

		n.	m.raw score	s.d.	read. age.	chron. age.
Secondary	Boys	16	68.9	40.5	10.0	14.1
12-16 yrs.	Girls	16	75.4	29.8	10.6	14.0
	All	32	72.1	35.2	10.3	14.0
Junior	Boys	20	49.7	33.2	8.2	10.5
8-11 yrs	Girls	25	20.7	22.8	6.2	9.9
	All	45	33.6	31.2	6.7	10.1
Infants	Boys	28	6.6	12.6	5.5	6.4
5-7 yrs.	Girls	25	6.8	13.1	5.5	6.3
	All	53	6.7	12.7	5.5	6.3

Table 21

Reading. By reference to two-year interval age groups.

Age Group	Boys n.	Boys Mean R.A.	Girls n.	Girls Mean R.A.	All n.	All Mean R.A.
15-16	4	11.5	5	12.0	9	12.0
13-14	9	9.3	7	10.8	16	9.9
11-12	11	9.7	10	6.5	21	8.0
9-10	8	7.8	13	6.5	21	7.0
7-8	11	6.2	13	5.7	24	5.9
5-6	21	5.4	18	5.1	39	5.3

Table 22

Reading.
By reference to medical classification.

	Without shunt.					With shunt.				
	n.	Mean raw score	s.d.	m. R.A.	m. C.A.	n.	Mean raw score	s.d.	m. R.A.	m. C.A.
Boys	24	34.1	37.2	6.9	8.7	40	36.6	40.2	7.3	9.6
Girls	16	34.2	42.1	6.9	9.9	50	26.9	32.3	6.3	9.4
All	40	34.1	38.7	6.9	9.6	90	31.2	36.2	6.7	9.5

Children in school A were re-tested both in the Piagetian and Reading tests after a three-year period. Table 23 below summarises the results.

Table 23

Reading
Comparison of results of School A after three-year period.

First test.				Second test.			
n.	Mean R.A.	s.d.	Mean C.A.	n.	Mean R.A.	s.d.	Mean C.A.
28	6.6	2.1	8.3	28	9.7	2.2	11.3

Piagetian Tests.

Full details of each child's performance in the Piagetian tests are to be found in Appendix F pages 392 to 399. Tables 24-34 overleaf present summaries of the data with respect to school, sex and medical classification.

Table 24.

Piagetian Tests (1a-10). Means and s.d of weighted scores.
Maximum score possible = 108.

	Boys			Girls			All		
School.	n.	m.	s.d.	n.	m.	s.d.	n.	m.	s.d.
A	16	58.3	34.3	12	42.0	36.9	28	51.3	35.7
B	15	39.3	40.5	12	30.7	32.1	27	35.8	36.4
C	12	47.9	37.2	17	44.2	36.5	29	45.8	36.2
D	21	76.6	38.7	25	69.4	32.2	46	73.8	34.6
All	64	57.9	39.7	66	50.9	36.7	130	54.8	38.2

Table 25.

Piagetian Tests (1a-10)
Means and s.ds of weighted scores, school departments.

	Infants 5 to 7+			Juniors 8+ to 11+			Secondary 12+ to 16+		
	n.	m.	s.d.	n.	m.	s.d.	n.	m.	s.d.
Boys	28	27.5	25.3	20	76.5	33.6	16	87.9	29.8
Girls	25	20.6	18.5	25	61.8	33.1	16	81.3	28.6
All	53	24.2	22.4	45	68.5	33.5	32	86.2	27.4

Table 26.

Piagetian Tests (1a-10)
Two-year interval age groups.

	Boys			Girls			All		
Age group	n.	m.	s.d.	n.	m.	s.d.	n.	m.	s.d.
15-16	4	104.5	7.0	5	96.2	0.1	9	99.9	9.4
13-14	9	82.2	36.9	7	81.0	29.2	16	81.7	32.7
11-12	11	91.1	22.6	10	65.6	36.5	21	79.0	32.0
9-10	8	56.1	39.9	13	63.0	34.2	21	60.4	35.6
7-8	11	63.3	20.9	13	43.1	25.0	24	52.3	25.0
5-6	21	19.1	21.8	18	15.4	16.4	39	17.4	19.4

Table 27.

Piagetian tests (1a-10).
Weighted scores expressed as a percentage. Two-year age groups.

Age group	n.	Boys	n.	Girls	n.	All
15-16	4	96.8	5	89.1	9	92.5
13-14	9	76.1	7	75.0	16	75.7
11-12	11	84.4	10	60.7	21	73.1
9-10	8	51.9	13	58.3	21	55.9
7-8	11	58.6	13	39.9	24	48.4
5-6	21	17.7	18	14.3	29	16.1

Table 28.

Piagetian Tests (Ia-10). Means and s.ds of weighted scores by medical classification.

	Without shunt			With shunt		
	n.	m.	s.d.	n.	m.	s.d.
Boys	24	60.7	36.7	40	56.2	41.8
Girls	16	64.2	36.3	50	46.7	36.2
All	40	62.1	36.1	90	50.9	38.9

Table 29.

Piagetian Tests. Means of weighted scores expressed as a percentage. Medical classification.

	Without shunt		With shunt	
	n.	mean%	n.	mean %
Boys	24	56.2	40	52.0
Girls	16	59.4	50	43.2
All	40	57.5	90	47.1

Table 30.

Summary of times children were at particular stages in tests Ia-10. By school and sex.

	Boys			Girls			All		
Stage	1	2	3	1	2	3	1	2	3
School A	278	244	342	324	152	172	602	396	514
" B	432	168	210	380	160	108	812	328	318
" C	273	167	208	442	194	282	715	361	490
" D	263	134	737	326	299	725	589	433	1462
Total	1246	713	1497	1472	805	1287	2718	1518	2784

Table 31.

Summary of times children were at particular stages in tests Ia to 10. By schools and sex (expressed as percentages).

	Boys			Girls			All		
Stage	1	2	3	1	2	3	1	2	3
School A	32.2	28.2	39.6	50.0	23.5	26.5	39.8	26.2	34.0
" B	53.3	20.8	25.9	58.6	24.7	16.7	55.7	22.5	21.8
" C	42.1	25.8	32.1	48.1	21.1	30.7	45.7	23.1	31.2
" D	23.2	11.8	65.0	24.1	22.1	53.7	23.7	17.4	58.9

Table 32.

Summary of times children were at particular stages in tests Ia to 10 by whole sample and sex.

	Boys (n=64)			Girls (n=66)			All (n=130)		
Stage	1	2	3	1	2	3	1	2	3
	1246	713	1497	1472	805	1287	2718	1518	3784
%	36.1	20.6	43.3	41.3	22.6	36.1	38.7	21.6	39.7

Tables 33 and 34 detail the results when the children were placed into age groups representing the three main areas by which schools are normally classified.

Table 33.

Piagetian Tests (1a to 10).
Summary of times children were at particular stages by school department and sex.

Stage	n.	1	2	3	n.	1	2	3	n.	1	2	3
Secondary	16	106	105	653	16	124	149	591	32	230	254	1244
Junior	20	220	188	672	25	402	333	615	45	622	521	1287
Infant	28	933	393	186	25	951	295	104	53	1884	688	290

Table 34.

Summary of times children were at particular stages on test 1a to 10 by school department and sex (expressed as a percentage).

Stage	1	2	3	1	2	3	1	2	3
		Boys			Girls			All	
Secondary	12.3	12.1	75.6	14.4	17.2	68.4	13.3	14.7	72.0
Junior	20.4	17.4	62.2	29.8	24.7	45.5	25.6	21.4	53.0
Infant	61.7	26.0	12.3	70.4	21.9	7.7	65.8	24.1	10.1

The following tables 35 to 63 give details of the results with respect to the individual tests.

Test 1a and 1b - Provoked Correspondence.

The sub-tests in these tests of provoked correspondence elicited responses similar to those which Piaget and his co-workers observed. Because of this similarity it was quite possible to place each child in one of the three following Piagetian stages;

Stage 1 Representing the level of thinking of the child who was able to construct without great difficulty the 'one-to-one' correspondence between the sets recognizing their initial equivalence.

Stage 2 Represented the level of thinking of the child who alternated between understanding and not, the concept of conservation; accepting the notion under some circumstances but rejecting it in more extreme situations.

Stage 3 Represented the child's unshaken demonstration of the concept under all conditions.

Table 35.

Test Ia - Provoked Correspondence. Summary of stage responses based on 4 subtests.

Whole Sample

	Boys (n = 64)			Girls (n = 66)			All (n = 130)		
Stage	1	2	3	1	2	3	1	2	3
n.	83	50	123	107	51	106	190	101	229
%	32.4	19.5	48.1	40.5	19.3	40.2	36.5	19.4	44.1

School Department.

	Secondary				Junior				Infant			
	n.	Stage 1	2	3	n.	1	2	3	n.	1	2	3
Boys	16	7	6	51	20	12	13	55	28	64	31	17
Girls	16	7	8	49	25	38	16	46	25	63	26	11
All	32	14	14	100	45	50	29	101	53	127	57	28

School Department - percentage stage responses.

	Secondary			Junior			Infant		
Stage	1	2	3	1	2	3	1	2	3
Boys	10.9	9.4	79.7	15.0	16.3	68.7	57.1	27.7	15.2
Girls	10.9	12.5	76.6	38.0	16.0	46.0	63.0	26.0	11.0
All	10.9	10.9	78.2	27.8	16.1	56.1	59.9	26.9	13.2

Table 36.

Test Ib - Provoked correspondence. Summary of stage responses (based on 5 sub-tests).

Whole sample

	Boys (n = 64)			Girls (n = 66)			All (n = 130)		
Stage	1	2	3	1	2	3	1	2	3
	130	38	152	153	37	140	283	75	292
%	40.6	11.9	47.5	46.4	11.2	42.4	43.6	11.5	44.9

Table 36 cont'd.

School Department

	Secondary				Junior				Infant			
	n.	1	2	3	n.	1	2	3	n.	1	2	3
Boys	16	12	4	64	20	18	10	72	28	100	24	16
Girls	16	7	8	65	25	48	10	67	25	98	19	8
All	32	19	12	129	45	66	20	139	53	198	43	24

School Department - expressed as a percentage.

Stage	1	2	3	1	2	3	1	2	3
Boys	15.0	5.0	80.0	18.0	10.0	72.0	71.5	17.1	11.4
Girls	8.8	10.0	81.2	38.4	8.0	53.6	78.4	15.2	6.4
All	11.9	7.5	80.6	29.3	8.9	61.8	74.7	16.2	9.1

Test 2a - Co-ordination of relations of equivalence.
Correspondence between several sets.

The three subtests of this main test elicited similar responses as in Tests 1a and 1b, consequently it was possible to use similar criteria in placing each child at one or other of the three main stages.

Table 37.

Test 2a - Summary of stage responses (based on 3 sub-tests).

Whole Sample

	Boys (n=64)			Girls (n=66)			All (n = 130)		
Stage	1	2	3	1	2	3	1	2	3
	62	41	89	88	27	83	150	68	172
%	32.3	21.3	46.4	44.4	13.6	41.9	38.5	17.4	44.1

School Department.

	Secondary				Junior				Infant			
Stage	n.	1	2	3	n.	1	2	3	n.	1	2	3
Boys	16	4	7	37	20	9	9	42	28	49	25	10
Girls	16	4	3	41	25	27	11	37	25	57	13	5
All	32	8	10	78	45	36	20	79	53	106	38	15

Table 37 cont'd.

School Department (expressed as a percentage).

	Secondary			Junior			Infant		
Stage	1	2	3	1	2	3	1	2	3
Boys	8.3	14.6	77.1	15.0	15.0	70.0	58.3	29.8	11.9
Girls	8.3	6.3	85.4	36.0	14.7	49.3	76.0	17.3	6.7
All	8.3	10.4	81.3	26.7	14.8	58.5	66.7	23.9	9.4

Test 2b - Multiple Correspondence.

This test is really in two parts, the first part dealt with in subtests (i) and (ii) and refers to one to one correspondence between 'n' sets, and secondly two to one correspondence in subtest (iii). With respect to the first of these concepts the criteria used for placing the children at particular stages were based upon Piaget's criteria (pages 213 -220).

Subtests (i) and (ii)

Stage 1 The child at this stage cannot make a one to one correspondence between two sets of objects except when the elements of one set are actually placed inside the elements of the other. For example, in Piaget's experiment the child gives only one egg to the doll and only one flower to each vase.

Stage 2 The child at this stage is similar to Piaget's subject p. 218, who for example thinks that each doll will have four or five eggs for the simple reason, "they've got more". Hesitancy also marks the child at this stage, clearly indicating that he has not attained the immediate understanding of the problem that the child at stage 3 has.

Stage 3 The child at this stage is (a) able to understand the relationships of multiple correspondence involved in the problems put to him: two flowers to one pot, two eggs to one soldier, and (b) to generalise to three, four and five.

Although Piaget has grouped the responses of his subjects to the situations posed in subtests (i) and (ii) with those of subtest (iii), in this study it was considered desirable to separate the types of responses since there were observable differences in the tests.

Test 2b - Two to one correspondence.

Stage 1 — The child at this stage is satisfied when he has put out the same number of 'single flower' containers as pots. It does not occur to him to double the number, he merely recognizes the necessity for a global increase and chooses any number at random.

Stage 2 — The child at this stage behaves similarly to Piaget's subject (p. 217) who began by putting ten single flower holders to match the ten flower pots and when he realized that there were flowers left did not attempt to estimate the number but at once added another ten tubes and unhesitatingly put flowers in.

Stage 3 — The child at this stage is able to understand the two to one relationship without intuitive trial and error.

Table 38.

Test 2b - (based on 3 subtests). Summary of stage responses.

Whole Sample

	Boys (n=64)			Girls (n=66)			All (n=130)		
Stage	1	2	3	1	2	3	1	2	3
	64	43	85	66	45	87	130	88	172
%	33.3	23.4	44.3	33.3	22.7	43.4	33.3	22.6	44.1

School Department

	Secondary				Junior				Infant			
Stage	n.	1	2	3	n.	1	2	3	n.	1	2	3
Boys	16	4	9	35	20	10	16	34	28	50	18	16
Girls	16	2	9	37	25	16	25	34	25	48	11	16
All	32	6	18	72	45	26	41	68	53	98	29	32

School department expressed as a percentage.

	Secondary			Junior			Infant		
Stage	1	2	3	1	2	3	1	2	3
Boys	8.3	18.8	72.9	16.7	26.7	56.6	59.5	21.4	19.1
Girls	4.2	18.8	77.0	21.3	33.4	45.3	64.0	14.7	21.3
All	6.3	18.8	75.0	19.3	30.4	50.3	61.6	18.3	20.1

Test 3a - Spontaneous Correspondence. Reproduction of figures.

The responses were assessed on Piaget's criteria found on pages 65 - 74.

Stage 1 — Children at this stage are those who are not concerned with the numerical details but rather with the configuration and dimensions of the model. In the case of simple closed figures children at this stage can correctly reproduce those which require a definite number of elements, provided that the form is familiar, but where the shape is unfamiliar the copy is no longer numerically correct.

Stage 2 — At this stage the child is able to make a one to one correspondence but this is always based on the particular properties of the figure, for without the figure, the child no longer thinks the two sets are equivalent.

Stage 3 — During the third stage, the correspondence no longer depends on the intuitive figure but rather on the details of the number in question.

Table 39.

Summary of stage responses (based on 6 subtests). Whole sample.

	Boys			Girls			All		
Stage	1	2	3	1	2	3	1	2	3
	117	50	217	119	65	212	236	115	429
%	30.5	13.0	56.5	30.1	16.4	53.5	30.3	14.7	55.0

School Department.

	Secondary			Juniors			All		
Stage	1	2	3	1	2	3	1	2	3
Boys	6	6	84	14	10	96	97	34	37
Girls	0	11	85	25	32	93	94	22	34
All	6	17	169	39	42	189	191	56	71

School Department expressed as percentage.

	Secondary			Juniors			All		
Stage	1	2	3	1	2	3	1	2	3
Boys	6.2	6.3	87.5	11.7	8.3	80.0	57.8	20.2	22.0
Girls	0	11.5	88.5	16.7	21.3	62.0	62.7	14.7	22.6
All	3.1	8.9	88.0	14.4	15.6	70.0	60.1	17.6	22.3

Table 40 below summarises the attributes which appeared important to each child in the performance of the task. Full details are to be found in Appendix H pages 416-422, tables 192-198.

Table 40

Test 3a - Analysis of responses to particular attributes.

	n.	Number only		Number and shape.		Number and colour.		Number, shape and colour.	
		Number	%	Number	%	Number	%	Number	%
Boys	64	14	21.9	19	29.7	16	25.0	13	20.3
Girls	66	12	18.2	22	33.3	17	25.7	12	18.2
All	130	26	20.0	41	31.5	33	25.4	25	19.2

Test 3b - Spontaneous correspondence. (Single rows, pages 74-85).

Stage 1 — The child at this stage bases his evaluations on only one or other of the two global qualities of the row, its length or the density of the elements without co-ordinating them. For example, Piaget's subject who began by making a compact row of 11 buttons to equal the 6 spaced out of the model, but since his row was longer removed 3 from the end, thus obtaining the same length.

Stage 2 — When the child who is at this stage is asked to pick out a number of elements equal to the number in a model row of six, he reacts immediately or as Piaget observes, almost immediately, by making an optical spatial correspondence with the model, but no longer accepts the equivalence of the two rows when the correspondence cannot actually be perceived.

Stage 3 — At the third stage, the child is able to make the correspondence quite free from perceptual or spatial limitations and persists in recognizing the equivalence of the two sets despite any displacements of the elements.

Table 41

Summary of stage responses (based on 6 subtests). Whole sample.

	Boys (n.=64)			Girls (n.=66)			All (n.=130)		
Stage	1	2	3	1	2	3	1	2	3
	135	94	155	159	117	120	294	211	275
%	35.2	24.5	40.3	40.1	29.6	30.3	37.7	27.0	35.3

Table 41 cont'd.

Summary of stage responses - School Department.

	Secondary			Junior			Infants		
Stage	1	2	3	1	2	3	1	2	3
Boys	9	16	71	21	26	73	105	52	11
Girls	20	23	53	45	40	65	94	54	2
All	29	39	124	66	66	138	199	106	13

Summary of stage responses - School department
(Expressed as a percentage).

	Secondary			Junior			Infants		
Stage	1	2	3	1	2	3	1	2	3
Boys	9.4	16.7	73.9	17.5	21.7	60.8	62.5	31.0	6.5
Girls	20.8	24.0	55.2	30.0	26.7	43.3	62.7	36.0	1.3
All	15.1	20.3	64.6	24.4	24.5	51.1	62.6	33.3	4.1

Test 4 - Development of the notion of measurement (pp. 223 - 243).

Stage 1 In such situations as those demanded by the subtests, measure has no meaning to the child at this stage. The child does not understand what he is supposed to do when asked to verify the evaluations by using the measuring beakers offered to him.

Stage 2 Piaget suggests a three-fold problem which identifies the child at this stage (i) there is conservation when the changes are only slight but non-conservation when the changes are more obvious. (ii) The child's limitation of metrical capacity although spontaneously suggesting the use of measures; and (iii) lack of understanding of the unit; the unit being precisely a common measure.

Stage 3 The child assumes conservation and measures spontaneously.

Table 42

Summary of stage responses (based on 2 subtests).

	Boys			Girls			All		
Stage	1	2	3	1	2	3	1	2	3
	69	26	33	79	21	32	148	47	65
%	53.9	20.3	25.8	59.9	15.9	24.2	56.9	18.1	25.0

Table 42 cont'd.

Summary of stage responses - School Department.

	Secondary			Junior			Infants		
Stage	1	2	3	1	2	3	1	2	3
Boys	8	5	19	16	10	14	45	11	0
Girls	10	9	13	23	9	18	46	3	1
All	18	14	32	39	19	32	91	14	1

Summary of stage responses - School department.
(Expressed as a percentage).

	Secondary			Junior			Infants		
Stage	1	2	3	1	2	3	1	2	3
Boys	25.0	15.6	59.4	40.0	25.0	35.0	80.4	19.6	0
Girls	31.3	28.1	40.6	46.0	18.0	36.0	92.0	6.0	2.0
All	28.1	21.9	50.0	43.3	21.1	35.6	85.9	13.2	0.9

Test 5a - Equating of quantities - unequal sets (pp. 190 - 95).

Stage 1 — When asked to equalise two unequal sets the child at this stage takes counters at random from the larger and transfers them to the other set.

Stage 2 — The child spontaneously constructs configurations, so as to compare and equate the two sets.

Stage 3 — The child proceeds by way of one to one correspondence, with or without verbal enumeration.

Table 43

Summary of stage responses (based upon 4 subtests.) Whole sample.

	Boys			Girls			All		
Stage	1	2	3	1	2	3	1	2	3
n.	87	89	80	90	107	67	177	196	147
%	34.0	34.8	31.2	34.1	40.5	25.4	34.0	37.7	28.3

Table 44

Summary of stage responses - School Department.

	Secondary			Junior			Infants.		
Stage	1	2	3	1	2	3	1	2	3
Boys	7	17	40	14	29	37	66	43	3
Girls	3	33	28	26	43	31	61	31	8
All	10	50	68	40	72	68	127	74	11

Table 44 cont'd.

Summary of stage responses (Expressed as a percentage). School Department.

	Secondary			Juniors			Infants		
Stage	1	2	3	1	2	3	1	2	3
Boys	10.9	26.6	62.5	17.5	36.2	46.3	58.9	38.4	2.7
Girls	4.7	51.6	43.7	26.0	43.0	31.0	61.0	31.0	8.0
All	7.8	39.1	53.1	22.2	40.0	37.8	59.9	34.9	5.2

Test 5b - Equating of quantities (pp. 195 - 198).

Stage 1 The child does not grasp the fact that the sum of the parts is equal to the whole, nor recognises the lasting equivalence of the two halves even when he has obtained them by distributing the elements term for term in two corresponding sets.

Stage 2 The child is able to construct two equal sets but does not recognise lasting equivalence.

Stage 3 The child understands that the two parts considered as units are equal, and that the sum of the parts is equal to the initial whole. Lasting equivalence is also recognised.

Table 45

Summary of stage responses. School Department. (based on 5 subtests).

	Secondary			Juniors			Infants.		
Stage	1	2	3	1	2	3	1	2	3
Boys	10	6	64	23	15	62	78	48	14
Girls	19	11	50	30	36	59	96	26	3
All	29	17	114	53	51	121	174	74	17

Table 46

Summary of stage responses (expressed as a percentage). School Department.

	Secondary			Juniors			Infants		
Stage	1	2	3	1	2	3	1	2	3
Boys	12.5	7.5	80.0	23.0	15.0	62.0	55.7	34.3	10.0
Girls	23.7	13.8	62.5	24.0	28.8	47.2	76.8	20.8	2.4
All	18.1	10.6	71.3	23.5	22.7	53.8	65.7	27.9	6.4

Table 47

Summary of stage responses. Overall sample.

	Boys			Girls			All		
Stage	1	2	3	1	2	3	1	2	3
n.	111	69	140	145	73	112	256	142	252
%	34.7	21.6	43.7	43.9	22.1	34.0	39.4	21.8	38.8

Test 6. Conservation of continuous quantity. (pp. 3-17) and p. 222.

Stage 1 For children at the first stage the quantity of liquid increases according to the size or number of the containers.

Stage 2 In the second stage, which is a period of transition, conservation gradually emerges, but although it is recognized in some cases, it is not so in all.

Stage 3 The child immediately postulates conservation of the quantities in each of the transformations to which they are subjected.

Table 48.

Summary of stage responses (based on 3 subtests). Whole sample.

	Boys			Girls			All		
Stage	1	2	3	1	2	3	1	2	3
No.	123	7	62	134	16	48	257	23	110
%	64.1	3.6	32.3	67.7	8.1	24.2	65.9	5.9	28.2

Table 49.

Summary of stage responses. School departments.

	Secondary			Juniors			Infants		
Stage	1	2	3	1	2	3	1	2	3
Boys	16	3	29	32	2	26	75	2	7
Girls	18	4	26	43	10	22	73	2	0
All	34	7	55	75	12	48	148	4	7

Table 50.

Summary of stage responses (Percentage).

	Secondary			Juniors			Infants		
Stage	1	2	3	1	2	3	1	2	3
Boys	33.3	6.3	60.4	53.3	3.3	43.4	89.3	2.4	8.3
Girls	37.5	8.3	54.2	57.3	13.3	29.4	97.3	2.7	0
All	35.4	7.3	57.3	55.6	8.9	35.5	93.1	3.5	4.4

Test 7 - Conservation of Discontinuous quantity (pp. 25-38).

Stage 1 There is no conservation.

Stage 2 The child conserves when there is a slight change in pattern but not when the change is more significant.

Stage 3 The child conserves unhesitatingly.

Table 51.

Summary of stage responses (based on 4 subtests.) Whole sample.

	Boys			Girls			All		
Stage	1	2	3	1	2	3	1	3	3
n.	126	9	121	140	20	104	266	29	225
%	49.2	3.5	47.3	53.0	7.6	39.4	51.2	5.6	43.2

Table 52.

	Secondary			Junior			Infant		
Stage	1	2	3	1	2	3	1	2	3
Boys	10	1	53	24	4	52	92	4	16
Girls	8	6	50	36	10	54	96	4	0
All	18	7	103	60	14	106	188	8	16

Percentage

Stage	1	2	3	1	2	3	1	2	3
Boys	15.6	1.6	82.8	30.0	5.0	65.0	82.1	3.6	14.3
Girls	12.5	9.4	78.1	36.0	10.0	54.0	96.0	4.0	0
All	14.0	5.5	80.5	33.3	7.8	58.9	88.7	3.8	7.5

Test 8 - Relations between parts and wholes (pp. 187-190).

Stage 1 The child grasps neither the equality of the two sets in question, nor the permanence of the second whole in spite of changes in the distribution of its elements.

Stage 2 The child begins by showing a similar reaction as in stage 1 but gradually comes to see, or as Piaget observes, can be made to see in this particular problem that although we have 7 > 4, we have also 1 < 4 and that these two facts compensate each other.

Stage 3 The child recognises each sub-set in relation to the other and both are seen in relation to their sum.

Table 53.

Summary of stage responses. Whole sample.

	Boys			Girls			All		
Stage	1	2	3	1	2	3	1	2	3
n.	28	18	18	38	16	12	66	34	30
%	43.8	28.1	28.1	57.6	24.2	18.2	50.8	26.2	23.0

Table 54.

	Secondary			Junior			Infant		
Stage	1	2	3	1	2	3	1	2	3
Boys	3	3	10	5	7	8	20	8	0
Girls	6	2	8	12	9	4	20	5	0
All	9	5	18	17	16	12	40	13	0

Table 55.

	Secondary			Junior			Infant		
Stage	1	2	3	1	2	3	1	2	3
Boys	18.7	18.7	62.6	25.0	35.0	40.0	71.4	28.6	0
Girls	37.5	12.5	50.0	48.0	36.0	16.0	80.0	20.0	0
All	28.1	15.6	56.3	37.8	35.6	26.6	75.5	24.5	0

Test 9 - Seriation (pp. 96-121).

Stage 1 The child cannot make a correct series.

Stage 2 The child discovers the whole set of relations necessary gradually by dint of empirical trial and error.

Stage 3 The child constructs the series without hesitation or error.

Table 56.

Summary of stage responses (based on 6 subtests). Whole sample.

	Boys			Girls			All		
Stage	1	2	3	1	2	3	1	2	3
n.	95	129	160	108	143	145	203	272	305
%	24.7	33.6	41.7	27.3	36.1	36.6	26.0	34.9	39.1

	Secondary			Junior			Infants		
Stage	1	2	3	1	2	3	1	2	3
Boys	8	18	70	14	35	71	73	76	19
Girls	7	16	73	33	63	54	68	64	18
All	15	34	143	47	98	125	141	140	37

	Secondary			Junior			Infants		
Stage	1	2	3	1	2	3	1	2	3
Boys	8.3	18.8	72.9	11.6	29.2	59.2	43.5	45.2	11.3
Girls	7.3	16.7	76.0	22.0	42.0	36.0	45.3	42.7	12.0
All	7.8	17.7	74.5	17.4	36.3	46.3	44.3	44.0	11.6

Test 10 - Ordination and Cardination (pp. 122-157).

Stage 1 — The child is neither able to estimate how many stairs the doll has still to climb nor to construct the stairs.

Stage 2 — The child succeeds in constructing after trial and error but has difficulty in stating how many stairs the doll has still to climb and also its order.

Stage 3 — The child successfully solves all the problems whether he is asked to determine the cardinal value given a particular position, or the converse.

Table 57.

Summary of stage responses (based on 2 subtests). Whole sample.

	Boys			Girls			All		
Stage	1	2	3	1	2	3	1	2	3
n.	29	27	72	32	37	63	61	64	135
%	22.7	21.1	56.2	24.3	28.0	47.7	23.5	24.6	51.9

Table 58.

	Secondary			Junior			Infants		
Stage	1	2	3	1	2	3	1	2	3
Boys	2	4	26	5	5	30	22	18	16
Girls	2	4	26	7	15	28	23	18	9
All	4	8	52	12	20	58	45	36	25

Percentage.

	Secondary			Junior			Infants		
Stage	1	2	3	1	2	3	1	2	3
Boys	6.2	12.5	81.3	12.5	12.5	75.0	39.3	32.1	28.6
Girls	6.2	12.5	81.3	14.0	30.0	56.0	46.0	36.0	18.0
All	6.2	12.5	81.3	13.3	22.2	64.5	42.5	34.0	23.5

Test II - Class Inclusion (pp. 161 - 184).

Full details of the sample's responses to the 'class inclusion' questions are found in Appendix D pages 371-374. Tables 59-60 below summarise the correct responses. The highest number of possible correct responses is 29.

Table 59.

Correct responses (whole sample).

Boys (n. = 64)			Girls (n. = 66)			All (n. = 130)		
m.	s.d.	%	m.	s.d.	%	m.	s.d.	%
17.1	8.6	59.0	16.8	7.5	57.9	16.9	8.1	58.3

Table 60.

	Secondary			Junior			Infants.		
	m.	s.d.	%	m.	s.d.	%	m.	s.d.	%
Boys	22.3	7.2	76.9	19.2	8.4	66.2	12.6	7.5	43.4
Girls	20.7	5.9	71.4	17.9	7.2	61.7	13.1	7.4	45.2
All	21.3	6.7	73.4	18.5	7.7	63.8	12.8	7.4	44.1

Table 61

Means, standard deviations and percentages based upon weighted scores (Tests 1a - 10).

	Whole Sample								
	Boys (n=64)			Girls (n=66)			All (n=130)		
Test	Mean	s.d.	%	Mean	s.d.	%	Mean	s.d.	%
1a	4.6	3.3	57.5	4.0	3.4	50.0	4.3	3.4	53.7
1b	5.3	4.6	53.0	4.8	4.6	46.0	5.1	4.6	46.0
2a	3.4	2.5	56.7	2.9	2.6	48.3	3.2	2.6	53.3
2b	3.3	2.3	55.0	3.4	2.3	56.7	3.3	2.3	55.0
3a	7.6	5.1	63.3	7.4	5.0	61.7	7.5	5.1	62.5
3b	6.3	4.9	52.5	5.3	4.8	41.2	5.8	4.9	48.3
4	1.5	1.7	37.5	1.2	1.7	30.0	1.4	1.7	35.0
5a	4.0	3.0	50.0	3.6	2.8	45.0	3.8	2.9	47.5
5b	5.5	4.2	55.0	4.5	4.1	45.0	5.0	4.1	50.0
6	2.1	2.6	35.0	1.7	2.3	28.3	1.8	2.5	30.0
7	3.8	3.8	47.5	3.3	3.7	41.2	3.6	3.8	45.0
8	0.8	0.8	40.0	0.6	0.8	30.0	0.7	0.8	35.0
9	7.0	4.2	58.3	6.5	3.9	54.2	6.7	4.0	53.8
10	2.7	1.4	67.5	2.5	1.5	62.5	2.6	1.5	65.0

Table 62

Means, standard deviations and percentages based upon weighted scores (Tests 1a - 10).

	Medical Classification					
	Without shunt (n = 40			With shunt (n = 90)		
Test	Mean	s.d.	%	Mean	s.d.	%
1a	4.5	3.3	56.2	4.2	3.4	52.5
1b	5.2	4.6	52.0	5.0	4.6	50.0
2a	3.5	2.4	58.3	3.0	2.7	50.0
2b	3.6	2.2	60.0	3.3	2.3	55.0
3a	8.6	4.8	71.7	7.0	5.1	58.3
3b	6.7	4.7	58.3	5.4	4.9	45.0
4	1.6	1.7	40.0	1.2	1.6	30.0
5a	4.3	2.7	53.7	3.5	3.0	43.7
5b	5.8	3.8	58.0	4.6	4.3	46.0
6	2.3	2.7	38.3	1.7	2.4	28.3
7	4.1	3.9	51.2	3.4	3.7	42.5
8	0.9	0.8	45.0	0.6	0.8	30.0
9	7.8	3.5	65.0	6.3	4.2	52.5
10	3.0	1.3	75.0	2.4	1.5	60.0

Table 63.

Means, standard deviations and percentages based upon weighted scores (Tests 1a-10).

School Department

	Secondary (n=32)			Junior (n=45)			Infant (n=53)		
Test	Mean	s.d.	%	Mean	s.d.	%	Mean	s.d.	%
1a	6.8	2.6	85.0	5.1	3.3	63.7	2.2	2.5	27.5
1b	8.6	3.2	86.0	6.6	4.4	66.0	1.7	2.9	17.0
2a	5.3	1.7	88.3	3.9	2.4	65.0	1.3	1.7	21.7
2b	5.2	1.4	66.7	3.9	2.0	65.0	1.7	1.9	28.3
3a	11.1	2.4	92.5	9.3	4.1	77.5	3.7	4.5	30.8
3b	9.0	4.2	75.0	7.6	4.7	63.3	2.4	2.9	20.0
4	2.4	1.7	60.0	1.8	1.8	45.0	0.3	0.8	7.5
5a	5.8	2.4	72.5	4.6	2.8	70.0	1.8	2.0	22.5
5b	7.5	3.8	75.0	6.7	3.7	67.0	2.1	2.7	21.0
6	3.5	2.5	58.3	2.4	2.6	40.0	0.3	1.2	5.0
7	6.7	2.7	83.7	4.8	3.6	60.0	0.7	2.0	8.7
8	1.3	0.9	65.0	0.9	0.8	45.0	0.2	0.4	10.0
9	10.0	3.1	83.3	7.7	3.5	64.2	4.0	3.1	33.0
10	3.4	1.0	85.0	3.1	1.3	77.5	1.6	1.3	40.0
Tests 1a-10 overall	86.2	27.4	79.8	68.5	33.5	63.4	24.2	22.4	22.4

The order of difficulty of the Piagetian tests, based upon weighted scores was investigated and Tables 64 to 68 below summarise the data.

Table 64.

Order of difficulty of Piagetian Tests

School Dept. (Most difficult = 1st.)

Secondary		Junior		Infant	
1st	Test 6	1st	Test 6	1st	Test 6
2nd	" 4	2nd	" 4	2nd	" 4
3rd	" 8	"	" 8	3rd	" 7
4th	" 2b	4th	" 7	4th	" 8
"	" 5a	5th	" 3b	5th	" 1b
"	" 5b	6th	" 1a	6th	" 3b
7th	" 3b	7th	" 9	7th	" 5b
8th	" 9	8th	" 2a	8th	" 2a
9th	" 7	"	" 2b	9th	" 5a
10th	" 10	10th	" 1b	10th	" 1a
11th	" 1a	11th	" 5b	11th	" 2b
12th	" 1b	12th	" 5a	12th	" 3a
13th	" 2a	13th	" 3a	13th	" 9
14th	" 3a	14th	" 10	14th	" 10

Table 65

Order of difficulty of Piagetian Tests
Whole Sample.

Boys		Girls		All	
1st	Test 6	1st	Test 6	1st	Test 6
2nd	" 4	2nd	" 4	2nd	" 4
3rd	" 8	3rd	" 8	3rd	" 8
4th	" 7	4th	" 3b	4th	" 7
5th	" 5a	5th	" 7	5th	" 1b
6th	" 3b	6th	" 5a	6th	" 5a
7th	" 1b	7th	" 5b	7th	" 3b
8th	" 2b	8th	" 1b	8th	" 5b
"	" 5b	9th	" 2a	9th	" 2a
10th	" 2a	10th	" 1a	10th	" 1a
11th	" 1a	11th	" 9	11th	" 9
12th	" 9	12th	" 2b	12th	" 2b
13th	" 3a	13th	" 3a	13th	" 3a
14th	" 10	14th	" 10	14th	" 10

Table 66

Order of difficulty of Piagetian Tests

Medical Category.

Without Shunt		With Shunt	
1st	Test 6	1st	Test 6
2nd	" 4	2nd	" 4
3rd	" 8	"	" 8
4th	" 7	4th	" 7
5th	" 1b	5th	" 5a
6th	" 5a	6th	" 3b
7th	" 1a	7th	" 5b
8th	" 5b	8th	" 1b
9th	" 3b	"	" 2a
"	" 2a	10th	" 1a
11th	" 2b	"	" 9
12th	" 9	12th	" 2b
13th	" 10	13th	" 3a
14th	" 3a	14th	" 10

The following tables 67 to 68 reflect the order of difficulty of the Piagetian tests when they were assessed on the basis of the number of children who were fully operational that is, at stage three.

Table 67

Order of difficulty of Piagetian Tests
(Based on stage 3 responses) Whole Sample.

Boys		Girls		All	
1st	Test 4	1st	Test 8	1st	Test 8
2nd	" 8	2nd	" 4	2nd	" 4
3rd	" 5a	"	" 6	3rd	" 6
4th	" 6	4th	" 5a	4th	" 5a
5th	" 3b	5th	" 3b	5th	" 3b
6th	" 9	6th	" 5b	6th	" 5b
7th	" 5b	7th	" 9	7th	" 9
8th	" 2b	8th	" 7	8th	" 7
9th	" 2a	9th	" 1a	9th	" 1a
10th	" 7	10th	" 2a	"	" 2a
11th	" 1b	11th	" 1b	"	" 2b
12th	" 1a	12th	" 2b	12th	" 1b
13th	" 10	13th	" 10	13th	" 10
14th	" 3a	14th	" 3a	14th	" 3a

Table 68

Order of difficulty of Piagetian Tests
(Based on stage 3 responses only.)

Secondary		Junior		Infants	
1st	Test 4	1st	Test 8	1st	Test 8
2nd	" 5a	2nd	" 6	2nd	" 4
3rd	" 8	3rd	" 4	3rd	" 3b
4th	" 6	4th	" 5a	4th	" 6
5th	" 3b	5th	" 9	5th	" 5a
6th	" 5b	6th	" 2b	6th	" 5b
7th	" 9	7th	" 3b	7th	" 7
8th	" 2b	8th	" 5b	8th	" 1b
9th	" 1a	9th	" 1a	9th	" 2a
10th	" 10	10th	" 2a	10th	" 9
11th	" 7	11th	" 7	11th	" 1a
12th	" 1b	12th	" 1b	12th	" 2b
13th	" 2a	13th	" 10	13th	" 3a
14th	" 3a	14th	" 3a	14th	" 10

It was considered essential to observe the development of the sample from school A in Piagetian terms after a period of three years. This was necessary to indicate if children who had been placed at either stage 1 or 2 had developed toward being fully operational after a period of school experiences together with normal maturation processes.

Full details of the comparison are to be found in Appendix G pages 408-414. Only one of the 28 children concerned was unable to be re-tested. This was because the child in question had made sufficient physical progress to be transferred to a normal school. All the relevant indications suggest that the child is coping well with the educational demands of her secondary school. Table 69 is a summary of the results based on 54 subtests.

Table 69

Summary of times children were at particular stages (Tests la - 10)

	1st Testing (School A)			2nd Testing (School A)			
Subject No. Stage	1	2	3	1	2	3	
1b	12	16	26	0	0	54	
2b	5	15	34	1	2	51	
3b	0	7	47	0	1	53	
4b	0	0	54	0	0	54	
5b	26	10	18	1	0	53	
6b	0	6	48	0	0	54	
7b	2	12	40	0	1	53	
8b	17	23	14	0	0	54	
9b	14	33	7	1	29	24	
10b	5	20	29	1	1	52	
11b	28	20	6	2	2	50	
12b	15	32	7	2	4	48	
13b	18	23	13	0	0	54	
14b	35	16	3	3	31	20	
15b	52	2	0	46	6	2	
16b	53	1	0	36	9	9	
1g	0	11	43	0	0	54	
2g	42	10	2	34	12	8	
3g	24	19	11	1	3	50	
4g	0	0	54	0	0	54	
5g	2	12	40	0	1	53	
6g	12	20	22	-	-	-	(Transferred to normal school)
7g	25	21	8	3	26	25	
8g	24	29	1	9	29	16	
9g	49	4	1	8	23	23	
10g	49	4	1	2	14	38	
11g	52	2	0	3	8	43	
12g	54	0	0	33	12	9	

Mean chronological age of School A at 1st testing 8.4 years. s.d. 2.6

In order to investigate whether there was any predictive value in the Piagetian number tests for mathematical competence the writer tested thirty-one of the sample after a three-year period on Young's Group Mathematics Test (1974, 3rd revision). Table 70 below details both the scores on this test and also the original Piagetian scores.

Table 70

Comparison of scores on Young's Group Mathematics Test with Piagetian scores obtained three-years previously.

	Subject No.	Young's max. 60	%	Piagetian max. 108	%
Oldest 1	(129)	11	18.3	1	0.9
2	(128)	25	41.7	0	0
3	(126)	18	30.0	27	25.0
4	(122)	1	1.7	0	0
5	(120)	3	5.0	1	0.9
6	(119)	13	21.7	1	0.9
7	(117)	23	38.3	25	23.1
8	(116)	11	18.3	16	14.8
9	(115)	47	78.3	7	6.5
10	(114)	45	75.0	78	72.2
11	(100)	51	85.0	46	42.6
12	(99)	3	5.0	0	0
13	(98)	21	35.0	37	34.3
14	(95)	49	81.7	31	28.7
15	(86)	41	68.3	78	72.2
16	(85)	27	45.0	51	47.2
17	(82)	60	100	51	47.2
18	(81)	21	35.0	20	18.5
19	(77)	22	36.7	37	34.3
20	(74)	32	53.3	95	88.0
21	(73)	29	48.3	70	64.8
22	(70)	37	61.7	84	77.8
23	(69)	50	83.3	91	84.3
24	(66)	54	90.0	98	90.7
25	(65)	57	95.0	102	94.4
26	(58)	51	85.0	41	31.0
27	(54)	58	96.7	51	47.2
28	(44)	16	26.7	14	13.0
29	(42)	59	98.3	108	100
30	(38)	58	96.7	101	93.5
Young-31 est	(32)	43	71.6	82	76.0

CHAPTER 7.

Statistical Treatment.

The Initial Data.

Data for each child were punched onto computer cards. Initially one card per subject was used. Values for twenty-three variables were recorded, as integers. These were, in order :-

1 Raven's Coloured Progressive Matrices.

2 English Picture Vocabulary Test.

3 Crichton Vocabulary Scale.

4 Reading.

5 Bender Gestalt Visual Motor Test. (error scores..hence negative correlation).

6 Piagetian Test (overall..i.e. total of columns 7-2 inclusive).

7 Provoked Correspondence (one static set).

8 Provoked Correspondence.

9 Correspondence between several sets.

10 Multiple Correspondence.

11 Spontaneous Correspondence (a)

12 Spontaneous Correspondence (b).

13 Notion of Measure.

14 Equating of Quantities...unequal sets.

15 Equating of Quantities...equal sets.

16 Conservation of continuous quantity.

17 Conservation of discontinuous quantities.

18 Relations between parts and wholes.

19 Seriation.

20 Ordination and cardination.

21 Class Inclusion.

22 I.Q...* also component of 23.

23 Pultibec (overall physical handicap rating..the higher the score the more the handicap, hence negative score.. NB I.Q. is a part of the score.

MEANS, STANDARD DEVIATIONS, CORRELATION COEFFICIENTS

A computer program was written in FØRTRAN which read in and stored all the data for a group of subjects and calculated the mean and standard deviation for each of the twenty-three variables, and also calculated Kendall's τ and Pearson's r and Spearman's ρ correlation coefficients for each variable with every other. The FØRTRAN program made use of the NAG subroutine GO2BAF and was run on the Loughborough University ICL 1904S* computer. The program was used to determine the means, standard deviations and correlations for the variables for the following subject groups:

Pupils:	all,	boys,	girls		
With shunts:	all,	boys,	girls		
Without shunts:	all,	boys,	girls		
Infant:	all,	boys,	girls,	with shunts,	without shunts
Junior:	all,	boys,	girls,	"	"
Secondary:	all,	boys,	girls,	"	"
2-year Groups:	all,	boys,	girls		
1-year Groups:	all,	boys,	girls		
School A:	all,	boys,	girls		
School B:	all,	boys,	girls		
School C:	all,	boys,	girls		
School D:	all,	boys,	girls		

INDEPENDENT CHECKING AND TESTING SIGNIFICANCE OF CORRELATIONS

To act as an independent check of the basic statistical treatment the data were firstly checked 'by hand' (one error was detected) and then submitted to Nottingham University to be analysed by the PMMD (Programmed Methods for Multivariate Data) Statistical package written by M B Youngman, run on the ICL 1906 computer.

Using the BSET program (Subset Extraction with significance testing) the means and standard deviations were recomputed, the Pearson product-moment correlation matrix was calculated and tested for significance at the 1%, 5% and 10% levels.

Multivariate Analysis of Variance

A computer program was written in FØRTRAN to analyse two sets of mean scores, e.g. one for boys and the other for girls, to test whether or not the differences observed are significant.

Number of populations: k (= 2)

Number of variables: p (=23)

Number of subjects in population 1: n_1

Number of subjects in population 2: n_2

Number of subjects in total population: $n_1 + n_2 = 130$

Let x_{jt_i} be the value of the jth variable of the ith member of population t.

Let $c_{j\ell} = \frac{1}{n} \sum_{t=1}^{k} \sum_{i=1}^{n_t} (x_{jt_i} - x_{j..}) (x_{\ell t_i} - x_{\ell ..})$

and $d_{j\ell} = \frac{1}{n} \sum_{t=1}^{k} \sum_{i=1}^{n_t} (x_{jt_i} - x_{jt.}) (x_{\ell t_i} - x_{\ell t.})$

where $x_{j..}$ is the average over all 130 subjects of variable j

$x_{jt.}$ is the average over n_t subjects of variable j.

Let c = matrix of $c_{j\ell}$ elements and

d = matrix of $d_{j\ell}$ elements.

then let $L = (|d|/|c|)^{n/2}$.

If the means of the two populations are the same then c = d so L = 1
If the means differ then L < 1. Low values of L suggest that the populations <u>do</u> differ with respect to the given group of variables.

The statistic $-2 \log L$ will vary roughly according to χ^2 with $(k - 1)p$ degrees of freedom, assuming that the populations have the same variançes and covariances.

The FØRTRAN program read in and stored the values of the 23 variables for the subjects in the two populations and then proceeded to calculate -2 log L, making use of the NAG subroutine FO3AAF to find the required determinants of the two matrices c and d. The program was run on the LUT ICL 1904S* computer.

Coefficient of Concordance

A second computer program was written in FØRTRAN to read in and store the results of the Piagetian tests for a group of subjects, and then to compute Kendall's coefficient of concordance. The FØRTRAN program makes use of the NAG subroutine MO1AAF which sorts an array in ascending order of size. However, the MO1AAF does not give ties the average rank but simply the first rank. As Kendall's coefficient requires the average rank for ties and many ties occur in the Piagetian scores (i.e. many subjects get the same scores on any one test), the program incorporated an appropriate adjustment to the rank produced by MO1AAF. The program was run on the LUT ICL 1904S* computer.

Kendall's coefficient of concordance, W, indicates the extent to which members of a set of m distinct rank orderings of N things tend to be similar. In this study, m = 130 (i.e. subjects) and N = 13 (i.e. the individual Piaget tests). Each pupil has a score on each test so in effect each pupil puts the tests into an order of difficulty. The extent to which pupils agree as to which tests are easiest/hardest is evaluated by the W statistic:

$$W = \frac{\text{variance of rank sums}}{\text{maximum possible variance of rank sums.}}$$

It follows that $0 \leqslant W \leqslant 1$ with $W = 1$ indicating complete agreement and $W = 0$ indicating no agreement.

One way to interpret W is as a measure of average Spearman rank-correlation coefficient:

$$M_\rho = \frac{mW - 1}{m - 1}$$

An approximate test of the hypothesis that there is no agreement suitable for $m \geqslant 8$ is

$$\chi^2 = m(N - 1)W \text{ , } N - 1 \text{ degrees of freedom.}$$

(N.B. this test is only appropriate for large m and N, the criterion being met in this investigation.)

Partial Correlation

The correlations between two variables may well appear high because they both are related to a third variable (eg age). When this is taken account of, it may be that the two variables of interest have almost no correlation with each other - all their intercorrelation being due to the third variable.

In this study it was apparent that age was a major factor in variation in many of the variables so a FØRTRAN program was written to compute partial correlations, with age excluded - ie first order partial coefficients of correlation.

The formula to determine this for variables 1 and 2, excluding 3 is

$$r_{12.3} = \frac{r_{12} - r_{13}\, r_{23}}{\sqrt{(1 - r_{13}^{2})(1 - r_{23}^{2})}}$$

The FØRTRAN program used the Pearson coefficients of correlation, computed in the manner previously indicated, making use of the NAG subroutine GO2BAF, and run on the LUT ICL 1904S* computer..

The need for age as a variable necessitated the use of a second punched card for each subject.

CHAPTER 8.

Interpretation and Discussion of Results.

This chapter relates the results of the analysis of data to the questions which were posed in Chapter I and at the same time discusses broader questions of interpretation and implication.

1. The first hypothesis tested was that children with differing degrees of spina bifida and hydrocephalus pass through normal stages in the development of number concepts as postulated by Piaget.

The results supported this hypothesis. It was evident throughout the investigation that the children, depending upon their responses to the Piagetian situations, could be placed at one or other of the stages outlined by Piaget (1952). Tables 30-58 on pages 108-123 detail the number and percentage of children at particular stages both in the tests overall and in individual subtests.

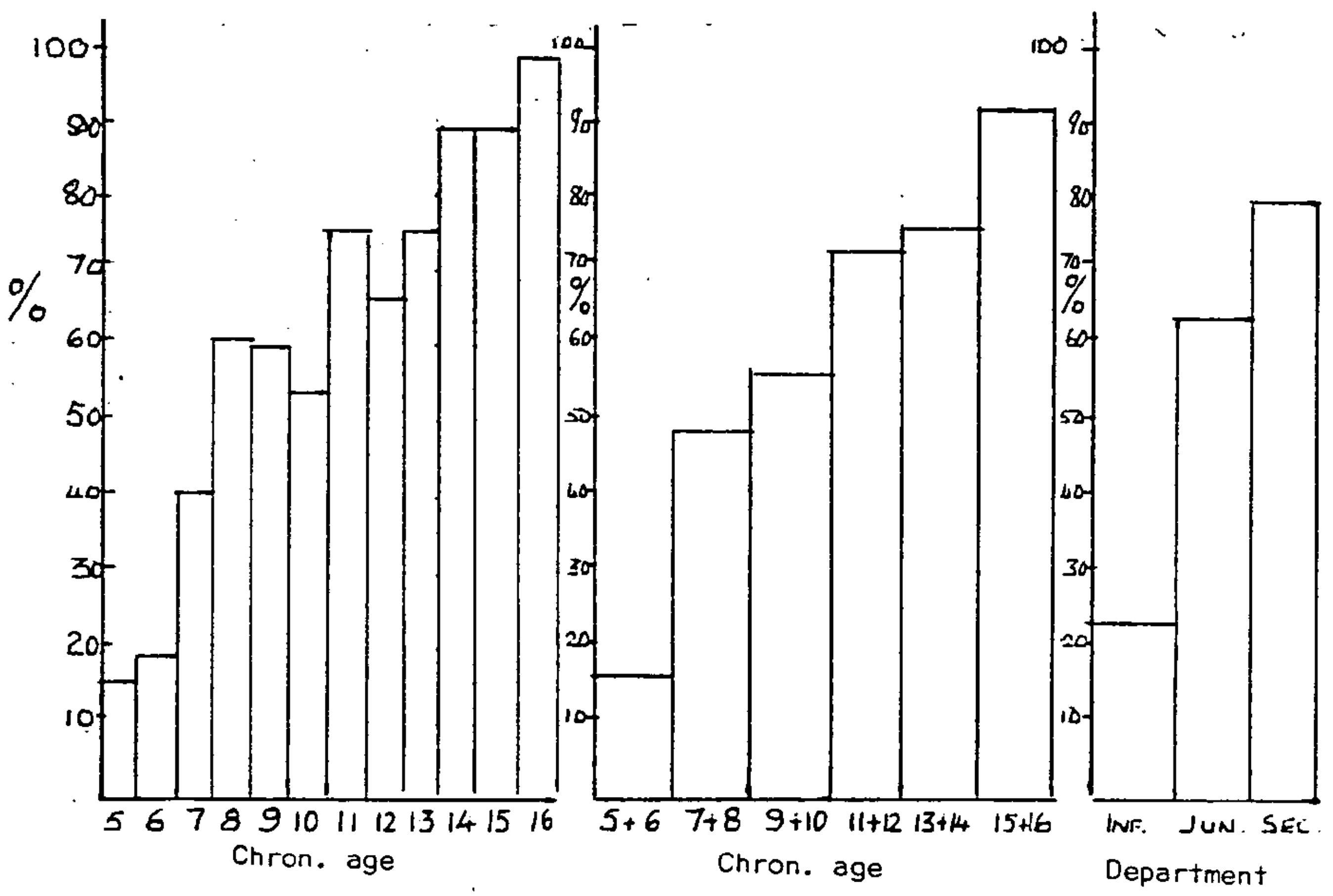
(a) The Piagetian tests overall.

The data with respect to the Piagetian tests were tabulated in two ways. The first method which reflected the number of instances children were at different stages, enabled the researcher to observe the development of number concepts. It can be seen from Table 34 on page 109 that, as might be expected, the younger children made fewer fully operational responses than those who were older. When the sample overall was considered in these terms the results show 65.8% of infants' responses were assessed as stage 1, 24.1% as stage 2 and 10.1% as stage 3. The juniors were assessed as making 25.6% stage 1, 21.4% stage 2 and 53% stage 3 responses. The secondary-age children's development is reflected in that only 13.3% of their responses were assessed as stage 1, 14.7% stage 2 and 72% stage 3.

The second method of tabulation used to facilitate statistical analysis was to give weighted scores to stage positions, Reference to Table 25 on page 107 shows that out of a maximum score of 108 the mean score of the infants was 24.2, juniors 68.5 and the secondary-aged children 86.2. The developmental picture is however even more clearly seen when the sample was broken down into two-year age groups. For example Table 26 shows the five and six year olds' mean weighted score as 17.4 and at the other end of the age range, the fifteen and sixteen year olds to be almost fully operational having a mean weighted score of 99.9. When the data were examined with respect to one-year age groups the mean weighted score of the five year olds was 13.3 and the sixteen year olds 107.3 (Table 181, page 404) Figure (viii) below illustrates the development of number concepts through the age groups.

Fig. (viii).

Percentage success in Piagetian tests.

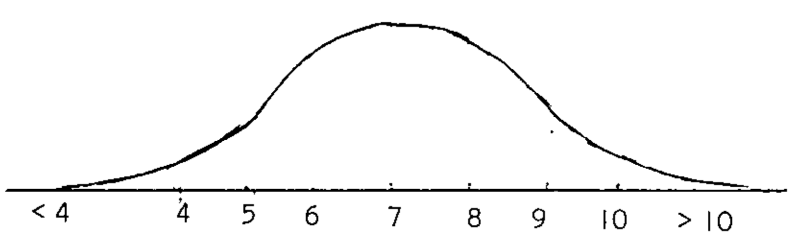


The results therefore show a clear progression in number development from the five and six year olds who were mostly non-operational to the seven to ten year olds whose transitional responses were tending toward operativity and finally to the eleven to sixteen year olds who, overall, were operational. There were however exceptions throughout in that operational responses were given in certain test situations by infants and non-operational responses were made by some secondary-aged children. Examples of this are to be seen in Table 175 of Appendix F, pages 392-398 in which it is shown that whereas a thirteen year old (24) was non-operational throughout a five year old (113) was mostly operational.

Wadsworth (1978) is one of many writers who confirm that some children develop more slowly than average and others proceed through Piagetian stages more rapidly. It is his view that the rate of development, or age of acquisition of a particular developmental concept, can be looked at in the sense of a normal curve as shown in fig. ix below.

Fig. ix.

Age at which children enter the concrete operational stage.



Wadsworth asserts that the average child enters the concrete operational stage around the age of seven, although he does not become operational with respect to all types of concepts or problems at the same time.

Most researchers, agreeing with Wadsworth's age of entry into concrete operations, would also share his view that although some children enter this stage at six years of age and a small percentage would do so at the age of five, on the other hand, some may be nine years of age and a small percentage ten or even later before they are operational. Such children are developing cognitively at a slower rate than the normal child and, for them, the educational implications are straightforward.

This study shows that although there was evidence of children being at different Piagetian stages, the ages at which they were fully operational, is, overall later than those commonly associated with normal children.

The concluding remarks in Fogelman's (1970) compilation of Piagetian studies support the findings in this study. He reports that although there was a difference in age of six or more years between the youngest and oldest groups tested in many of the studies, in some instances a few children in the youngest group had attained a concept and at least ten per cent of the oldest children had not. Also, the age of the oldest children tested is often at or above the age of secondary transfer. Fogelman adds a salutary thought in that it is only recently that there has been an adjustment to the idea that the seemingly simple concepts examined in his summary are acquired very gradually during the period of primary schooling and a sizeable minority cannot handle these concepts even after they are in the secondary school.

In this study the children aged between eleven and sixteen years reflected considerable development in Piagetian tests, the results indicating that this section of the sample made 80% operational responses to the tests overall.

The children in School A were re-tested on the same Piagetian tests after a three-year interval. The results tabulated on pages 408-412 show that whereas the mean weighted score was 51.3 (47.5%) on the first testing, it was 86.9 (80.4%) on the second.

A comparison of the results reflects a noticeable movement towards full operativity which had occurred during the three-year period. Such development, which would naturally be expected of normal children, lends support to the view that although spina bifida children are later in approaching operativity they are nevertheless operational, with some exceptions, by the secondary age.

Table 189, page 412 shows that at the end of the three-year period, only one child (6) of secondary age, who, although having clearly made progress, was still non-operational. One other (13) was not assessed because, in view of her excellent educational and physical progress had been transferred to a local secondary school. Of the remaining fifteen children, who were now of junior age, one child (25) was non-operational, only slight progress having been made through the three years, two other eight-year olds (27) and (28) who although not yet fully operational had nevertheless progressed through the period, moving from 0% and 1% operativity to 27.8% and 25% respectively.

The non-operational eight-year old child (25) who had only made slight cognitive progress during the three years at school had in the first year several periods of absence due to constant ill-health caused by a series of acute urinary infections and kidney malfunctioning, hospitalization for surgery for a urinary diversion and later hamstring relief. It is interesting to note that two other children of the same age (24) and (26) also had periods of absence in the first year of school life and yet these two had progressed from 6.5% and 1.8% operativity respectively to 83.3% and 87.0%. The performances of these three children at the end of the three-year period present an important question, "Why did two of the three make such marked progress in contrast to the one who made only little?" Intelligence is one likely factor, (25) for example had an I.Q. of 69 whereas (24) and (26) had I.Qs of 92 and 90 respectively. Other factors are those of general health and vitality and drive. (25) is constantly unwell, frequently has urinary infection which necessitates regular anti-biotics yet he is extremely placid, seemingly contented and easily satisfied. (24) on the other hand although having had similar periods of ill-health is always full of vigour, interest and activity. It is also significant to note that these two children strongly reflect their parents' attitudes.

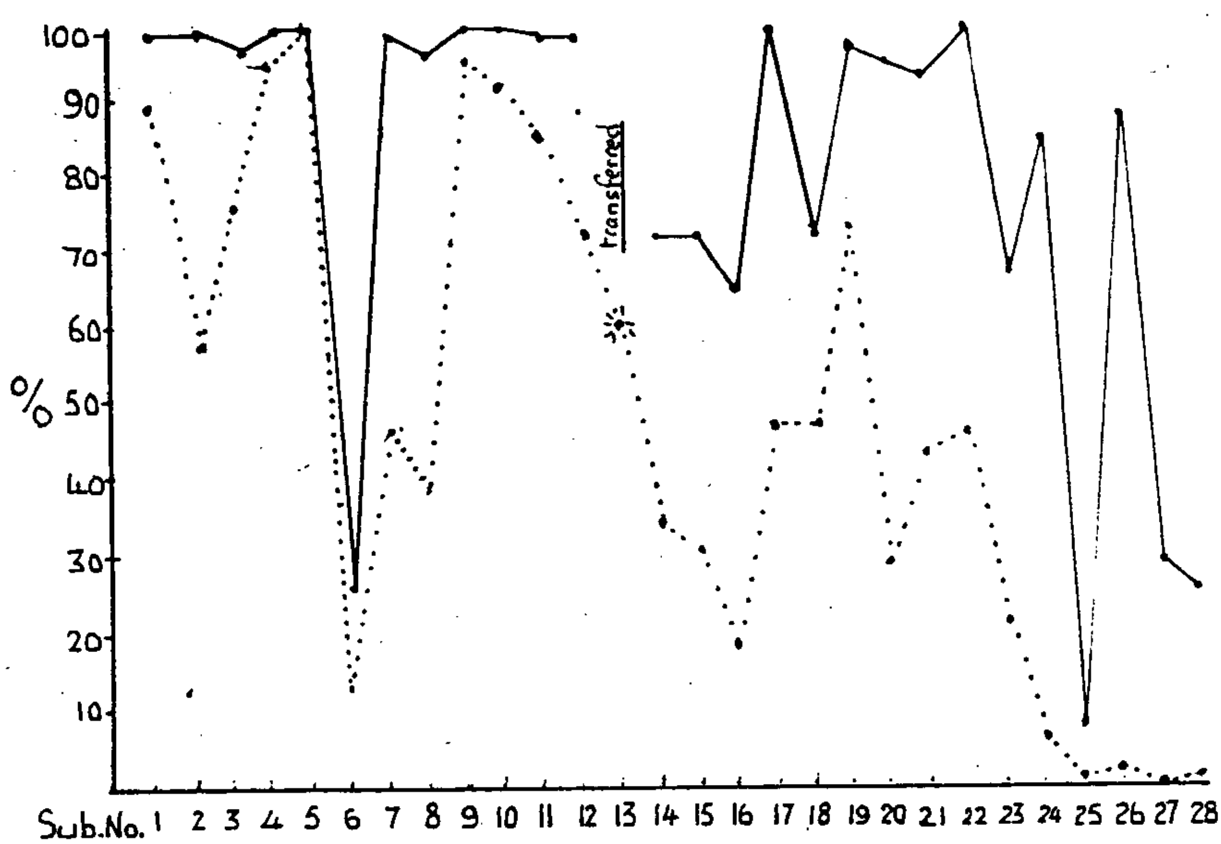
Fig. (x) overleaf illustrates the movement towards operativity during the three-year period.

The responses of the children indicated that some of the individual Piagetian number tests were more difficult than others. Consequently the data were analysed to investigate whether there was a consistent order of difficulty with respect to the concept or concepts involved in the tests. Having analysed the data using the Kendall's formula for the coefficient of concordance a significant measure of agreement was observed ($p < .01$).

The tests in order of difficulty are enumerated overleaf.

Figure (x).

Comparison of results on Piagetian tests.



.............indicates first testing and

____________ second testing (after three-year interval.

Table 71. Order of difficulty in Piagetian tests.

Most difficult	1	Test	8	Relations between parts and wholes.
	2	"	4	Development of the notion of measurement.
	3	"	5A	Equating of quantities - unequal sets.
	4 Equal	"	1B	Provoked correspondence - two moveable sets.
	4 "	"	5B	Equating of quantities - equal sets.
	6	"	6	Conservation of continuous quantities.
	7	"	7	Conservation of discontinuous quantities.
	8 Equal	"	2A	Provoked correspondence - several sets.
	8 "	"	3B	Spontaneous correspondence from a given set.
	10	"	9	Seriation.
	11	"	1A	Provoked correspondence - one static, one moveable set.
	12	"	2B	Generalization of 'n' sets.
	13	"	3A	Spontaneous correspondence.
	14	"	10	Ordination and cardination.
Least difficult	15	"	11	Class inclusion.

It would therefore appear that the differing difficulties observed in the reactions to the tests would suggest the possibility of using this information as a basis for teaching strategy with spina bifida children. Such a view is held by Magne (1975) who, as an outcome of his research with Swedish children having particular difficulties in mathematics, and also his reading of the work of Piaget among others, states that it is possible to create hierarchies so that mathematical content can be arranged in some sort of steps. Stressing the interdependence between many parts of mathematics, as for example a pupil studies addition and later subtraction, ideas from the former subsequently helping the latter, Magne seems to recommend the construction of a more rigid hierarchy with respect to the number system; for instance a child must probably begin with simple number ideas such as one-to-one correspondence between elements of sets and the notion of equality before getting on to the ideas of cardinal and ordinal numbers. Magne concludes that these questions of hierarchies of mathematics are very important but extremely difficult and what is needed most of all are penetrating studies in the exciting field of hierarchy.

Controversy however does exist with respect to structure in mathematics and psychology. Howson (1973) asserts that the question of whether structure or activity should introduce a new mathematical idea was one of the most controversial raised during the Second International Congress on Mathematical Education. This controversy was summarised by Fischbein (1973) who has outlined the problem which faces mathematical educators thus, "On the one hand, should one leave the general schemes of thought to form themselves gradually....Or on the other hand is it better that the child should be given the opportunity to function with these schemes, these structures, very early on in his development, so that they can be used as true matrices for the formation of his mathematical thought?" Whitney (1973) at the same Congress, pointed out in his talk 'Are we off the track in teaching mathematical concepts?' that concepts cannot be directly taught but must be acquired by the learner through his own experiences.

Piaget's paper which was discussed at the Congress emphasized that there exists as a function of the development of intelligence as a whole, spontaneous and gradual construction of elementary logico-mathematical structures and that these natural (natural in the way one speaks of the 'natural' numbers...Piaget) structures are much closer to those being used in traditional mathematics. Freudenthal (1973) is of the opinion that the child should start with structures which are more primitive and simpler when being introduced to mathematical structures. In a discussion concerned with Piagetian research and education, Hooper (1968) was interested in the idea that the curriculum sequence should be designed to harmonise with the child's changing cognitive status and that the teacher's task should be of relating classroom requirements and schedules to measures of cognitive function and structure.

Whitney (1973) seems to admirably sum up the essential Piagetian approach when he emphasizes the need to study individual children so that little by little the besetting problems are discovered and how to overcome them determined. In brief, Whitney feels that the focus has been too much on the subject matter, not enough on the child himself.

(b) Responses to the Piagetian tests.

In this study of the development of number concept in spina bifida children it was considered important to compare their reactions to those well documented responses of non-handicapped children. In order to do this, copious notes were made of relevant comments, replies to questions and methods used throughout the tests.

Interest is usually stimulated when the reported dialogue precipitated by the questions asked by Piaget and his colleagues and reported in 'The Child's Conception of Number' (1952) is closedly studied in teacher discussion groups. Piaget's study suggests the importance for the teacher to observe how children may react both verbally and actively in different situations. Throughout this study the children's comments, although frequently unsolicited, were interesting and frequently reminiscent of the dialogues reported by Piaget.

Children to whom reference will be made will be designated firstly by their school, A. B. C or D, secondly by their number within the school sample and thirdly (b) for boy and (g) for girl.

Tests la, lb and 2a. Provoked Correspondence.

There was a certain impulsiveness in many children's responses to the question, "Are there enough eggs (flowers, men etc.) to fit into...?" Anderson and Spain (1977) discussing the differences which can be observed in the way children attempt to solve problems observe that many spina bifida children act impulsively rather than reflectively. Most children in this study gave an immediate, affirmative answer to the first question, some of the remainder gave a negative reply and several were reluctant to answer. There was, however, a tendency for the older children to quietly count before they replied, the counting usually being indicated by a nodding of the head as each element was noted. There may have been more counting than was observed, since in some cases the counting was inaudible and the movement of the head only very slightly perceptible. For example, although there were in fact the correct number of elements, A7b replied immediately, "More than enough", he also added, "I think there's more than enough." A14b on the other hand replied, "I think there's too much." A9g said "I'll have to work it out." Both A10g and A11g reluctantly observed, "I don't know, I think there might be." B4b replied, "Let's see shall we?" and B9g repeatedly said throughout the subtests, "Of course there is", and B11g stated, "I don't know until I try." C4b asked, "Can I have a look first?", C7b began by saying, "I'll see", and after some thought, "I think there isn't." D3b kept remarking, "There's only one way to find out", D12b also said, "I'll soon find out." D16b said, "What! without fitting them in?", D21b replied, "I shall check." D13g said, "I bet there is", and thereafter, "Sure is."

There was a great deal of reluctance to practically construct a one-one correspondence with the particular elements in the respective subtests. It was frequently necessary for the tester to suggest that the child could find out if there were enough elements to match the second set. The children who were fully operational were quite explicit in their response to the questions designed to test conservation. A46b for example observed, "You just can't change the number by altering the shape!" This child also remarked when the configuration of one set was radically altered in subtest (iv) of Test Ia, "Yes I can tell by looking although it is a bit difficult to tell." A1g said, "You are confusing me, I know they are the same because I counted and fitted them in." An Asian child who finds difficulty in expressing himself in English said, "They are the same because I tried them first but you spreaded them out." B2b remarked, "I've tried them in, I didn't take any away, you didn't take any away, they must be the same." B13b who was most concerned with minute details of the apparatus said, "Well you see", and after a long pause, "Every time there were enough in the holes so they must be the same." D21g observed,"There is not more of anything. You've just spread them out so that it looks as if there are more", in a later subtest she said, "There isn't any more of anything because I put them all in and there's no more flower pots with nothing in". There were interesting comments made by children during the course of Test 2A. A3b said, "They are the same because they (referring to one of the sets) stick out this side and that side". A6b said, "I didn't hear any drop, and you didn't put any down so they must still be the same". A4g said, "You have spread them out. If you pushed them all together you would see that they are the same". When she was asked, "How do you know?", replied, "Well, I checked them. I put them all in (i.e. the flowers) and they all came out the same". A5g also observed, "You've only closed them together". There were many examples of this use of 'approximate' language which did not explain conservation precisely in correct grammatical terms but which nevertheless was an adequate means of communication. Fry (1964) albeit in another context stresses the need to accept approximate language in much the same way as approximate speech is accepted when used by children with hearing loss or speech defect.

D2b confidently affirmed throughout the subtests, "I can tell... and I counted". The transitional children gave replies which were reminiscent of those detailed by Piaget. When the configuration of a particular set was radically altered there was considerable uncertainty for example, A1b commenced every reply with "These are tricky". A2b with obvious embarrassment remarked, "I am getting confused". A1g also said, "You are confusing me". B3g repeatedly throughout the subtests said "That was a trick". D16g cautiously replied, "You aren't going to catch me because I'll count them again!"

The actual length of the line occupied by one set or the other was clearly an important factor in influencing the children's replies. For example, A9b repeatedly estimated the length by positioning each of his hands at either end of the line and holding this distance between his hands transferred the position to the second set.

The use of the word 'more' by some children was of special interest.

For example, A8g referred to "More men and more seats". A12b answered, "There are more seats and more men...ten seats and ten men". C13g exclaimed, "There's the <u>same</u> number but <u>more</u> holes". C14g having said, "It's magic" continued with, "More holes and more people", and "More people and more seats". D16g said, "There are more people and more seats which are the same". D22g replied, "More white eggs but the same number". D23g, "More purple flowers but the same number", and D25g, "More of both".

As with operational children who were confident in their reply to the conservation situation, the non-conservers were equally confident and quick in their reply that the sets were no longer equal. The overall impressions in this series of subtests was that most children were able to count and frequently did so either audibly or by nodding the head and most were able to construct the correspondence. It was necessary throughout the subtests to prompt the children to actually effect a one-to-one correspondence. Some children clearly had problems of manual dexterity. The children, some of whom were particularly interested in the details of the apparatus,enjoyed using it.

<u>Test 2b. Multiple Correspondence.</u>

A1g continued in the same manner as she had done in the previous tests by saying at the beginning of each subtest, "I am getting confused". A2b also said, "I am confused, I can only give them two eggs". A5g having incorrectly replied, "Eight each", followed up by saying, "But surely they couldn't eat all of that number!" A10g's reply was, "I don't know, but they would have a lot". D19g referred to "Greedy soldiers".

There were several methods of solving subtests (iii) which investigated the child's ability to construct a two-to-one correspondence. A9b said "I can't tell unless I put them in" (i.e. all the flowers into the single holders). A4g exclaimed, "I must use all the holders", A8g took a handful of holders out of the container and asked, "Do you think I need a few more?" A2b said, "I'll take out a handful and will put them in one by one". He eventually took out nine holders which were only sufficient for one set. B1g remarked, "About eleven". Since there were nine flowers in each set she really needed eighteen single holders. B4b used his favourite expression, "It's hard to say", then continued after a pause "Oh! about this many", indicating just four. Some children said, "I will count out eighteen", others, "I'll take out one for every flower", several said, "I'll count them", which they did, two by two. Some did not obviously count but preferred simply to take out one single holder at a time, placing the flowers in until there was none left. In fact D13g affirmed, "Only one way to find out, put them in". Two children ignoring counting or inserting the flowers, placed two single holders next to each flower pot. It was noticed that of the variety of method used in solving subtest (iii) 'Two to one Correspondence' only two children made an immediate two to one correspondence. Many children were content to deal with only one set of flowers in this subtest.

Test 3a. Spontaneous Correspondence.

In this test the children demonstrated different approaches to the situations which were affected by visual preferences. Hutt et al. (1976) although in a different context and having studied such preferences concluded that whereas on the one hand young children's preference depended upon the attention-value of the stimuli rather than the content on the other, the nature of the material viewed was more effective in determining the older children's preference.

Although the pattern of questions throughout the subtests was exactly the same in that due emphasis was placed upon the number of the elements, the replies often indicated that many of the children were more affected by the other attributes of colour and shape. A1g asked, "Any colour?", A5g, "Doesn't it matter what colour?", A7g having said "Same colour? I must count", then on reflection added, "Any colour?" A8g referring to the counters, laughingly remarked "I absolutely love smarties, I'll put different colours to make it nice". A12b wondered aloud, "Shall I make it all red?" C12b repeatedly said, "Can I put yellow or blue?, No! I think I'll put green". C4g and C5g said "Same colour?", C6g questioned, "Red colour or what?", C13g said, "All greens?" and C1b asked, "Any particular colour?"

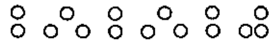
Shape also elicited considerable initial interest, for example A1g repeatedly muttered, "This is difficult", A3g proudly exclaimed, "See how I'm doing it...I'm clever!" A8g expressed her concern about the subtests concerned with circles thus, "This is round, I can't do rounds very well". It was noticeable how few children used the term 'circle'preferring usually to use 'round'. A10g referring to one shape said, "It looks like a star". A11b chatting throughout the subtests frequently said, "It sort of makes a pattern", "Do you want the same pattern?" and A15b exclaimed, "I can see a shape". A16b, who was easily distracted, replied when shown a rhombus, "Here's its legs, big ears, thats his horse!" D2b and D4b asked, "Any pattern?", D3b "Just like that?", D5b, "In the same place?" and D6b "Arranged in same way?" Of special interest in this respect was D2b's comment, "It's a help to do the same pattern isn't it? I'll do each one separately, I always find the easy way. I don't go in the deep end first!" Presumably the point he was making was that the correct number could be easily achieved by matching the shape of the model. A5g who did not overtly count, placed counters on the models in a one to one method and remarked, "This is the easiest way!" A8g wanted to know, "Does it matter what sort of mess I put them in?" A12b was very critical of the shapes and made excellent reproductions. A13b said, "I'll put them on top and then I'll count". B1b who didn't overtly count remarked, "I just matched them", this seemed to have been the result of a transfer of a mental picture from the model to his own reproduction. Some children who were clearly counting the elements on the models found difficulty in keeping the 'anchor' counter in mind, this being particularly true of circular shapes. For example, A4g exclaimed, "I've counted wrong. I know why, I need to remember where I started". In a later test she said, "I must keep my finger on". C1b said, "I can't remember where I started".

Koppitz (1975) with particular reference to the Bender Gestalt Test refers to the use of anchoring as another type of behaviour that is characteristic of children who are compensating for weakness in the visual motor area and in recall. This process involves placing a finger of one hand on the part of the design that is being copied while drawing the same with the other hand. By this method the child can keep track of where he is working and what part of the design has already been completed. Koppitz affirms that a less intelligent or younger child will count and recount the dots or circles after drawing each separate dot or circle and will keep forgetting the number counted repeating the process over and over again, only to end up, as likely as not, with an incorrect number.

It was surprising to observe how few children, even though the original instruction, "Put the same number" was repeated many times, were content only to do that. Most were concerned with the other attributes of colour and shape, the latter in many instances in fact determining the correct number.

So it seemed that number was not overall the main criterion to the children; in very few instances were they content to find the correct number of counters with complete disregard to the other attributes. The rhombus presented particular difficulty to those who wished to replicate its shape. The failure to 'anchor' a commencing counter was the cause of lack of success in counting in the closed figures. It was interesting to note that several children affirmed that they could recognize a definite shape on the first of the models presented to them although the counters had been randomly placed.

Test 3b. Spontaneous Correspondence from a given set.

Counting was more evident in this series of subtests than in any of the other tests. The preferred method of constructing the second set seemed to be by a matching system, that is, each element was placed precisely beneath its corresponding element in the initial set. There were exceptions however, particularly in respect of the non-conservers, to whom the length of the line of elements was more important than the number. For example although D12 correctly counted the six elements in the first set nevertheless placed nine elements in the second set, but also carefully ensured that the lengths of the two sets were the same. . The conservers made similar responses to those in previous tests, for example, A4g, "Ah! they are the same, they've only been spread out" and in another subtest, "They are only bunched up". D10g, "Tommy's are all together, but they are still the same. You haven't taken any away".

An interesting comment was made by C12g, "There are the same number but more in this line of counters". C15g gave a similar answer, "Same number but there are more men". D19g, hesitating in her reply said, "Let me count! I don't really know". B13b, who counted frequently had problems with the subtest related to the sets of sweets and remarked when the configuration was altered, "I thought I had given them the same, I didn't try. I don't know what has happened, I know one is shorter than the others". A11g, B5b and B6b were quite happy to place a handful of elements on the table to represent the second set, without any attempt to count or make a one-to-one correspondence between the sets.

The writer observed that the construction of the second set to correspond with the given set presented no problem to most of the children. Counting was clearly evident throughout the subtests. The perceptual cue determined by the length of the line of elements was an important factor.

Test 4. Development of the notion of measurement.

Many children suggested the use of measurement. For example, B4g immediately said, "Can I measure them?" B1b after a long pause said, "I'd measure it", B11b, "By measuring" and B13b, "I could measure, but I don't know how!" D8b affirmed, "Only one way to find out". D1g said, "I will tip in and measure." Some children however did not use the word measure, for example A2b replied, "I don't know how you could do that", A7b thought the problem could be resolved "By putting them in the same kind of jar". A11b suggested "This is a special formula!" B5g said, "Put them together and look", B7b answered, I'd see which is the biggest".

It was clear throughout the subtests that apart from the fully operational children, and despite the fact that frequently the child's attention was drawn to the availability of measuring beakers which could be used to solve the problems,many were unable to utilise the suggestion. A2b, for example, said "I don't know how you could do that" and D5g firmly asserted, pointing to the measuring beakers, "I don't need those. I can tell by looking". A6b's reaction to the cue was still to ignore the beakers and to try to estimate the equality or otherwise of the liquids by lifting the containers to the level of his eyes and thus trying to make a visual estimation. B5b suggested that he didn't need the beakers since he could put the containers together because as he pointed out, "One is a bigger container". B7b also said, "I'd see which is the biggest!" The height of the liquid in the tall, narrow container was clearly a strong perceptual cue to most of the non-operational children. For example C3b said, "It's a larger tube than this one, (pointing to a measuring beaker), I am confused, I should measure but I'll use this tall one". C4b said, "I can't use measures because they are lower".

Even when the tester gave an example of pouring the liquid from a container into a measuring beaker to give the child a clue, the non-operational children were not able to proceed. Some tried to continue pouring the liquid from the other two containers into the one already used by the tester with a consequent spilling over, (Fig. A below). Development of the use of the measuring beakers could be observed in that some used two and were uncertain about the use of the third. B2b used two measures into each of which he poured approximately the same quantity from one of the containers, (Fig. B below). Then he took a third measure into which he poured about a half of that which he had just poured into the second.

Figure A.

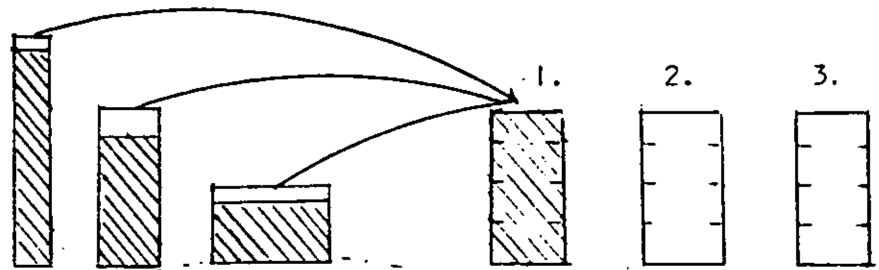
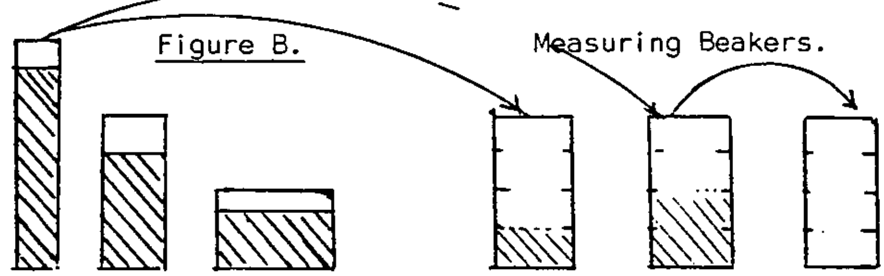
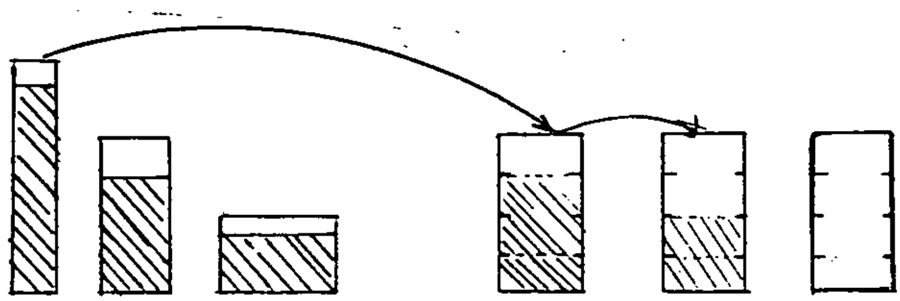


Figure B.



B5b took a measure into which he poured the liquid from one container (Fig. C below), then poured it from that measure into a second one, remarking as he did so, "There's about four kilogrammes and three kilogrammes".

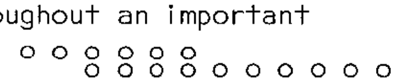
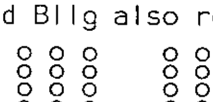
Figure C.



B13b suggested, "I could measure" and when asked how said, "perhaps by using beads..but I don't know...you could pour a bit in this beaker but ...well...well...well".

The children in general seemed to accept the notion that to measure would solve the problem but there was an inability to actually perform the task.

Test 5A. Equating of quantities - unequal sets.

There were differences of approach and replies to this series of subtests. Most children were aware of the numerical difference between the sets although describing this in various ways. For example, A2b said, "One is bigger, one is smaller and one has more counters." A2b replied, "They are not the same amount." A12b was very emphatic in his reply, "One is small and one is ever so big. Can I make a big circle." B9b, B10b and B11b each said, "One is long, one is short." B12g replied, "It has not many on." C1g referred to one set thus, "Not as many", C4g said, "One is less, one is more." C5g answered, "One has six, one has twelve." C9g said, "One is smaller, one is longer, the longer got the most", and "One is close together, one has more." C1b replied, "One is longer and has more counters." C5b pointing to one set said, "This has more counters." D1b, D2b, D3b D6b, D7b and D18b counted each set correctly. The words short and long, little and big and even fat and thin were used more than less and more. The shape of the sets was throughout an important factor. A11b thought the shape in subtest (i)  was like a cannon and the circle in subtest (iii) looked like the moon and a bit of the sky. Throughout the subtests A14b was most interested in the shapes, often saying, "I could make a train truck." A9g thought the circles in subtest (ii) were eyes, and those in subtest (iii) faces. B2g saw a fish and a flower in the two circles of subtest (ii), B5g and B11g also referred to the circles as flowers. D20b thought subtest (iv)  was a necklace, and D25g thought they were two bracelets. There was a general reluctance to use the term circle, the preference being to call them rounds. For example, C10b said, "Two round ones", D16b and D17b called the circles, two rings and D2g referred to them as two wheels. Several children felt that there was no difference between the sets, for example A6b said of subtest (i) "They are the same, they are both red", and of the sets in subtests (ii) and (iii), "They are the same, they are both circles." A2g also said of the circles, "They are the same." A10g thought the sets were the same throughout. B4b said of each subtest, "I think that they are exactly the same". B14b affirmed constantly, "They are the same...I'm sure... I'm sure". B2g said of the circles, "Both are round and are quite the same". A13b said of the rows of counters in subtest (i) "one is on top of the other", C6b indicating directionality replied, "One is pointing this way and one is pointing that way".

The operational children found no difficulty in constructing two equal sets, although there was a general reluctance to destroy the configurations in so doing. B6b said, "I will jumble them up" and B7g asked, "Shall I shuffle them up", B5g referred to "Scrumbling them up". Preference was to count both sets, remove the excess in the one set and then add a half of this sum to each set. There was a tendency amongst the other children to immediately reply in terms suggesting that the task was impossible unless (a) extra counters were provided to give more in each instance to the smaller set or (b), counters were removed as unnecessary from the larger set. For example, A2b said, "I can't without being given some more", A3b replied, "Only if you put more. You must add on". A10b suggested, "This is hard". B2b was convinced, "I can't do it without more counters. It can't be done". B13b insisted, "You must take them off". B5b putting the onus on the tester said, "I can't, can you?". C6g was most definite, "No way". C10g said, "I know one has more but I can't make them the same". C4b feeling the task quite impossible replied, "One is shorter. I can't do these...they are very difficult. I would need magic".

Some children reversed the sets by taking the extra counters from one set and adding them to the other thus making the bigger smaller, and the smaller bigger, for example, D2b appreciated the humour of the situation he had created and constantly lauged at what he had done.

It was observed throughout the test that as was found in Test 3A number seemed less important than shape. Also most children said that they either needed more counters from the reserve pile or they could dispose of the extra number to the reserve. It was interesting to note the children's reluctance to use mathematical terms such as <u>circle</u>, <u>diameter</u> and <u>circumference</u>.

Test 5b. Equating of Quantities - equal sets.

The preferred manner of sharing each set was by using a 'one for you, one for me' method. Exceptions to this were, for example, A9g who counted in two's throughout the subtests, "Two, four, six...eighteen". That is the two sets were constructed and counted simultaneously. B11b counted thus, "One, two, for you; one, two, for me" etc. C14g had yet another interesting method of counting and sharing the set; she counted and placed the elements in position thus, "One, two" for the first set, then transferred the count to the second set, "Three, four", followed by moving to the first set, "Five", then the second, "Six" etc.

The following children, A11g, A12g, A14b, B12g, C11b were quite content throughout the subtests to share the original set into two approximate piles with no overt regard to equality. Several children were particularly interested in the play situation engendered by using the two dolls to whom each child had given their own pet names. For example, A14b having said, "I'll give Jane her's first" decided that since Jane was younger she ought not to have so many. B10b replied, "Normally she (one of the dolls) has a bit more, my other sister (the other doll) can have one". B13b who thought there were too many elements to begin with, said, "I'll say four each and we'll save the rest!" C12b, having placed all the elements in one long line rather than in two groups, complained, "I've given all to my brother and there is none left for me". B5g confessed, "I'm not very good at sharing".

The replies and reactions to the conservation situations were similar to those detailed in the previous tests.

Test 6. Conservation of continuous quantities.

The subtest in which the perceptual cue had been removed by the use of an opaque container elicited interesting comments, for example, A5g said, "I can't see through the black, so how can I tell?" B4b also explained, "I can't see, so I can't tell". B8b exclaimed, "I can't see inside." B8b was not prepared to choose because although he peered in, his comment was "I can't see inside". Most children thought there was more liquid inside the transparent container.

Subtest (iii) which posed the situation in which the child was required to look at a container of liquid and then to pour the same amount of liquid into an empty container, presented difficulty to a large proportion of the children; even the operational children tending to hesitate before solving the problem. D12b's reply, "That can soon be settled. I'll use the measuring beakers", was an excellent example of the reactions of the children who were conserving. The transitional children's reactions were well illustrated by B7b who, thinking there was more liquid in the transparent beaker commented, "It's deeper. I know that. It's also higher; I've got brains".

The height of liquid in the container was constantly the compelling factor; some children being so very careful in their scrutiny of the varying heights. Although problems of mobility made it difficult for them to get into such a position that they had a parallel to the table view of the differing heights, they nevertheless attempted this.

The main features in this test were that the height of the liquid was a strong perceptual cue, and the removal of the perceptual cue in subtest (i) caused uncertainty. Subtest (iii) presented the greatest problem to most children.

Test 7. Conservation of discontinuous quantities.

Similar reactions with respect to the transparent and opaque containers as observed in Test 6 were evident in subtest (i). A4g, whose attitude was similar to that of several others. looked carefully inside the opaque container and said, "I know they are the same but I'd like to count them". C14g replied, "I can count these in the transparent container but I can't see those in the other one". When B13b, who was sure that although the containers looked different nevertheless held the same number, when pressed for an explanation could only reply, "Well...well...well!" and left it at that.

In general the children found these subtests easier than those in

Test 6. Counting was evident throughout. The removal of the perceptual cue caused hesitancy. Height was an important factor. Most non-operational children thought the transparent container held more beads than the opaque.

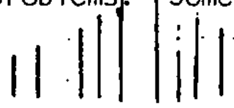
Test 8. Relations between parts and wholes.

This was a difficult test to all concerned. Many children seemed unable to isolate the numerical nature of the problem because of the necessity to fully comprehend and remember the language content. For example A4b repeatedly asked, "Do you mean through the whole day?" B7b, even after a repetition of the test situation asked, "Do you mean in the morning or in the afternoon?" Some children, as for example A7g, merely replied, "This morning" or, "This afternoon". Counting as such presented no problem to most of the sample but the language content did.

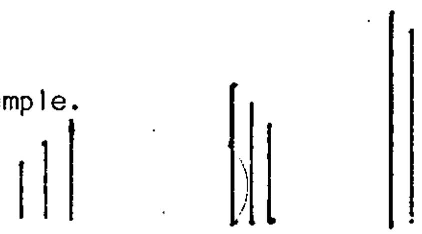
Test 9. Seriation.

The apparatus interested the children, this being particularly true with respect to the set of Russian dolls. The relative sizes of the sets prompted comments such as, "They go smaller and smaller", "Some big and some small", "They get smaller in size". "All are a different size. One is large, the second is large, this is the third largest". The familial nature of the dolls, particularly with respect to the younger children, also prompted interesting comments. For example A8b, an Indian child, observed, "This is father, this is mother, sister, big boy and little sister". A2g, "One is big, one is little but small. The little one should really be next to mother." A7g said, "This is mummy. This is a girl. That is middle sized. That's a tiny one." B9b asked, "Which is daddy one?" B10g constantly referred to the smallest doll as "The bab" and the bigger ones as other members of her family. D24g also referred to the baby one and said "I'll find the baby first and the giant last". When asked to firstly place the dolls in order two children placed the smallest next to the biggest because as they said, "The baby should be next to mummy".

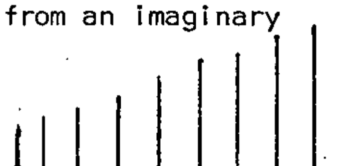
Some children seriated by choosing the biggest first, placing it in position then selecting the biggest of those left and so on. Some chatted audibly as they performed the task saying, "Next biggest, next biggest" etc. Several of the younger children made no real attempt to fully seriate the sets but were content to match only the smallest of each set; some just paired off the dolls in a series of subsets, whilst others made several seriations within each set. Several children attempted to seriate the sticks by holidng each one vertically and comparing its height with that of the dolls. Most children had less difficulty in seriating the dolls than the balls; the stick seriation presenting most problems. Some made the following pattern with the sticks



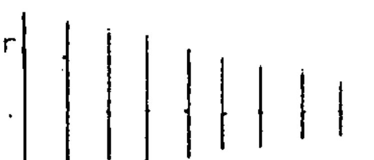
whilst others made several sets, for example.



Subtest (vi) presented a particular problem to many children in that they were uncertain how to set about inserting a second group of straws into the seriation they had just completed. Some were content to leave the first set intact and form a second seriated set with the extra straws. Most children levelled the seriation from an imaginary base line, for example



a few of the older children used the centres or the ends of the straws in the following manner



Selecting the biggest or longest of the remainder of the particular set in constructing the seriation seemed the more favoured method, although there were exceptions when the reverse was true. There was a general reluctance to destroy the seriations to assist in solving subtest (iv) and (v).

Test 10. Ordination and Cardination.

The children used several methods to construct the cylinders into stairs . Some attempted with increasing difficulty to place the cylinders on top of each other. In fact A8b persisted in trying to do this even when the smallest and next to smallest' cylinders were placed in position by the tester as in Figure A. B10g, B7b and C7g placed the cylinders in a correct order but laid them horizontally as in Fig. B.

Figure A.

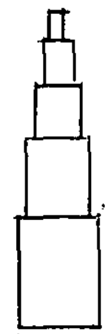
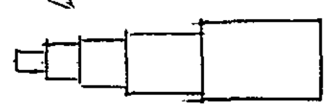


Figure B.



D10g made two seriations as in Figure C and said, "I can't put the little one in because it is too far to step up".

Figure C.

There was a variety of terms used to define the order of the steps, for example, A13b said, "One is the smallest; this is the second, third, fifth (leaving out fourth) and this the biggest". A9b replied, "Smallest, two, three, next biggest, next biggest, biggest". B4g did not use the referred term fifth, but as "Second to top". When the tester pointed to the first and sixth, B6b referred to "The front one and that's the back one". B10b used the description "Little step...big step" and replied as did B11b to the tester's questions thus, "That one...that one.. that one!" B9g said, "This one, this one, that one". B12g referred to the order of the steps as "Little one, (the first), big one, (the second), small one, (the third), number four, number five and the biggest (the sixth)". C3g preferred to say, "The small one, the next to small one, halfway between the biggest and the smallest". C13g who previously had constructed several sets of stairs out of the one set of cylinders said, "Small one...the baby one. The middle-sized Mummy (third), Daddy (fourth), big one (fifth), big one (sixth), big one (seventh)" C15g answered,"The bottom step, middle step, middle step big one, big one, big one, big one". C19g replied, "The little one, the little sized one, the bigger sized one, the bigger sized one, the bigger sized one, the little one, the big one". Interesting descriptions were made by D6b who referred to "First smallest, second smallest, third smallest", etc. until the "Eighth biggest".

Although one would have assumed that the seriation of the cylinders would present less difficulty than the seriations in Test 9, some children nevertheless were unable to complete the formation of the stairs.

There was a reluctance to use ordinal terms such as first, second, third and so on preferring words such as bottom, small one and big one.

The children had less problems with referring to the cardinal number of an element than its ordinal number.

Test 11. Inclusion.

There seemed little problem for the children in defining the common trait of the objects in each subset. There was a tendency, when presented with the particular situation for them to describe each member of the set, for example, "Two planes, seven birds, one kite... they all fly". The details of the objects interested some children such as A6b who being concerned with the types of planes asked, "Is that a Vulcan bomber?" and A7b who wanted to discuss if the cows in one test were actually cows and not bulls. A8g argued that it was not correct to say of the kite that it could fly like a plane, since it really just floats in the sky. A5g thought that colour was the common bond in some subtests for example, "Birds, aeroplanes, kites, they are all black". A6g looking at the 'things that fly' illustration, did not count the objects but called out the names to coincide with the number in the following manner, "Plane, plane, plane... bird, bird, bird, bird, bird, bird, bird...kite".

Many children consistently compared the subsets rather than make a comparison between the subset in question and the main set itself; the result of this comparison being that the subset containing more elements was said to have more than the set to which it belonged. For example, when B11g who had insisted that there were more birds than things which fly was asked, "Why do you say that?" replied, "There are seven birds but only two planes." When asked if there were as many planes as things that fly he replied, "There are only two planes so there must be more birds." There was further evidence that many children found it necessary to compare the subsets in the illustration of the set of flowers, five of which were tulips and five hyacinths. A4g for example, when asked if there were as many tulips as flowers, answered, "They are the same because there are five tulips and five hyacinths." Some children rarely answered the inclusion question with a yes or no but rather counted the subsets and gave the number of elements in each. For example, C5g having been presented with 29 inclusion situations audibly counted the subsets on 25 occasion, in the following manner, "There are three girls and two boys", "There are two men and five ladies" and "There are seven birds and two planes."

There was a tendency for the children to be more successful on the subtests using actual models than those which were visually illustrated.

The impression gained from most replies was that the children tended to assume the inclusion questions referred to comparison between the subsets rather than a subset and the set in question. Sinclair (1974), writing on the quantification of class inclusion found, as did the present writer that the original form of the test does not easily allow the tester to determine the stage at which the child is operating. Sinclair stresses that the test relies uniquely on the child's verbal answers and lacks situations where the child himself has to construct classes and subclasses. The theoretical analysis seems to indicate, as did the children's answers, that the main difficulty lies in the fact that the child is asked to compare within one collection, the extension of a subclass with that of the total class.

Teachers at all levels of mathematical education are interested in the practical outcomes of class inclusion; it is being more and more explored in infant schools and experimented with in junior schools.

It is commonplace to see quite young children using Venn diagrams, set notation and 'logical blocks' and so on in the modern school. Intersection, union, sets and subsets are often introduced quite early in the average child's school life. Although this emphasis is most commendable it is, in the writer's view, most important for teachers to realize that this notion is an integral part of the child's development of cognitive structures. In order to kindle discussion amongst a group of teachers interested in mathematical education, Fletcher (1975) provocatively stated, "Sets have become a rather foolish fashion because far too many people have taught the early stages without knowing where it led. There is no point in teaching sets, or indeed any mathematical notion, without a proper idea of where you are going." In the writer's view readiness is also an important factor in this issue.

2. The second hypothesis tested was that spina bifida children without a shunt are significantly more successful overall in Piagetian number tests than those with.

Despite a consistent trend for those children without a shunt to be more successful on these tests overall than those with, a multivariate analysis of the data did not indicate that the difference between the groups reached a level of significance (chi^2=19.71, d.f.15 which is less than the 22.3 required for significance at the .01 level). Also when the means of the groups' total weighted scores on the Piagetian tests overall were compared by use of a t test, the resulting t value of 1.59 was found to be insignificant. Overall therefore the data did not support the hypothesis in question. When the Piagetian tests were examined individually, it was seen that the non-shunts were significantly more successful in Test8 (Relations between parts and wholes), 9 (Seriation) and 10 (Ordination and cardination), t=1.98, 2.13 and 2.3 respectively $p<.05$.

This result raises certain questions some of which are more medically orientated than educationally. One such question might be, "Has the hydrocephalus so frequently associated with spina bifida, even though not apparently sufficiently severe enough to require a shunt, had a greater deleterious effect on the intellectual and educational development of such children than is commonly assumed?" In other words is the presence of hydrocephalus itself, shunt or not, the particular handicapping factor. Most research pinpoints the presence of hydrocephalus which is observable in 70% to 80% of children with spina bifida to be a primary cause of their retardation. The problem however is rather more complex since, hydrocephalus may be present even though it is not observed. What does appear to be particularly important is, not so much that the hydrocephalus necessitated a shunt, but the time lag between the clinical observation that such a procedure was needed and its insertion. Another important aspect is the history of any malfunctioning of the shunt system after its insertion. It is recognized that since complications with the shunt may threaten life and permanently impair intellectual functioning, treatment is a matter of urgency. Anderson and Spain (1977) outline the four most common complications: (i) obstruction of the catheter due to growth, (ii) blocked shunts, (iii) infection of the shunt system and (iv) disconnected shunts. Such complications may mean, at the least, prolonged absences from school and at the worst intellectual damage. For example obstruction in the catheter may cause severe headaches, drowsiness, fits and even unconsciousness. Infection, which may develop soon after the insertion of the shunt or even after several years of successful shunt functioning, may cause fever, listlessness and progressive anaemia.

Most of the children with a shunt investigated in this study do not appear to have suffered from these complications, there were certain exceptions however, as for example (18) from school A, who had had the shunt changed and who had been very ill for long periods. Despite his serious illnesses he progressed from 47.2% at the first testing to 71.3% at the second.

The I.Qs of those with a shunt were significantly lower than those without, this agreeing with the findings of medical and psychological researchers. The mean I.Q. of those with a shunt was 77.7, s.d. 15.3 and of those without 88.1, s.d. 15.4 A t test indicates the difference between means to be significant ($t = 3.8$ $p < .01$).

Also, the rating of overall handicap which includes the extent of paraplegia, general health, vision, hearing and dexterity (as measured by the Pultibec scale) indicated that the group with a shunt was significantly more handicapped than the group without; the Pultibec score for the former being 34.3, s.d. 6.5 and the latter 29.7, s.d. 6.0 ($t=3.93$, $p<.01$)

The group with a shunt was also significantly more perceptually immature as measured by the Bender Gestalt than the group without; the mean error score of the former being 12.8, s.d. 8.0 and of the latter 8.9, s.d. 6.8 ($t=2.86$, $p<.01$).

3. <u>The third hypothesis was that there is a significant negative correlation between operativity in the Piagetian number tests and degree of overall handicap as reflected by the Pultibec scale.</u>

There was support for this hypothesis. Examination of the data which is detailed in Appendix I pages 424-427 reflects a correlation coefficient of -0.22 $p<.01$ between the two variables in question. When the variable of chronological age was excluded the partial correlation coefficient was -0.41 $p<.01$. The correlations, although lower than might have been expected indicate that there is some relationship between the degree of handicap and success in the Piagetian tests.

The Pultibec system which was used to measure overall handicap was designed to evaluate the positive functional capacities of the individual child rather than his overt defects, and at the same time to give as much emphasis to those capacities that remain unimpaired as to those that are limited. This medical assessment approach is far-seeing and has clear ramifications for the teacher of handicapped children. Ordinary clinical records so often only note defects and give little information about their functionally limiting effects, and even less information about other possible compensating assets of the individual concerned.

The Pultibec ratings of the spina bifida children in this sample were assessed on the basis of information gleaned from discussions with the physiotherapists and nursing staffs of the schools and by reference to the medical files. The one serious omission in Pultibec from the writer's point of view is that since the scale is not designed specifically for children with spina bifida, there is no facility to assess the degree of hydrocephalus and the effect of the shunt if fitted. It may well be however the I.Q. rating in the Pultibec scale does, to some extent reflect this condition. It is the view of most researchers that hydrocephalus, particularly where a shunt is fitted, is associated with lower than average I.Q. and in fact may be a contributory factor in this retarded intellectual development.

Each quality assessed on the Pultibec scale is evaluated along a scale of six grades. Grade I, with the exception of the I.Q. factor, denotes complete normality in every respect and Grade 6 denotes functional uselessness.

It can be seen from Figure (xi) which is based on the data tabulated in Appendix A pages 281-285 that the main area of physical handicap is that of the lower limbs. It is also seen with respect to P (physical capacity) that the sample as a whole tends to be nearer Grade 3 than 2 indicating that although less capable than those in 2 and I, nevertheless would be able to do a full day's work if the environment is suitable.

When the overall measure of upper limb functioning is examined it is seen that the hand movement reflects slightly less ability than that of the arm. The mean score of 1.6 for hand movement (Table 96 Appendix A) shows that with some exceptions, the sample had almost normal competence in use of hand and fingers with reasonably successful results in the tasks performed, but slower than in Grade I. Co-ordination in this grade is only slightly affected suggesting that tasks such as drawing, writing and painting can be accomplished in a reasonably competent way. Five children however had noticeable difficulties with hand movements; 10b's left hand for example was grossly reduced in usefulness, and even with the right hand found fine movements such as required in writing, doing up buttons and shoe laces most difficult. Movement in 22b and 15d's right hand was extremely slow being capable only of coarse activity and limited usefulness.

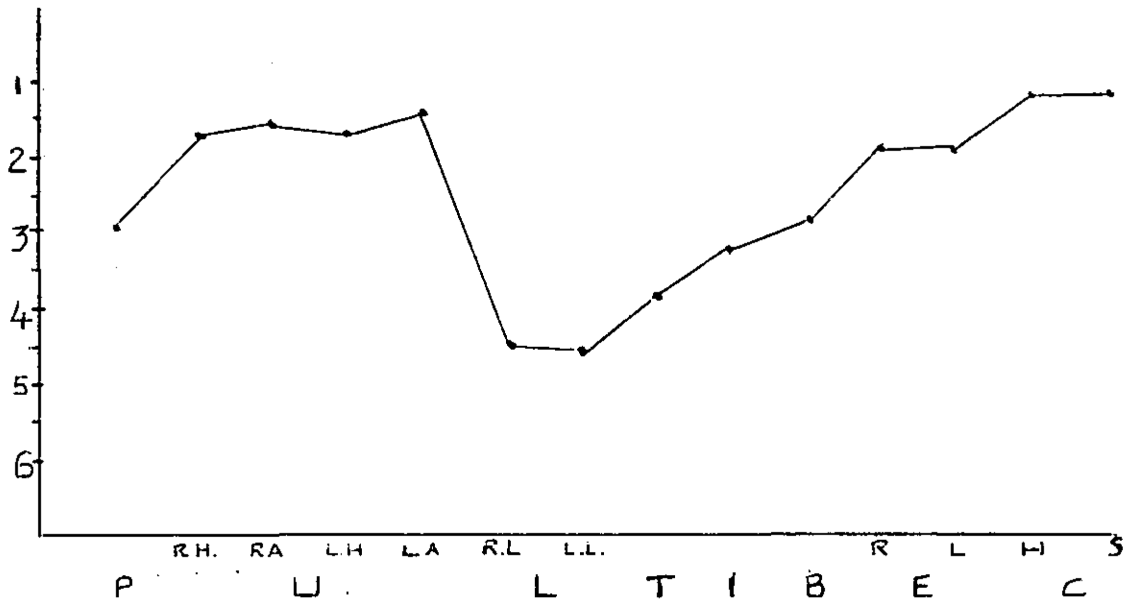
Twelve other children also had problems of hand movement performing manual tasks slowly and reflecting reduced co-ordination. 71 (54.6%) of the sample were assessed as having competent use in both hands and fingers, and were within normal limits of speed, dexterity and range in seizing, holding, grasping and turning. Four children had normal ability in one hand with diminished competence in the other. Overall competency in arm movement tended to be, although only slightly, better than that of the hand.

It can be seen therefore that although 54.6% had near to normal competence with respect to hand and arm movement, there was still a considerable number with problems of speed of movement, accuracy and other manipulative skills.

Figure (xi) clearly shows that the significant area in the overall physical handicap was that of lower limb functioning. The mean overall rating was 4.4 for the right and 4.5 for the left leg. This means that the sample as a whole fell somewhere between the rating 4 indicating that they were only able to walk short to moderate distances (that is, approximately 20 - 200 yards without a rest) at a slow pace with, if necessary, the aid of calipers, sticks and other walking aids; would probably need support for standing and occasionally need a wheelchair and the rating 5, which would define them as able with very close supervision and if necessary with the help of calipers, to walk a few steps, a wheelchair being necessary when help is not available. Forty-five children (34.6%) were rated as category 6, which indicates that they neither were able to walk even with help nor for all practical purposes to stand; a wheelchair was needed at all times. The rating for toilet ability for the sample as a whole was 3.7 which indicates that overall these children had particular problems in this respect. The rating shows that the sample is between those who with the aid of a urinary bag, catheter for bladder control or specially trained for bowel incontinence and who since they are paraplegic need ancillary help, and those who are in constant need of help.

Fourteen (10.8%) of the sample were graded 6, indicating them to be completely incontinent of bowel and bladder necessitating complete assistance.

Figure (xi). Pultibec Profile of sample.



The intelligence ratings were based upon precise S.B. or W.I.S.C. tests, details of which were found in the medical files. The overall Pultibec rating (3.2) places the sample in the dull-normal (Pultibec terminology) classification, that is I.Q. 75-99. The actual I.Q. mean and standard deviation of the sample was 80.9 s.d. 16.0; the I.Q. range being 47-132. The findings of this study with respect to the intellectual development of spina bifida children is very much in line with the conclusions of many research studies. In this sample some were of above-average intelligence while others were well below average.

When the data were examined to investigate the correlation between I.Q. and success in the Piagetian tests the resulting value $r=0.31$ $p<.01$ although low, indicates a moderate relationship between the two variables. When the chronological age variable was removed and a partial correlation computed the result was $r_{-age}=0.52 (p<.01)$.

There has been considerable discussion around the relation between I.Q. and the ability to solve number concept tasks, particularly since Piaget originally based his developmental stages of number concept on chronological age. Subsequent research has supported C.A. as being an important variable in number concept performance (Goldschmid 1967). Recent work however by Cohn-Jones and Seim (1978) who, having considered the intellectual factors affecting number concept development, focuses upon the contradictory nature of much of the research. These writers conclude from the research to date that the relationship between I.Q. and chronological age may be more important than either factor alone in influencing the development of number concept. They add however, that further investigation under controlled conditions is necessary to determine the relative contributions of mental age, chronological age and I.Q. to number concept development.

Mental ages of the one-year age groups and two-year age groups were calculated and are tabulated in Appendix F page 406.
Figures (xii) and (xiii)below illustrates the development of the children through the different mental age-groups.

Figure (xii).

Mental age and operativity based on two-year age groups.

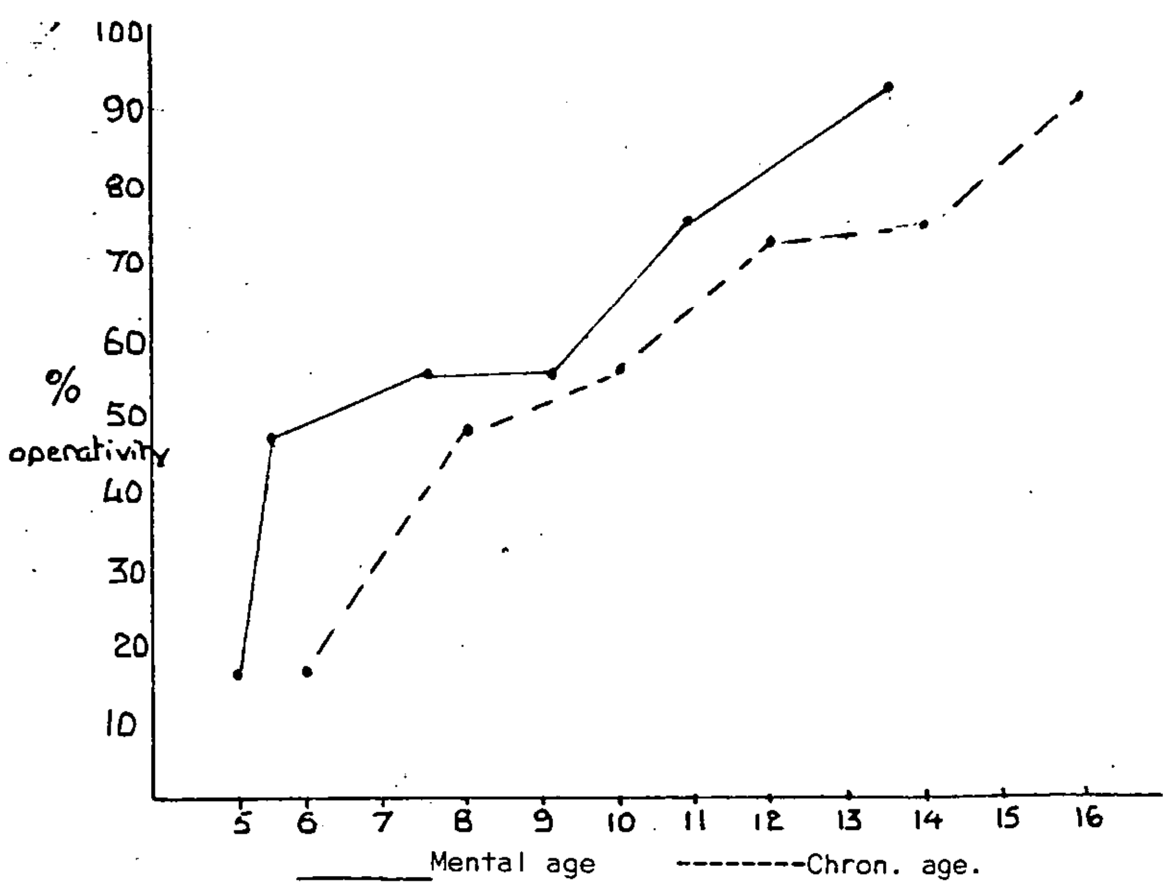
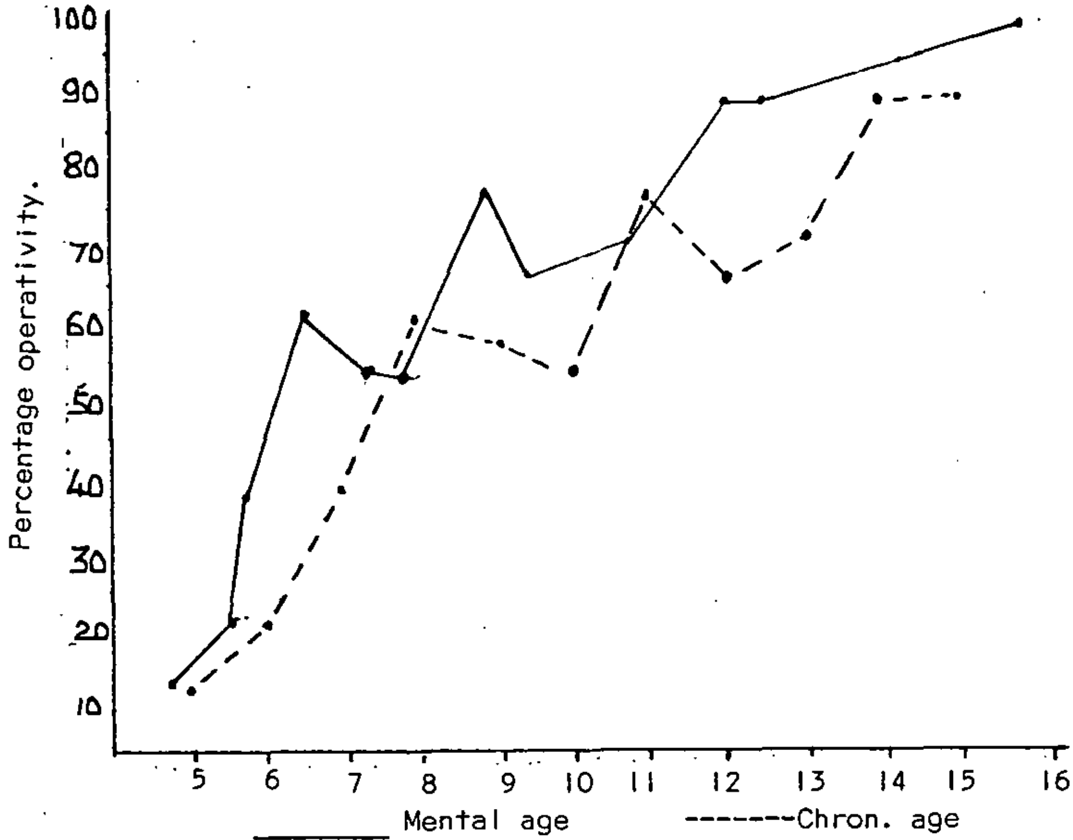


Figure (xiii). Mental age and operativity based on one-year age groups.



Allowing for some variations it can be seen that although there is a steady progress toward full operativity from a mental age of 4.8 years on, the increase from 55% toward a 100% operativity is particularly noticeable from a mental age of nine years.

The assessment of the sixth variable,behaviour, was based upon the results of discussions with teachers, child care staff, nurses and physiotherapists. The mean Pultibec rating for the sample was 2.7, which places them between those who are conscientious and persistent in tasks within their capacity and those who are similarly conscientious but lack drive as compared with grade I and 2. Fifteen children (11.5%) in this sample were rated by the Pultibec classification 4 as having overtly aggressive or withdrawn tendencies beyond normal limits, a percentage similar to that reported in Anderson's (1975) study, in which she found that 11% of her sample showed behaviour disorders as assessed on Rutter et al's (1970) scale.

Only five children (3.8%) were thought of as conscientious and persistent in any task and were thus classified as grade I. Despite the tendency to lack 'drive' which the Pultibec assessment suggests there was nevertheless consistent interest shown in the Piagetian and standardized tests. The children in each age group participated readily, conversed easily and relatively fluently and found the apparatus used in the number situations appealing.

Sixty-nine (53.1%) children were assessed by the medical staffs as having normal visual acuity for near and distant vision. Six (4.6%) were classified as having a considerable measure of visual impairment, two (1.5%) were rated as having severe visual disability. The overall mean rating for the remaining fifty-three (40.7%) was 1.8 which places these children between those having normal visual acuity and those who have retractive errors corrected by spectacles.

The final Pultibec classification relates to communication which includes hearing and speech; the mean rating (1.1) in both instances indicating that overall this sample had no problems in these respects. Only two children (1.5%) were assessed as having a borderline hearing loss, and three (2.3%) had mildly defective speech with some lack of clarity. The findings in this study with respect to hearing and speech are in line with those of Woodburn (1973) who found only two out of seventy-four spina bifida children to have a hearing loss and the G.L.C. study (1967-69) in which three of the one hundred and forty five spina bifida children had severe hearing loss.

Although there is a significant, albeit low, inverse correlation between the degree of handicap and operativity in the Piagetian tests there were nevertheless instances in the individual tests where the correlations were too low to be significant. Consistently substantial relationships however were seen when the age factor was removed from the calculations and partial correlations computed (Table 71).

Table 71.

Correlation of overall handicap (Pultibec) with individual Piagetian tests.

Test	1a	1b	2a	2b	3a	3b	4	5a
r	-0.16	-0.13	-0.15	-0.22*	-0.26**	-0.23**	-0.14	-0.25**
r - age	-0.27**	-0.27**	-0.29**	-0.38**	-0.43**	-0.37**	-0.25**	-0.39**

Test	5b	6	7	8	9	10	11
r	-0.19	-0.13	-0.12	-0.09	-0.23	-0.22	-0.13
r - age	-0.3**	-0.22*	-0.26**	-0.18*	-0.41**	-0.33**	-0.21

* = $p < .05$ ** = $p < .01$

In a study relating to the development of seriation and ordination in a small sample of spina bifida children, Jenkins (1977) found that physical handicap due to the condition alone appeared to have little effect on conceptual development even though it seems logical that a greater handicap would mean a greater retardation.

The data of this study whilst not supporting Jenkins' view with respect to these concepts nevertheless do indicate the relationship between overall handicap and Piagetian tests to be not as high as might have been anticipated.

4. <u>The fourth hypothesis that spina bifida boys are significantly more successful educationally, particularly with respect to the development of number concepts, than girls was not supported.</u> Although there was a trend for the boys to be consistently more successful than the girls, neither a multivariate analysis of the data nor a comparison of the difference between the groups' means of the aggregate weighted scores indicated a significant difference; in the first instance, $chi^2 = 12.06$ d.f. 15 and secondly $t = 1.04$ both values being insignificant.

Anderson and Spain (1977) have pointed out that it is a well established finding in the literature on handicap that the incidence of handicapping conditions such as cerebral palsy, severe subnormality, autism and speech defects is higher among boys. Surprisingly this is not so with respect to spina bifida and related congenital malformations. Not only are girls more likely to have spina bifida but they are also likely to be more severely handicapped and a higher proportion will require shunts. Although the sample is too small for generalization the study reflected the observations made by these writers. Table 9 page 102 shows that the girls were marginally more physically handicapped than the boys as measured on the Pultibec scale. The mean ratings respectively being 33.2 s.d. 6.7 and 32.6, s.d. 6.7. The difference between the means was not significant ($t = 0.51$). The mean I.Q. scores of the girls was also only marginally lower than that of the boys. 80.2, s.d. 15.2 and 81.6. s.d. 16.9 respectively; the difference between the means being insignificant ($t = 0.5$). When the groups' performances on the

Piagetian number tests were compared,(Tables 203 and 206, pages 430-434), it is seen that the girls' mean weighted score (50.9, s.d. 36.7) is lower than that of the boys (57.9, s.d.39.7), but not significantly so (t=1.04). When the Piagetian number tests are looked at individually it is seen that although with one exception, Test 2B, the boys were more successful, in no instance was the difference significant (Table 219, page 447).

Wadsworth (1978) has commented upon the intriguing phenomenon that few differences with respect to sex are found in the assessment of intellectual development in Piagetian-type interviews. On average Wadsworth asserts, boys' performances on Piagetian tests equate with those of the girls despite the usual findings that until early adolescence the latter tend to be more successful on conventional I.Q. and achievement tests. Biggs (1967) also expresses the same view. In her study of children's progress in primary schools, that is, through the period of developing operativity in Piagetian terms, she found a tendency for girls to surpass boys in most aspects of school work and particularly in mechanical arithmetic. The study supports research findings that spina bifida girls tend to be more severely handicapped. The girls in this study had a higher Pultibec score and had marginally lower I.Qs. Unlike non-handicapped girls however, they were less successful on both the standardized and Piagetian number tests. An exception was noted in the Bender Gestalt in which the girls overall had marginally lower mean error scores (11.3, s.d. 7.2 compared to 11.9, s.d. 8.5).

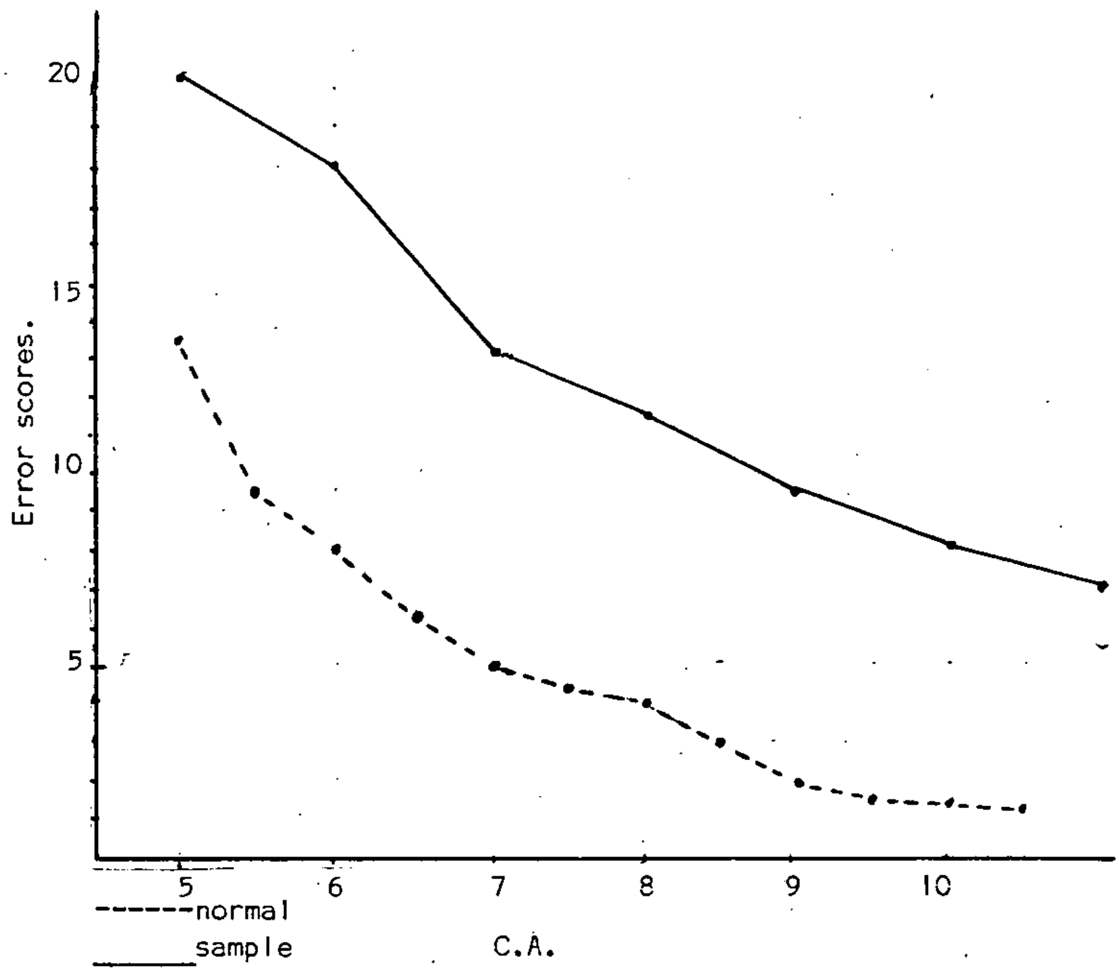
Biggs also made the interesting observation that when tests which demand insight are considered boys tend to do better. Although such a tendency was apparent in this study, the differences in the mean scores were not significant.

5. <u>The fifth hypothesis that spina bifida children have specific problems of a perceptual nature was supported in this study.</u>

When the children's performance on the Bender Gestalt was assessed the results showed their mean error score to be considerably higher than normal. Tables 112-136 of Appendix C, pages 319-340 detail the results and Fig. (xiv) illustrates the deviation from the norm.

Figure (xiv)

Bender Gestalt.

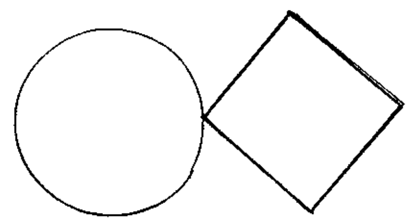


It is seen from Table 13 on page 103 that the boys had higher mean error scores than the girls, although not significantly so, and the children with a shunt had significantly higher mean error scores than those without ($t = 2.86$ $p < .01$).

Children with motor handicaps are frequently depicted as having serious disabilities in visual perception. Two arguments supporting this observation are (a) as cerebral dysfunction is often the suspected cause of both motor impairment and visual misperception, the likelihood of a visual perceptual deficit is enhanced in any sample of children with motor disability; and (b) as many theorists postulate a direct relationship between motor development and perception, significant defects in one skill should produce some impairment of function in the other. It is equally possible however, that the observed high incidence of perceptual disorder in motor handicapped children may be a function of the tests used to measure visual perception. As Newcomer and Hammill (1973) point out, most common tests of visual perception require considerable motor ability.

The most prevalent devices, for example the Bender Visual Motor Gestalt Test and the Frostig Developmental Test of Visual Perception, actually measure visual-motor integration, since they both include tracing or copying tasks. It must be said that if perception is measured with such devices, the results may reflect a child's motor deficiencies rather than his perceptual inadequacies. The rationale for measuring visual perception by using a test of visual-motor integration is reflected in a statement by Bender (1938) "The motor behaviour of the small child...adapts itself to resemble the stimulus perceived in the optic field". Newcomer and Hammill devised an investigation to answer two important questions, (i) Do motor-handicapped children as a group have serious deficiencies in visual perception?, (ii) Are visual perception and motor development relatively independent systems? They argued that the performance of motor handicapped children on a motor-involved test will deteriorate as the severity of their motor disability increases. If visual perception and motor development are independent systems, performance on the motor-free test should not deteriorate but should remain relatively constant across degree of handicap. If motor-handicapped children have significant visual disabilities, their perceptual ages derived from the motor-free test will differ significantly from their chronological ages. Perception, or the interpretation of what is seen, depends on maturation as well as on the child's experience. For example in the Bender

Gestalt Test, it cannot be said that the child is able to perceive Design A correctly until he can determine, consciously or unconsciously, that the design consists of a circle and a tilted square, not a rhombus, and that they are of about equal size, arranged in the horizontal position, and are touching each other. But just because the child can perceive and



can even describe or match correctly what he perceives does not necessarily mean that he can copy. In order to copy it the child has to translate what he perceives into motor activity, that is, he has to put it down on paper. The child is able to accomplish this task accurately only if the integration of his perception and motor co-ordination has matured to the level usually obtained by eight or nine-year olds. Difficulties in copying the Bender Test figures, therefore, may result from immaturity or from malfunctioning in visual perception, in motor co-ordination or in the integration of the two. A child who produces a poor Bender test protocol may have difficulty in any one or two of these areas or in all three of them. Koppitz (1975) affirms however that most school age children with immature Bender test records do not have poor visual perception nor do they show difficulties with motor co-ordination, instead they have problems with perceptual-motor integration; that is, they still have difficulty with higher level integrative function.

Koppitz seeing the Bender test as neither a visual perception test in its own right nor by the same token, a test of motor co-ordination, views it as test of visual-motor integration. This is also the view of Bender (1970) who speaks of the global nature of the Gestalt function and of the inseparableness of the perceptual and motor capacities. She takes exception to any effort to analyse this global function into its component parts, for obviously to her the integrative process is much more complex than either visual perception or motor co-ordination. Using the Bender Gestalt Test, Newcomer and Hammill (1973) found that motor-handicapped children perform progressively poorer on such a test of visual-motor integration as the severity of their motor handicap increases. Conversely, they tend to function appropriately for chronological age on a motor free test of visual perception regardless of motoric disability. The spina bifida child however has, apart from motor disability, the attendant problem of varying degrees of hydrocephalus.

Dodds (1975) looked at the effect of hydrocephalus on the visual-perception of spina bifida children by using the Frostig Test of Visual Development and found that the visual motor co-ordination skills of hydrocephalics are probably inferior to those of non-hydrocephalic children.

Anderson and Spain (1977) rightly make the point that often visuo-perceptual and motor skills need to be combined and it is on tasks of this nature that many spina bifida children, especially those with shunts, have marked difficulties from a very early age.

Anderson and Spain raised an interesting question relating to the generally poor performance of spina bifida children on visual-motor tasks of all kinds. Acknowledging the role of poor motor-control they state that as yet we are not in a position to say how far difficulties of this kind can be attributed on the one hand to neurological abnormalities (although there can be little doubt that these are involved) and on the other to deprivation of early sensory-motor experiences. Tew and Laurence (1975) add another variable to the whole question of the visual-perceptual functioning of spina bifida children; namely that of inferior intellectual development; they suspect that visuo-perceptual impairment is probably an expression of low intelligence. Scherzer and Gardner (1971) having tested spina bifida children on the Bender Gestalt found that those who showed significant perceptual-motor dysfunctioning had I.Qs below 70.

Kamii (1974) is also of the view that even perceptual discrimination or perceptual skills require more intelligence than educators admit. The role of intelligence, however, despite its accepted importance in the development of visuo-motor skills is not wholly clear. For example in a pilot study of the visual-perceptual functioning of a group of spina bifida children on the Frostig Visual Development Test, (Migdal (1976) made the interesting observation that it was not constant in each instance that a high I.Q. related to a high perceptual age or the converse. Koppitz (1975) in a detailed study of children's performance on the Bender Gestalt found that although those with good results tended to have average or above-average I.Qs those with immature scores may have high or low I.Qs depending on what other factors are present.

An examination of the inter-test correlations in this study shows that although there is clearly a relationship between I.Q. and Bender Gestalt ($r=-0.28$ $p<.01$) the correlation is not nearly as high as might be expected. When the variable of overall physical handicap (Pultibec) is compared with Bender Gestalt the observed relationship is also low, although significant ($r=0.25$ $p<.01$).

It seems therefore necessary to look beyond the variable of I.Q. and degree of physical handicap, even though these variables clearly play a part, in the under-functioning in visual-motor performance of spina bifida children; it is likely that the effect of hydrocephalus particularly where it was sufficiently severe to warrant a shunt, is an important factor.

The results of the study indicate that although the mean error scores of the non-shunts were relatively high (mean=8.9, s.d. 6.8), those of the shunts were <u>much</u> higher (mean=12.8, s.d. 8.0). The difference between the means being significant ($t=2.86$ $p<.01$).

It would appear therefore that the depressed performance in visuo-motor performance is the result of a combination of lower I.Qs, lack of mobility, the effect of hydrocephalus with and without shunts, deprivation of early sensory-motor experiences and other as yet unknown neurological impairments caused by the spina bifida condition itself.

Since the main aim of this study was primarily to investigate questions relating to the specific weakness of spina bifida children in number development it is important to ascertain if there is a link between this aspect of cognitive development and visual-motor maturity. Several writers have observed a particular relationship between visual-perception and number development. Wedell (1967) for example points out that 'number, usually taught in terms of the spatial arrangements of materials, is likely to be affected by perceptual impairment'. Schonell and Schonell (1957) suggest that inadequate development of visual imagery may constitute a handicap in calculation. Koppitz found the Bender Gestalt to be more closely related to number than reading and observed that mathematics is difficult for children with poor visual-perceptual skills. Frostig and Maslow (1973), both of whom are very concerned with the importance of visual-motor activity, stress for example the role of body movement and manipulation of objects in the development of number concepts. Asserting that body movement is the ideal means by which a child can learn the basic ways in which time and space are related; they pose questions which the child might ask; "Will it take longer to walk or run?" "Will I arrive first if I am faster?" "I walk around the chair, and then I will crawl under the table. Is the table high enough?" "I will run a straight line first and then a curve". (Underlined words are those emphasized by the authors). It needs little imagination to realize that these experiences cannot be enjoyed in a practical way by the paraplegic infant such as the spina bifida child. Visual-perceptual difficulties have a greater influence on the learning of mathematics than even on reading stress Frostig and Maslow, since an understanding of visually perceived relationships is essential to mathematics. Eye-hand co-ordination, another factor in visual-motor ability, is necessary for the accurate placement of numerals. It is equally important that numerals be legible to facilitate addition, subtraction and other mathematical processes. Poor figure-ground perception ability, the tendency to perseverate, impaired perception of spatial relationships and imagery, and difficulties in the directional position of numerals are all important ingredients in the process of acquiring number and mathematical skills.

Cruickshank (1975) also stresses the role of visual-motor perceptual development in concept formation. He emphasizes for example, how the perceptually handicapped, because of lack of experience, poor ability in holding or handling pencils or crayons, developmental immaturity in both fine and gross movements, have difficulties in acquiring mathematical proficiency.

Rimmer and Weiss (1972) interpreted the Bender Gestalt as a cognitive task based on Piaget's theory of the development of number and geometric concepts. Although not systematically treating the motor-expressive aspects of the test, an area which they stressed was in need of much more research, they nevertheless considered that the Bender Gestalt was useful as a concept-development in Piagetian terms. They suggest that the task of copying the Bender Gestalt figures could be expressed formally as mathematical transformations and test performance expressed as a mathematical task.

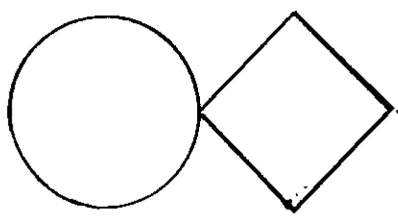
The procedure devised by Rimmer and Weiss was to view the Bender Gestalt as a cognitive task based upon Piaget's theory of arithmetical and geometrical conceptual development. They then analysed the Bender Gestalt results by reference to maturation of geometric concepts and maturation of arithmetic concepts. Unfortunately their paper does not deal with the third aspect of the analysis, namely maturation of motor-drawing ability.

In a study of perceptual factors which relate to number concept development Cohn-Jones and Seim (1978) found increased visual-perceptual skills led to improved number concept understanding in both retarded and non-retarded children. Although recognizing the need of more research to pinpoint further the specific perceptual skills important to number concept development these researchers found that the influence level of perceptual ability (as measured on Frostig) resulted in greater reliance on irrelevant perceptual cues in number judgement and in poorer performances on tasks of number concepts. It is of interest to note that the number tests used were based on those described by Piaget and were similar in kind to those used in this study.

The four aspects which need to be assessed in the Bender Gestalt are; distortion of shape, rotation of figures, integration and perseveration. Tables 124 to 127 of Appendix C on pages 334-337 details the sample's error scores relating to each of these aspects. Photostats of actual drawings are to be found in Appendix B page 291. A card missing in the following pages is due to the particular aspect under discussion being irrelevant as far as that particular card is concerned.

(i) Distortion of shape

Card A.



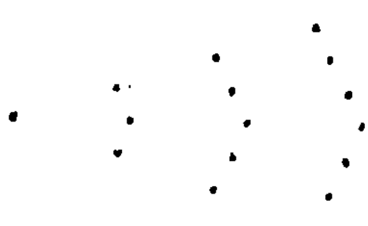
45% of the responses indicated one or more of the following distortions; the square or circle was misshapen, or there were extra or missing angles. 46% of the drawings showed a disproportion between the size of the square and circle, an error score being given if one is at least twice as large as the other.

Card 1.

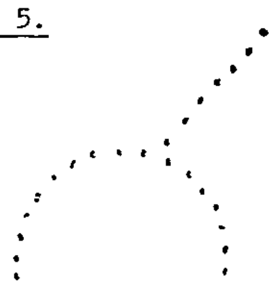
29% of the sample converted five or more dots into circles.

Card 3.

33% of the sample responses converted five or more dots into circles.

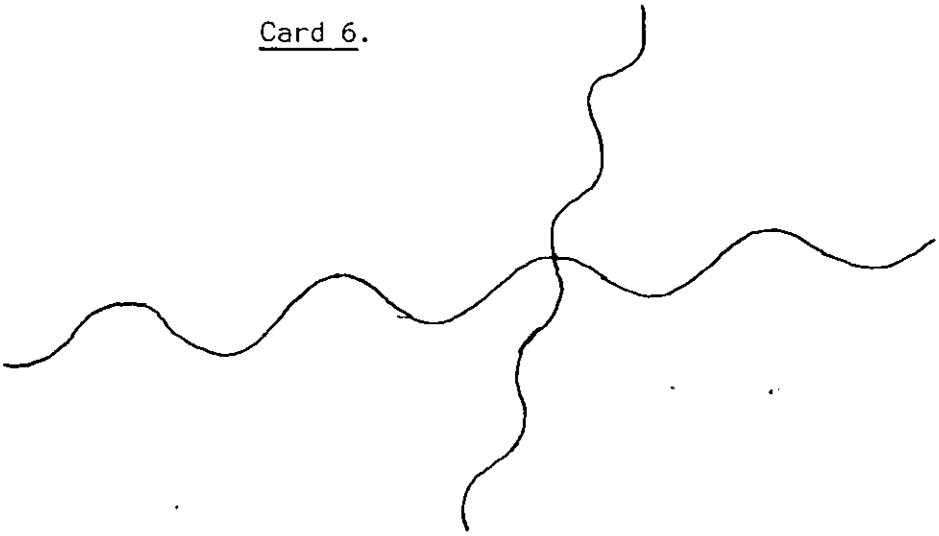


Card 5.



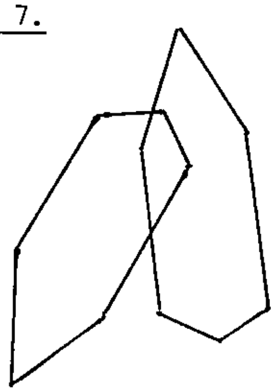
41.5% of the sample converted five or more dots into circles. The boys made noticeable more error scores than the girls on this aspect of the card. (50% as against 33%).

Card 6.



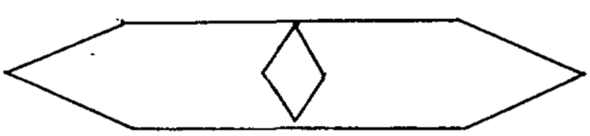
30% substituted three or more angles for curves. Again the boys made more error scores (37.5%) than the girls (22.7%) 22.3% drew one or both curves as straight lines; boys and girls reflecting similar error scores.

Card 7.



41.5% of the sample made error scores in reproducing the hexagons disproportionately, that is they constructed one at least twice as large as the other. The boys were much less successful than the girls on this aspect of the drawing, 48.4% making error scores compared to the originals. It was found that 80% had either excessively misshapened or had inserted extra angles or missed some out. The girls in this respect did less well, 84.8% making error scores compared to 75%.

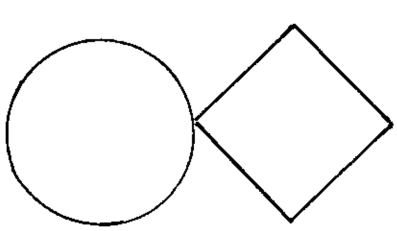
Card 8.



70% of the sample excessively misshaped the hexagon or diamond, inserted or missed out angles, or completely omitted the diamond. The boys made fewer errors (65.6% compared to 74.2%).

(ii) Rotation of shape.

Card A.

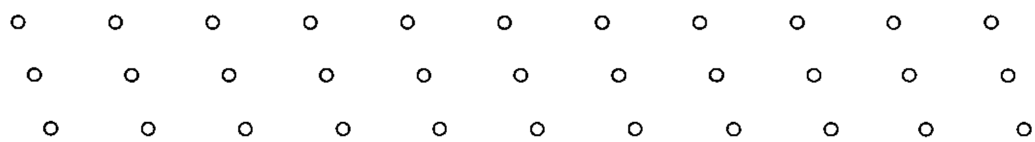


43.1% of the sample made error scores on the basis of having either rotated the figure or any parts of it by more than 45° or indeed having rotated the stimulus cards, this being done frequently.

Card 1.

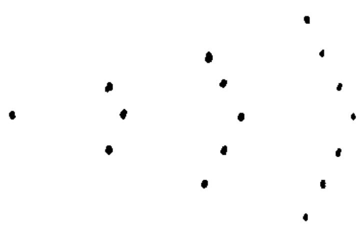
. . . . Overall only 19% of the sample rotated the line of dots by 45° or more above or below the horizontal. It was clear that more of the boys had error scores (28.1%) than girls (10.6%).

Card 2.



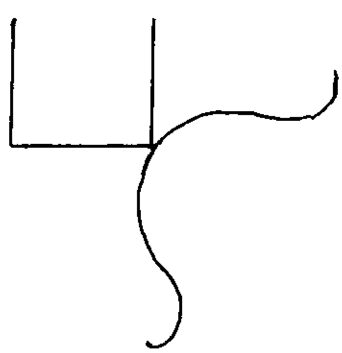
15.4% of the sample (18.7% boys, 12.1% girls) rotated the lines of circles through 45° or more.

Card 3.



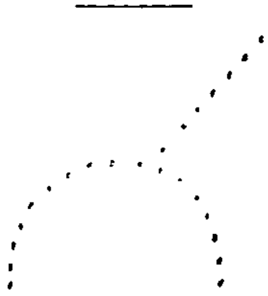
There was a noticeably large increase in the number of children whose drawings reflected a rotation of the axis of the figure by 45° or more. There were more boys than girls who made error scores in this respect (48.4% compared with 44.0%, overall 46.1%).

Card 4.



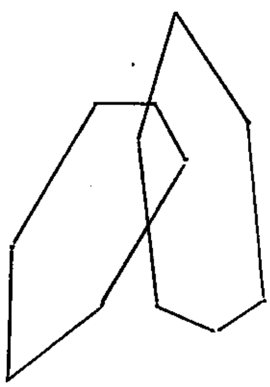
More girls than boys rotated the figure by 45° or more (47% compared to 40.6%, overall 43.8%).

Card 5.



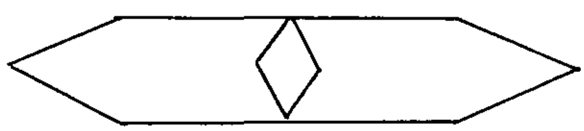
There was a higher percentage of error scores on this card than on any of the other cards (50.8%). The girls made more error scores than the boys (56.1% compared to 45.3%). The increase in error scores was probably due to there being a second criterion involved in the scoring, namely that apart from the rotation of the total figure by 45° or more it was also necessary to assess the rotation of the extension, for example if it pointed toward the left side or whether the extension began on the left of the centre dot of the arc.

Card 7.



40% of the sample rotated this figure or parts of the figure by 45° or more. Boys and girls performed similarly. (39.1% of the former and 40.9% of the latter).

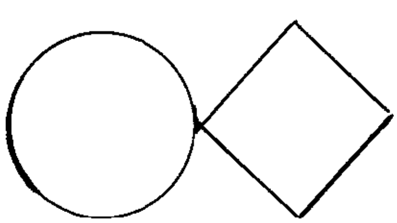
Card 8.



26.9% of the sample rotated the drawing by 45° or more (28.1% boys, 25.7% girls).

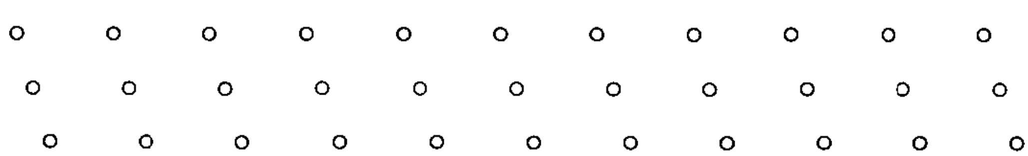
(iii) Integration.

Card A.



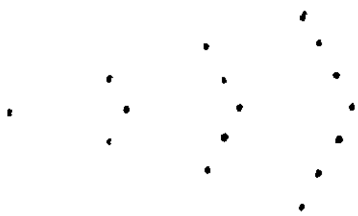
47% of the sample failed to join the circle and the square in that the distance between the arc of the circle and adjacent corner was more than one-eighth of an inch; an error was also scored if the distance overlapped by the same distance or more.

Card 2.



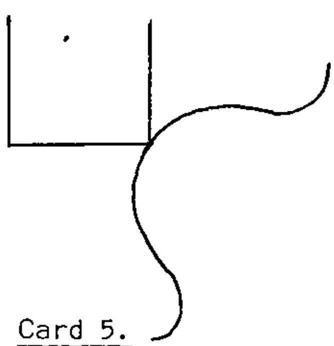
31.5% of the sample made error scores relating to one or two rows of circles having been omitted, or four or more circles drawn in the majority of columns, or a row of circles added.

Card 3.



52.3% of the sample either lost the shape of the design in their drawings or failed to increase the number of each successive row of dots, or just drew a conglomeration of dots. A small percentage (10.8%) drew a continuous line instead of a row of dots.

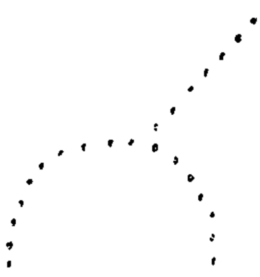
Card 4.



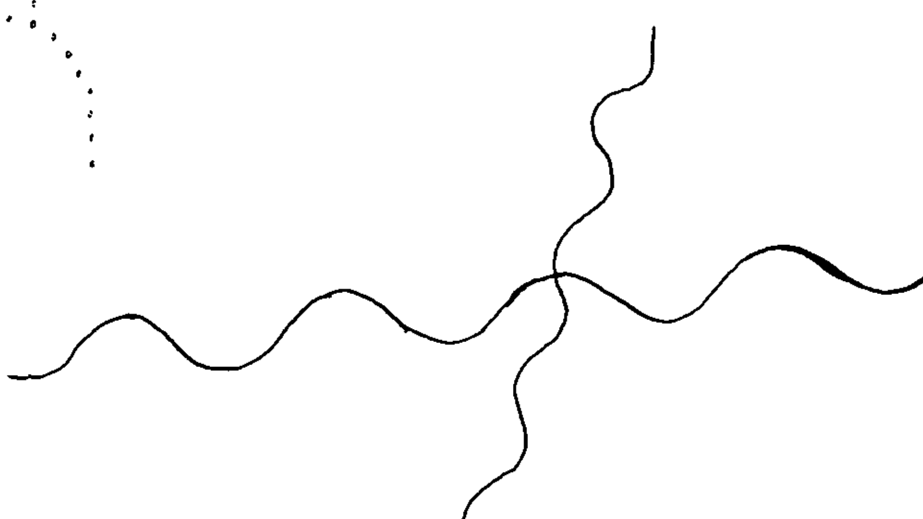
52.3% of the sample drew the design so that the distance between the curve and adjacent corner overlapped by more than one-eighth of an inch apart, or similarly failed to touch by a similar margin.

Card 5.

40% of the sample made error scores on the shape of the design whilst 29.2% drew continuous lines instead of dots in either the arc or the extension or both.

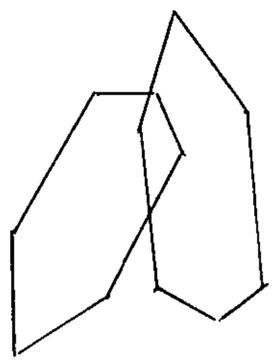


Card 6.



30% of the sample either failed to draw crossing lines, or they crossed at the extreme end of one or both lines. In some cases the two lines were drawn in an interwoven manner.

Card 7.



A large proportion of the sample (61.5%) had problems with the integration of the hexagons. Either the hexagons did not overlap or they did so excessively.

(iv)Perseveration.

Card 1.

. . . . 22.3% of the sample drew more than fifteen dots in the row (25.8% of the girls and 18.7% of the boys).

Card 2.

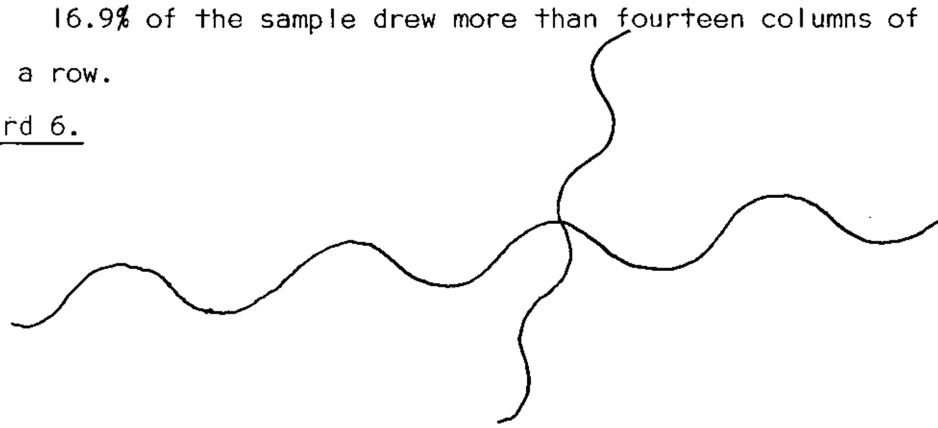
o o o o o o o o o o o

o o o o o o o o o o o

o o o o o o o o o o o

16.9% of the sample drew more than fourteen columns of circles in a row.

Card 6.



41.5% drew six or more complete sinusoidal curves in either direction (45.3% of the boys and 37.9% of the girls).

It is seen from Tables 124-127 on pages 334-337 of Appendix C that the sample overall had most difficulties with the shape presented on the stimulus card. Assessing the cards overall it is seen that 45.5% of the sample made error scores in respect to shape. The most difficult shapes being the hexagons on Card 7 (80% error scores) and the hexagon enclosing the diamond on Card 8 (70% error scores).

The next most difficult aspect was integration, the sample making 39.4% error scores on the cards overall. Card 7 again presented most difficulty, 61.5% making integration error scores, cards 3 and 4 followed in order of difficulty.

35.7% of the sample made rotation errors and 26.9% made perseveration errors.

The second of the two perceptual tests, Raven's Coloured Progressive Matrices emphasizes visual-perceptual reasoning rather than visual-motor co-ordination. Fig. (xv) illustrates the performance of the sample on both tests when compared to the norm. Tables 101-103 in Appendix C, pages 310-312 give full details of the results. The mean of the boys' raw scores was 18.6, s.d. 7.8 and 16.8, s.d. 6.1 for the girls. Although the boys did better on the test, the difference between the means was not significant ($t=1.38$). The mean of the shunts' raw scores was 17.2, s.d. 7.1, and of the non-shunts' 18.9, s.d. 6.9, the difference between the means was not significant ($t=1.28$). As might be expected there was a significant correlation indicating a substantial relationship between the results on the Bender Gestalt and Raven's C.P. Matrices. $r=0.74$ and $r_{-age}=0.5$ ($p<.01$).

Although the performance on Raven's C.P. Matrices indicates a measure of immature visual-perceptual reasoning, the deviation from the norm was not as wide as that observed in the Bender Gestalt. To some extent therefore it would appear that the motor element on which success in the Bender Gestalt depends, is a factor which needs to be taken into account in discussing the sample's performance.

Table 72 overleaf shows the inter-test correlations between the two perceptual tests and the other measures.

Fig. (xv)

Raven's Coloured Progressive Matrices.

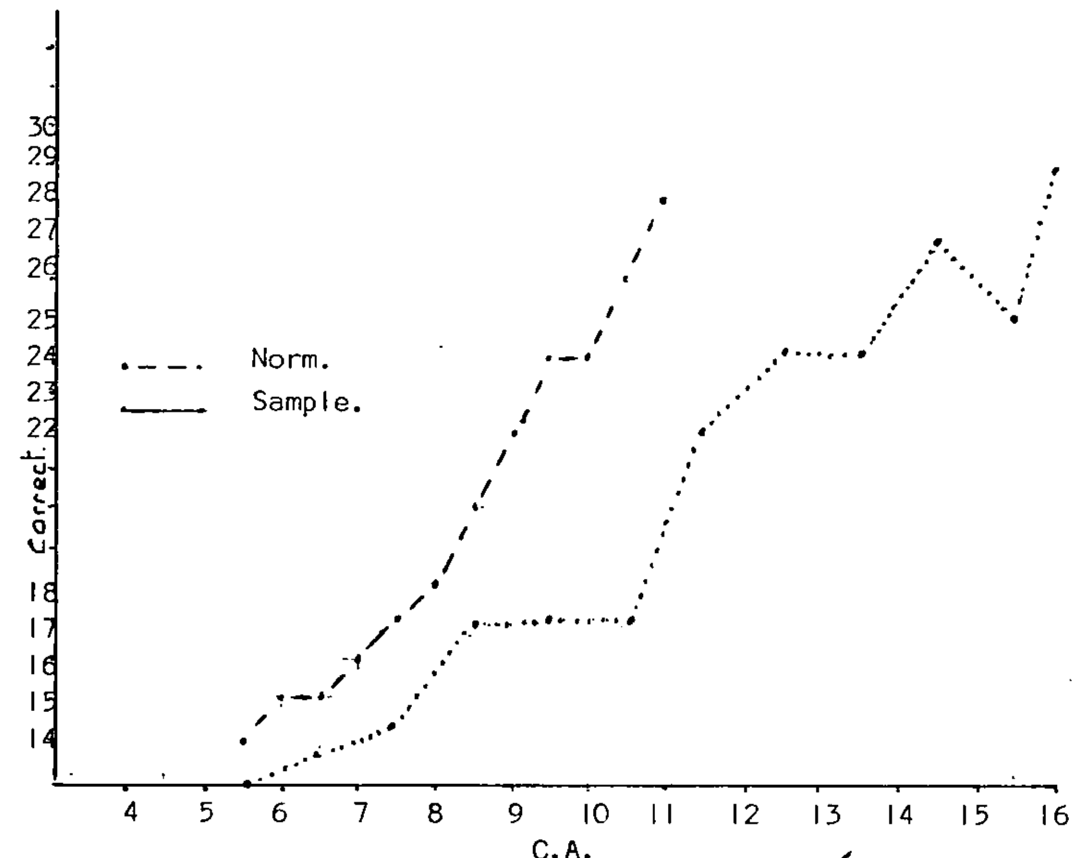


Fig. (xvi)

Perceptual age.

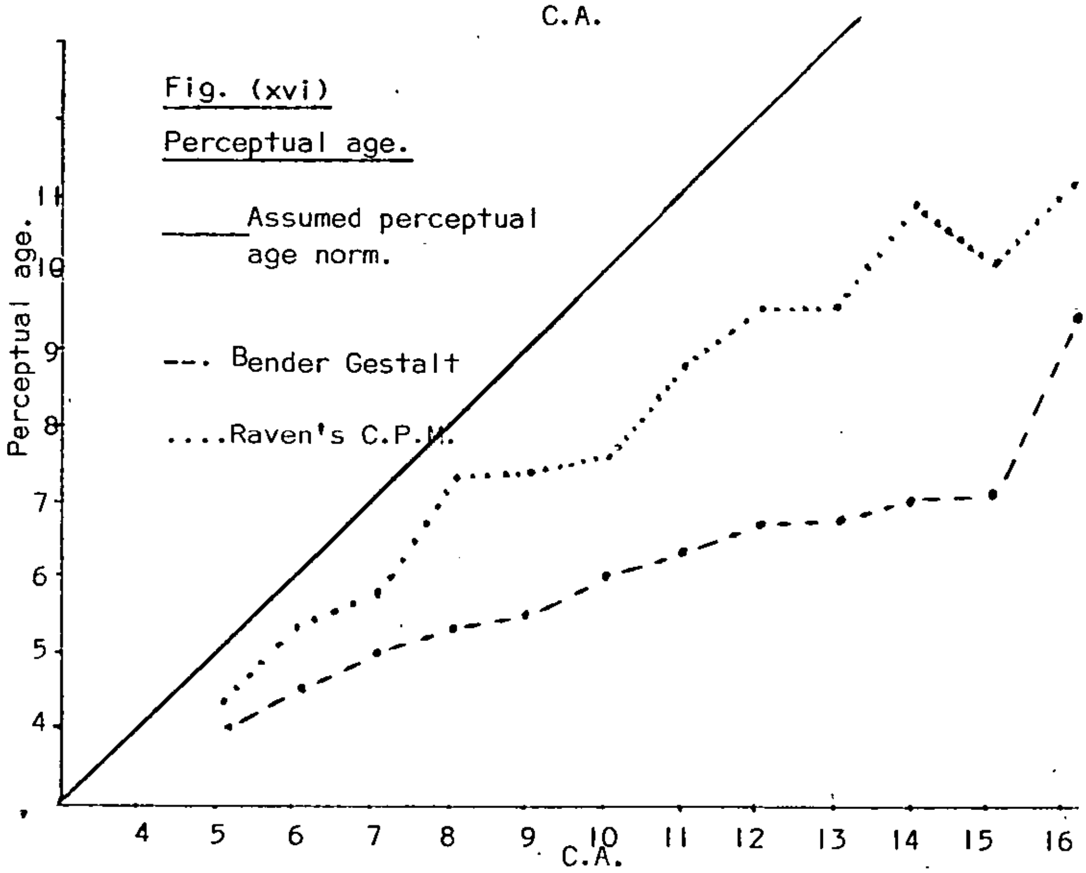


Table 72

Inter-test partial correlations. (r_{-age})

	E.P.V.T.	C.V.S.	Reading	Piaget	I.Q.	Pultibec
Bender Gestalt	-0.45	-0.45	-0.27	-0.62	-0.48	0.45
Raven's C.P.M.	0.43	0.49	0.34	0.52	0.49	-0.36

There was a significant trend, as seen in table 72, for both perceptual tests to substantially correlate with the other measures, this being particularly evident with respect to the Piagetian tests.

The studies by Anderson (1975), Spain (1967-1969) and Dodds (1975) reflect the visuo-motor problems spina bifida children, particularly those with shunts, have in the performance aspect of I.Q. tests. These researchers noted that the children were laboriously slow, that the marks drawn by the hydrocephalics were shaky, and that the items which gave the lowest scores were those requiring visuo-spatial skills such as mazes and geometric designs. Whilst collecting background information prior to testing, the writer also noticed that whereas the verbal scores on the I.Q. tests were usually within normal limits the performance scores were frequently much lower and in fact considerably depressed the final I.Q. assessment.

During the past several years, teachers have become increasingly interested in implementing teaching strategies for children whose retardation has been traced to a perceptual handicap. As a result there have been several remedial programmes designed to compensate for this deficit. Although, as Zach and Kaufman (1972) assert, the proposition that perception is a basic requirement for learning is sound, the question of who is included under the label of the perceptually handicapped is intimately linked not only to the methods employed in identifying these children but also to how the aetiology of their problem is viewed. Zach and Kaufman, seriously questioning the adequacy of the concept of perceptual deficit for education, studied the validity of current procedures for identifying the perceptually deficient child, the methods of training in perceptual skills and the concept of perceptual deficiency. They concluded on the basis of the available data that caution should be exercised against haste in designating children as perceptually handicapped. There is little doubt that some children have perceptual problems which handicap their school achievement, but how they are identified, how their problem is defined, and how they are to be perceptually trained, is still unclear.

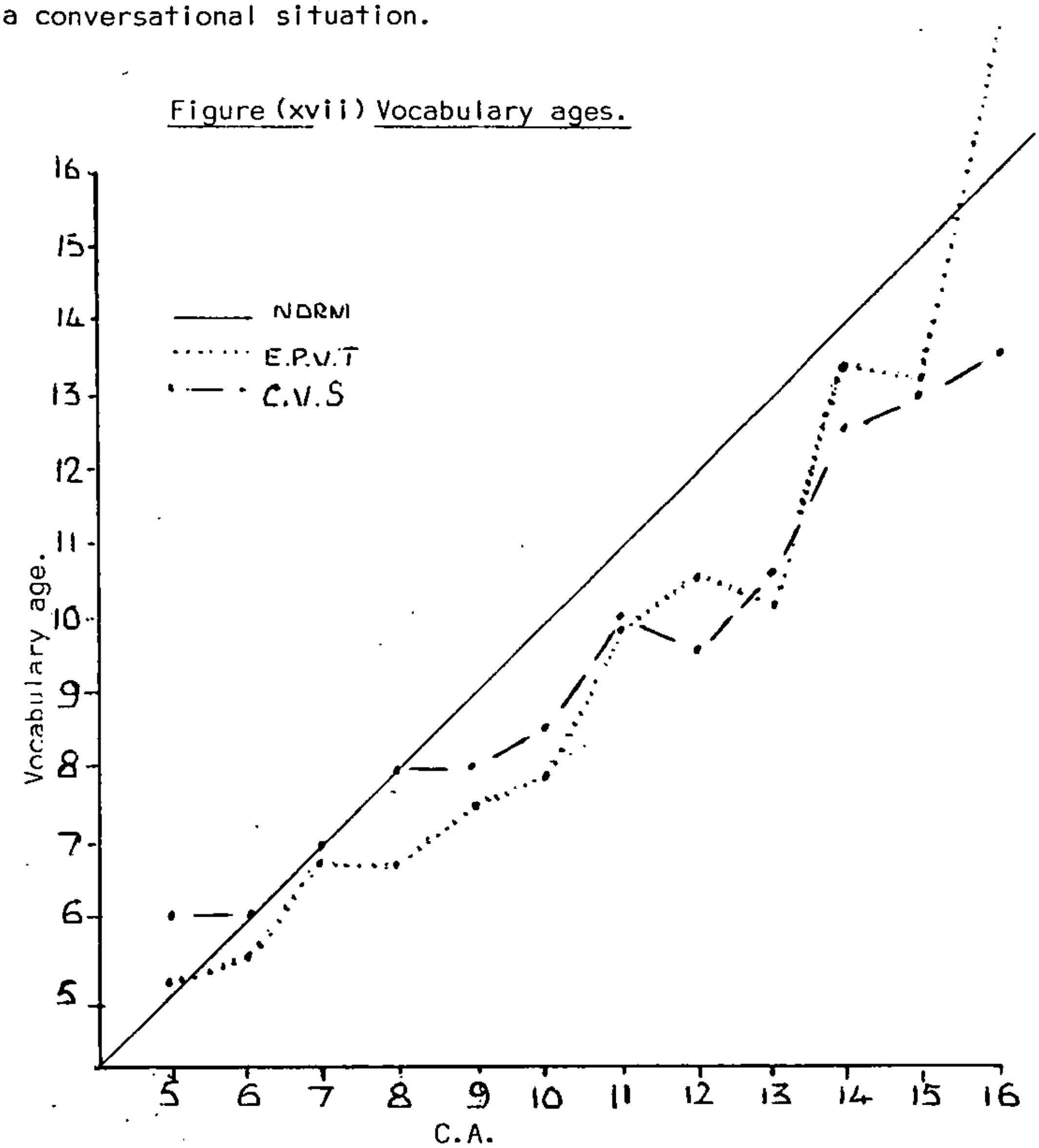
6. <u>There was support for the hypothesis that the well attested progress in pre-school spina bifida children's acquisition of vocabulary skills is not maintained thereafter to the same extent.</u>

Full details of the sample's scores in the two vocabulary tests are to be found in tables 104-111 on pages 313-318 of Appendix C. Fig.(xvii) overleaf illustrates the vocabulary ages of the sample at differing chronological ages. Several researchers, for example Spain (1974) and Anderson and Spain (1977) have reported that young spina bifida children acquire vocabulary skills quite normally. Some difference of ability has however been noted between those with shunts and those without, the latter being more successful. Anderson's study showed the spina bifida group to have unimpaired vocabulary skills and Spain's investigation of the syntactic development of spina bifida children, despite syntax being difficult to test at an early age, indicated that this aspect of their language development was relatively good.

Pilling (1973), in a comprehensive review of much of the literature concerned with the verbal development of children with spina bifida and hydrocephalus, concludes that when compared to their peers they are more talkative and have an advanced vocabulary. However, despite this apparent facility in language, there is some evidence that the speech of the children with hydrocephalus is superficial, lacking in appropriateness to the situation, and they do not understand the meaning of the words used. There are conflicting findings on whether in fact those with hydrocephalus are more talkative than spina bifida children who have no observable hydrocephalus or their non-handicapped peers. For example, Diller et al.(1966) and Fleming (1968) report on the one hand that the verbal output of the hydrocephalic children was no larger than that of others whilst on the other hand Swisher and

Pinsker (1971) comparing spina bifida children having shunts with congenital amputees found the former to make more verbal responses in a conversational situation.

Figure (xvii) Vocabulary ages.



When compiling information in respect of the children in this study it was noticed that their I.Q. scores concerned with their verbal performance was consistently higher than the scores related to the performance aspect of the task. From a practical point of view there was hardly any problem respecting conversation generally or specific verbal instructions as the study developed. The learning problems which spina bifida children have do not seem to be due to slow or inadequate language development in their early years. Indeed they give the impression of having acquired the mother tongue remarkably well which, in view of their many handicaps and the complexity of language, is a considerable achievement. Schaub (1978) writing on the importance of oral language takes the view that children who enter schools at the age of five with very wide patterns of language and comprehension have a great advantage when entering school for the first time.

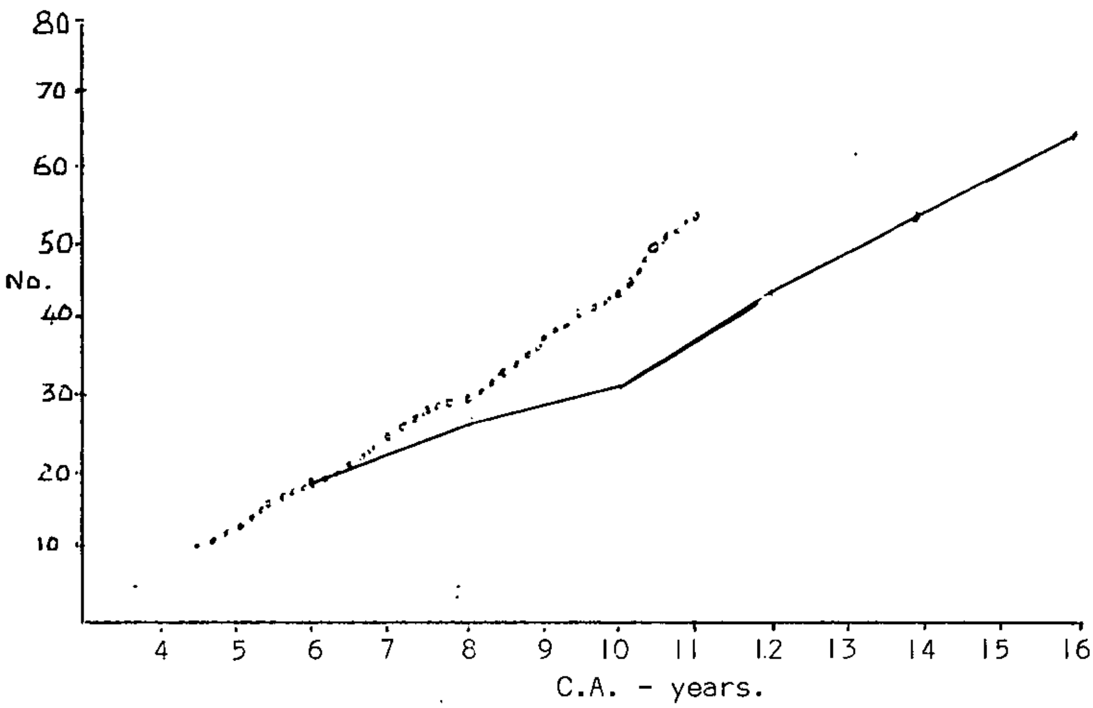
The Bullock Report (1975) states, "We cannot emphasize too strongly our conviction of the importance of oral communication in the education of the child". This conviction is supported by studies made amongst children experiencing educational problems and by the opinions and feelings voiced in many teacher discussion groups. Indeed, slow or inadequate language development not only handicaps a child's education but causes difficulty in his whole emotional, intellectual and social development. It seems with respect to spina bifida children that due to their handicap, they have been exposed to a wide sample of language during the early years. They will not only have heard many people, including surgeons, paediatricians, general practicioners, nurses and other professional people speaking to and round them but also they will have been able at a very early age to enter into conversation, to make mistakes and have them corrected in a secure background. They will therefore have heard different forms of speech, casual and formal, precise and discursive and they will have had close attention from the family for the first years of life.

The language-disadvantaged child by contrast will arrive at school with less of this experience and so with less ability for self expression and as Schaub rightly concludes, little is to be gained by either the teacher or the child in pursuing literacy, numeracy and other areas of education if there cannot be accelerated development of oral language as soon as possible.

The results of this study support the view that the spina bifida children starting school have at least a normal oral vocabulary. In fact the findings on both the Crichton Vocabulary Scale and the English Picture Vocabulary Test show that the children in this particular sample were marginally above average at five years of age, were average at six, seven and eight years with a falling off thereafter. Figs. (xviii) and (xix) overleaf illustrate the tendency, with respect to

Figure (xviii)

Crichton Vocabulary Scale - 2 year age groups.

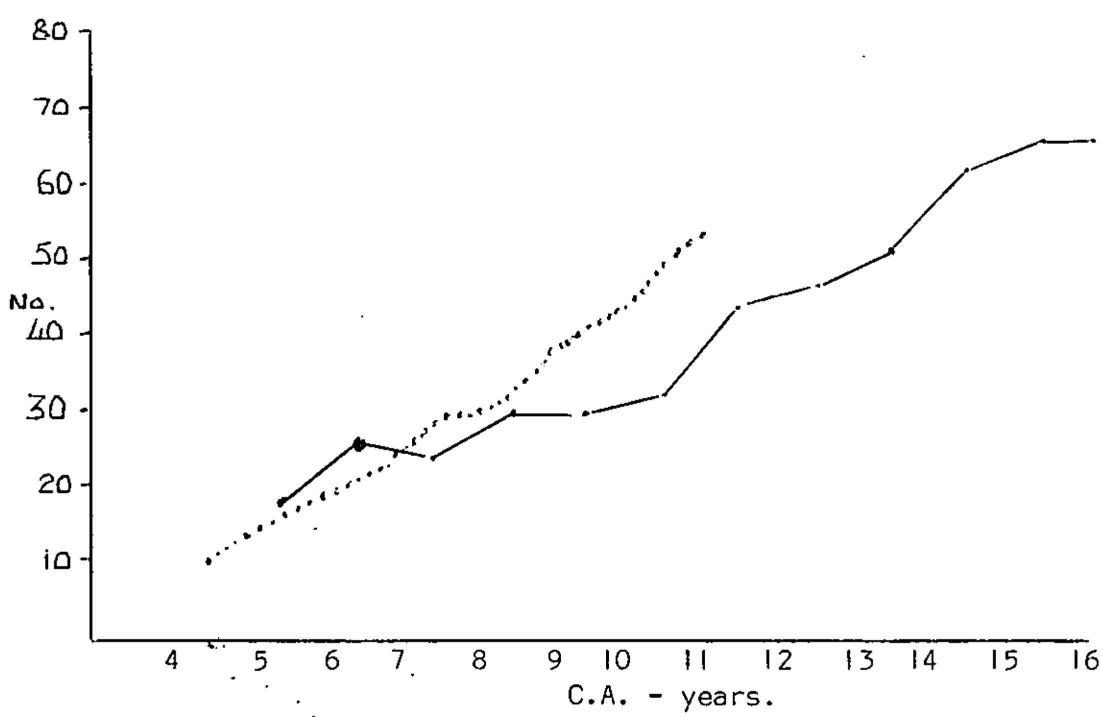


Key...............normal scores

_______________sample's scores

Figure (xix)

Crichton Vocabulary Scale - one year age groups.



the Crichton Vocabulary Scale to fall away rather markedly after the age of eight years. Despite the spina bifida child's exposure in the pre-school period to quite a high degree of sophisticated language, these influences lessen as the child grows older and perhaps can be attributed, as in the case of non-handicapped upper junior and senior children who exhibit the same tendency, to the fact that they have relatively less time for oral expression and make fewer demands on adults' time. Schaub makes the observation with respect to non-handicapped children that even though they hear acutely, for one reason or another, they switch off at the age of five years.

The Crichton Vocabulary Scale results showed that although the sample between the ages of five and eight years were, to use Raven's (1974) nomenclature, verbally average, the nine to elevens were definitely below average in verbal ability. Although there is a cut off point in the table of norms at the age of eleven it can be seen from figs.xviii and xix that if the average graph continued in more or less a straight line there is a continuing retardation in the ages over eleven, although Raven does suggest that with children of less than average ability the scale can be used quite satisfactorily up to the age of sixteen or more.

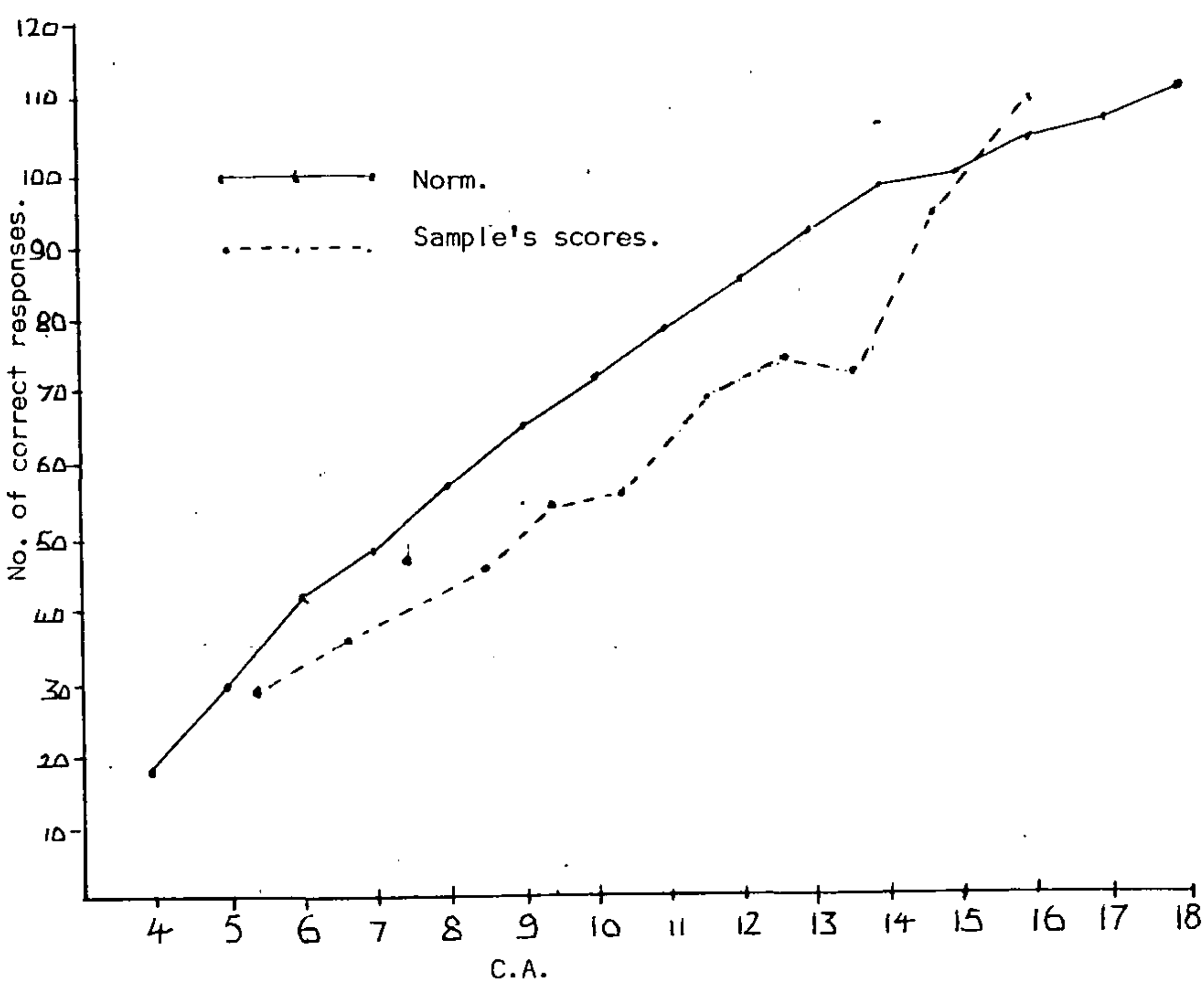
The vocabulary age of the boys as reflected by the Crichton test was marginally higher than that of the girls, 8.7 and 8.3 years respectively. These ages reflect a retardation of 0.8 years for the boys and 1.2 years for the girls. The children without a shunt were also slightly more successful than those with, the respective vocabulary ages being 8.7 and 8.5 years; the former reflecting a vocabulary retardation of 0.9 years and the latter 1.0 years.

Caution needs to be exercised in interpreting the results with respect to the over elevens since, as Brimer and Dunn (1970) observe, application of tests designed and standardized on a lower age group to older children are never fully satisfactory, either in terms of the assumptions that are made on the process of measurement or in terms of the comparative statements that can be made about children. They are of the view that it is preferable for a child to be compared with other children of the same age even though the general interpretation of the resulting standardized score is made in terms of the age at which that particular score is the mean score. The English Picture Vocabulary Test meets the objections raised by Brimer and Dunn since it does in fact cover the age range of two to eighteen years. The E.P.V.T. like the Crichton Vocabulary Scale, is a measure of listening vocabulary but unlike the former does not depend upon an oral explanation of the stimulus word. The resulting test score is most accurately described as a measure of the level of semantic reference which a child is capable of comprehending.

Figs. (xx) and (xxi) below illustrate the sample's performance when compared to the norms of the test.

Figure (xx)

English Picture Vocabulary Test. One-year age groups.



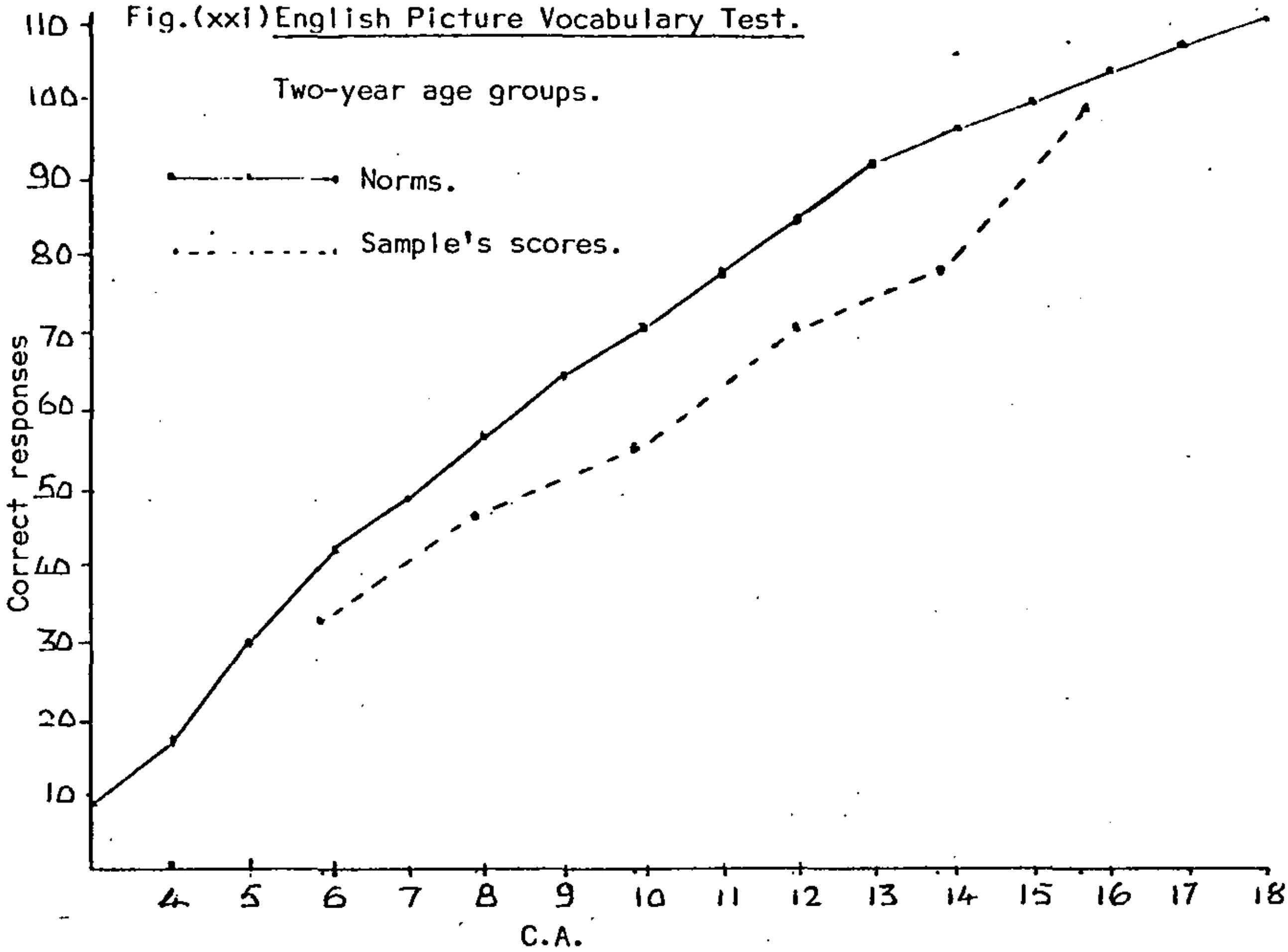


Fig.(xxi) English Picture Vocabulary Test.

When the sample (C.A. 9.5. years) is viewed overall the mean vocabulary age was 7.8 years reflecting a retardation of 1.7 years; the mean vocabulary age of the boys (C.A. 9.5 years) was 8.1 years and of the girls (C.A. 9.5 years) 7.5 years. When the data were examined to compare the performance of the shunts with the non-shunts it was seen that the former group (C.A. 9.5 years) had a vocabulary age of 7.5 years and the latter (C.A. 9.5 years) 8.1 years.

There was, as might be expected, a substantial relationship between the two vocabulary tests; $r = 0.89$, $p < .01$. Figure xviii on page 190 illustrates a similar vocabulary development through the age groups as measured by both the Crichton and English Picture Vocabulary Tests. There is a suggestion with respect to the development as measured by the E.P.V.T. that although as hypothesized, the early acquisition of of vocabulary skills was not maintained through the age-range, there was nevertheless a movement toward the norm after thirteen years of age. Unfortunately the sample's performance on the Crichton Vocabulary Test cannot be completely satisfactorily assessed after the age of eleven for the reasons already stated

Inherent in Piaget's theory is the need for the teacher to learn to understand what the child is saying and to be able to respond in the same mode of discourse. Piaget, who, although as Furth (1969) points out, does not think language is necessary for operational thinking, nevertheless does say, "Without interchange of thought and co-operation with others, the individual would never come to group his operations into a coherent whole." (1963). Hamel (1971) and Griffiths et al. (1967) stress the importance of paying attention to the semantic and syntactic aspects of language in investigating the number concept of children. It is important for example to know whether the child understands the concepts more and same in judging conservation attainment. Otherwise it remains uncertain whether one measures conservation or the understanding or misunderstanding of the words used. Sigel and Hooper (1968) in their reflection on the role of language in the development of number concepts suggest that when children are in a particular transitional Piagetian stage, increased exposure to language may well be the stimulus which propels the child forward. These authors however hasten to add that in their view the role of language is to facilitate rather than determine cognitive behaviour.

A similar outlook has been expressed by Sinclar (1967) who looked at the relationship between language level and two Piagetian-type situations, namely conservation of continuous quantities and seriation. She did, in fact, find that children who succeeded in these tasks had more sophisticated language abilities in a number of different ways. But when she proceeded to teach the less advantaged group the language of the more advanced children, believing this would be a help in cognitive tasks, found that it was not only extremely difficult to teach them the language patterns but on the whole the children performed no better afterward. Contrary to her original hypothesis, Sinclair concluded that language development is dependent on the level of thinking rather than being responsible for the level of thinking. Although it is not the purpose of this study to discuss the arguments for and against the role of language in cognitive development, it does seem important for the teacher to recognize that although many young spina bifida children enter school with an adequate vocabulary there appears to be a falling off in this respect during the critical period of number concept formation. The teacher needs to ask as do Schwebel and Raph (1974) in their discussion of Piaget in the Classroom, "To what extent can incorrect language forms be tolerated and accepted during these formative years when children are making exciting discoveries and learning new ideas and also is it possible to accept incorrect answers which are wrong in the absolute sense but appropriate and normal for a child at a given age?" Some writers, for example Sinclair and Kamii (1970) have particularly insisted on the necessity of letting the pre-operational child go through one stage after another of giving the wrong answers before expecting him to have adult logic and language. Others, as for example Almy et al. (1966), Duckworth (1964) and Furth (1970) have pointed out that language is important, but not at the expense of thinking.

There was a substantial correlation in this study however between vocabulary skills and success in the Piagetian tests: $r=0.8$ $p<.01$, $r_{-age}=0.58$ $p<.01$, $r_{-age}=0.54$ $p<.01$ with the English Picture Vocabulary Test. To what extent therefore the acquisition of vocabulary skills has enabled the spina bifida child to move towards Piagetian operativity or, on the other hand, the degree to which the development of cognitive skills has affected vocabulary acquisition is uncertain.

When figs. xviii and xix are compared with figs. xx and xxi it is noticed that the E.P.V.T. reflects a marginal difference at the age of five; the C.V.S. score placing the children of this age slightly above average. At the other end of the age range it is seen that on the E.P.V.T. the fifteen plus children are moving decisively to the norm whereas the C.V.S. reflects a continuing deviation at this age from the norm.

The tests however reflect different aspects of the child's language development; ability in the E.P.V.T. demands comprehension of the spoken stimulus word and visual perception as the choice is made. On the other hand the C.V.S. whilst requiring comprehension of the spoken stimulus word also demands an acceptably oral expression of the meaning of the word. Another important factor in the comparisón of the results on E.P.V.T. and C.V.S. is with respect to the method of scoring; the former which is scored objectively has little room for error, whereas the latter is scored more subjectively with the possibility of an increased margin of error. However, despite the element of subjectivity with respect to the C.V.S., the close correlation between the tests lends support to the view that overall the young spina bifida child's acquisition of vocabulary skills is within normal limits.

Since it appears that there is a falling away thereafter it is clearly important for the teacher to be concerned with the linguistic content surrounding number and mathematical situations. It has been previously discussed in this chapter that when the relative difficulties of the Piagetian tests were examined, the one test which presented most difficulties (Test 8 'Relations between parts and wholes'), was a situation in which the important number element could easily be hidden by its linguistic content. There are certain words, the understanding of which is essential in a mathematical or number vocabulary, which are closely linked with normal development; for example, Donaldson and Balfour (1968) found that most children under five could not differentiate the word 'less' from 'more'. In a later study Donaldson and Wales (1970) also found that children up to this age could not distinguish 'same' from 'different', both terms meaning 'same' to them.

Clark (1971) observed that children of this age also had difficulty in correctly using the antonyms 'before' and 'after', while Chomsky (1969) found that children under eight interpreted 'ask' and 'tell' alike. These confusions are interpreted by Clark (1973) as the result of over-extension that is, "Where over-extension entails that the lexical entry for the meaning of a word in a child's vocabulary is incomplete". (p.101). Clark argues that since learning to attach meanings to words involves interpreting and coding perceptual data, these perceptual features themselves may well belong to the "universal set of semantic primitives"; in other words, the earliest semantic features are derived from perceptual data. This study by Clark, as Hutt et al. (1976) observe illustrates how intimately inter-related are the developmental processes of perception, attention, language and for that matter, cognition. It is of interest to note that in this study there is a substantial correlation between the vocabulary tests and both the tests of visual-perception and visual-motor maturity. The correlation between the C.V.S. and Raven's being $r = 0.76$ $p < .01$, E.P.V.T. and Ravens, $r = 0.73$ $p < .01$, between C.V.S. and Bender-Gestalt $r = -0.74$ $p < .01$, E.P.V.T. and Bender-Gestalt $r = -0.74$ $p < .01$.

In the earlier part of this chapter reference has been made to the type of vocabulary used by the children throughout the number tests. Although many of the responses were ungrammatical or inappropriate the approximate language used was frequently adequate to convey the child's stage of operativity. For example in tests 1a and 1b, the expression "You spreaded them out" or "They're all bunched up", was often used or when being confronted with a conservation situation the interesting comment "There isn't more of anything" was heard. 8g for example, did not say that the two sets were the 'same' preferring to state, "There are more men and more seats". 14g's reply in one test was, "There's the <u>same</u> number but <u>more</u> holes". This eight-year old was using 'same' and 'more' to convey that with respect to the attribute of number both sets were the same but were different when the attribute of shape was concerned. D25g, who was almost twelve years of age, repeatedly used the phrase, 'more of both' to indicate both sets had the same number. There was a reluctance to use mathematical words such as 'circles', even among the older children, 'round', 'rings' or 'wheels' being the words used. Even though it might have been expected in relevent tests that the terms 'radius' or 'diameter' would be used by some children, they in fact were not. It was noted also in Test 4 which dealt with the notion of measurement that although the word measure was frequently used there were few children who not only used the word but proceeded to apply it practically. Words such as jumble up, shuffle up and even scrumble up were used synonymously when the children were asked to equate sets in Test 5A. Words and phrases used in the seriation tests were frequently immature although at times imaginative, for example in reference to the relative sizes of the elements of the set, "One is big, one is little but small", or, "This is a Mummy, this is a girl, that is middlesized, that's a tiny one", or "I'll find the baby first and the giant last."

The words frequently used in the ordination tests and to which reference has been made earlier, although acceptable and understood, form the basis for more refinement in the teaching situation. The word more for example did not present difficulty to most children but the tests showed the necessity to realize that more means something other than adding some more to what is already there, it can also refer to someone having more than someone else when two quantities are compared. As well as big and little the child needs to acquire an extension of vocabulary with which to make more accurate descriptions for example, long, short, tall, wide, fat and thin. The child also needs to acquire words formed from these by reference to comparative and superlative degrees. It is also important that children extend their understanding of words related to size through their experiences in the teaching situation.

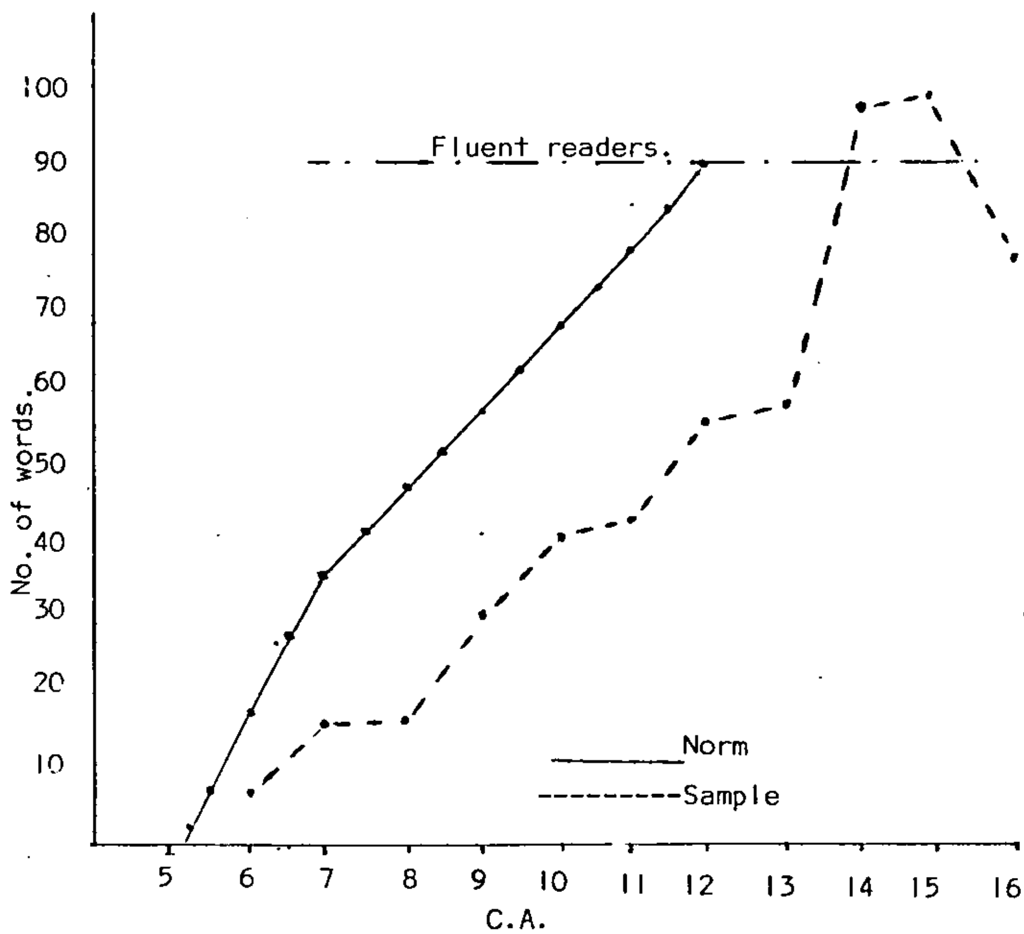
The teacher needs to be extremely sensitive to the child's development in the use of words, and aware of the moment when the individual child is ready to transfer from the type of vocabulary used in this study by some young and even some older children, for example as in Test 9 (Seriation), "Daddy one, Mummy one and baby one" to descriptive words such as biggest, middle one and smallest.

Some children ran out of words to label elements within the series of Test 9, for example, "This is a Mummy, this is a girl, that is middle-sized, that's a tiny one." There is clearly a linguistic difficulty in seriation since any element which is neither the biggest nor the smallest when compared to its adjacent element is either the next biggest or the next smallest, depending upon which way one looks at it. Understandably some tried to resolve this dilemma by using one description from either end to the middle, then using the other as they passed the middle to the other end.

7. The last hypothesis to be tested was that the level of reading attainment of spina bifida children is below normal at each age level. Details of the results of the sample's performance on the Burt Word Reading Test (1974 Revision) are to be found in Appendix C pages 341-345. Figs. (xxii) and (xxiii) below illustrate the sample's performance through the age range when compared to the norms of the raw scores as given in the manual, page 8.

Figure (xxii)

Reading. One-year age groups.



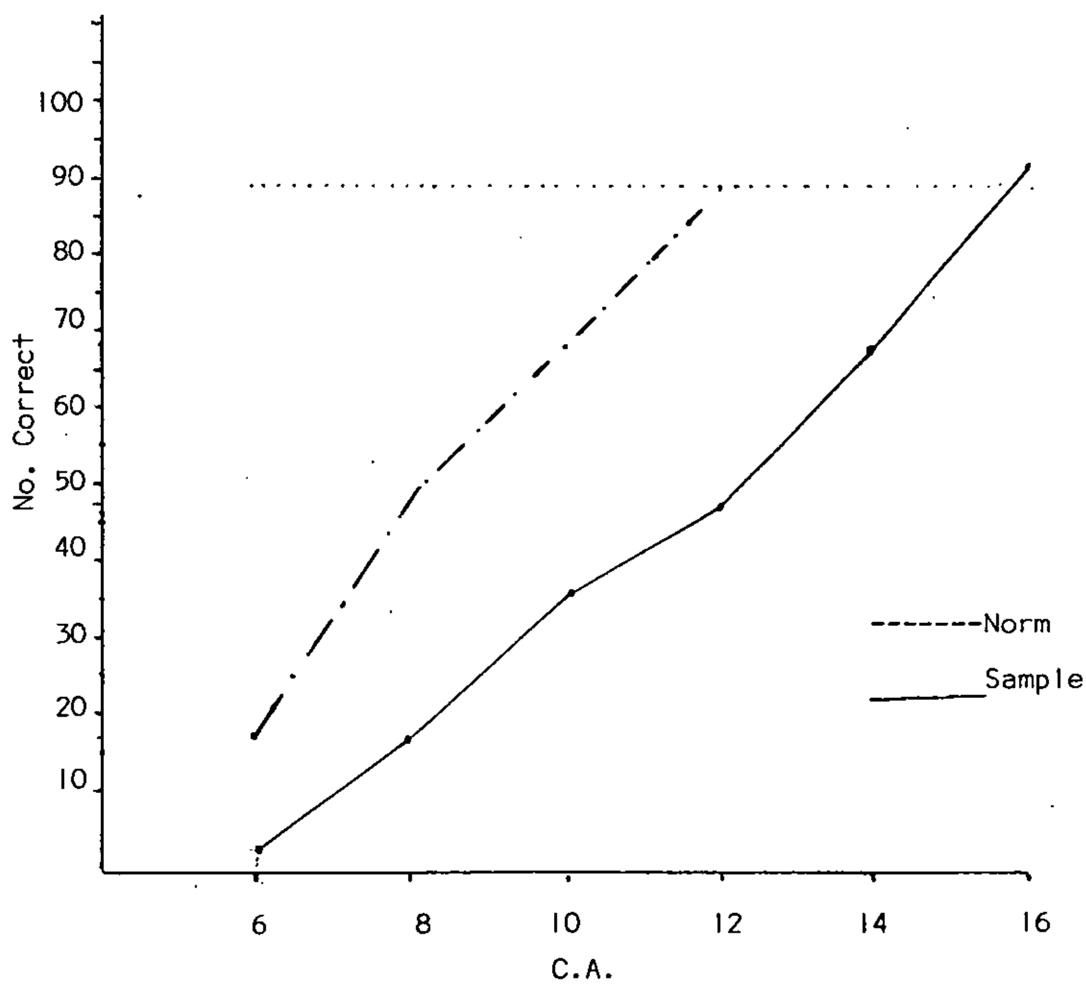
The norms of this particular reading test cover an age range of 6.3 to 12.0 years whereas the norms of the 1954 revision cover an age range of 5.3 to 12.0 years. For the sake of comparison Figure(xxiii) indicates the lengthening of the 1974 range to include the 5.3 to 6.4 year norms as indicated on the 1954 table of norms.

The main reason given for the restricted age range in the 1974 revision is the findings of the testers that at the earlier stages of education, length of time in school has an effect on the level of reading attainment which obscures that of age.

The mean reading age of the sample (C.A. 9.5 years) viewed overall was 6.8 years, reflecting a retardation of 2.7 years. The mean of the boys' reading ages was 7.0 years (C.A. 9.5 years) reflecting an overall reading retardation of 2.5 years, and for the girls 6.5 years (C.A. 9.5 years) reflecting a retardation of 3.0 years.

Figure (xxiii)

Reading. Two-year age groups.



The findings from this study with respect to the reading ability are very much in line with other studies, a good example of which is that by Diller et al. (1969). They found that the spina bifida groups, with and without hydrocephalus were less stable as far as school achievement is concerned as they become older and found evidence to support the notion of 'a partial cumulative lag which affected the children's competence in reading'. Their study reflected a two-year retardation in reading with a noticeable falling away from the norm between the ages of eight and ten years.

When the mean reading ages of the non-shunts (C.A. 9.6 years) and shunts (C.A. 9.5 years) were assessed in this study, it was seen that the former had only a marginally higher reading age than the latter, 6.8 years and 6.7 years respectively.

When the sample was grouped according to school departments as shown in Table 235 of Appendix J, page 453 it was seen that the mean reading age of the secondary children (mean C.A. 14.0 years) was 10.4 years, of the juniors (mean C.A. 10.1 years) 6.8 years. When Tables 234 and 236 which detail the reading performance in one and two-year age groupings were examined, it was seen that there was an average retardation of 3.6 years with respect to the age groups between nine and fourteen years of age. The position with respect to the fifteen and sixteen year olds is not so clear, since it is difficult with the norms cutting off at 12.0 years to relate reading age to chronological age. All that can be said is that this group was reading above the cut-off point.

Fig. (xxiii) shows that had the straight line based upon the norms continued,the performance of the fourteen year olds indicate a narrowing of the deviation. The progress toward fluency is maintained at fifteen years with the graph indicating a falling away at the age of sixteen; this last result being based upon only three children, two of whom were excellent readers and the third who was having great difficulty.

When the results of the thirteen to sixteen year olds overall are examined the picture seems more encouraging. This group (mean C.A. 14.4 years), had a mean raw score of 76.6, s.d. 36.8 which reflects a reading age of 10.9 years. Given that a reading age of 12.0 years represents fluency the retardation is not nearly so pronounced. When the performance of the fourteen to sixteen year old children (mean C.A. 15.3 years) is examined the results show that of the thirteen children concerned only one had serious reading problems, the others being fluent. The mean raw score of this group being 94.4 s.d. 23.9 reflecting a reading age higher than the maximum in the table of norms.

When the performance of all the pupils over the age of nine years is viewed in practical terms as indicated in Table 236 of Appendix J page 454, it is seen that 10.4% were non-readers, 41.8% were in need of remedial help, 17.9% were acceptably good readers, that is, being less than one-year retarded and 29.9% were fluent.

The findings of this study with respect to the reading ability of spina bifida children is in line with the view of Anderson and Spain (1977) who state that although there is a large group which is unlikely to have any serious difficulty there is an equally large group, mostly with shunts, who are likely to be slow in learning to read and who are at risk of falling increasingly behind their peers. For example, when the performance of the over-nines with and without shunts, was compared (Table 237, page 454), it is seen that 63% of the former needed remedial help, 37% were capable readers; 47.6% of the non-shunts needed specific remedial measures and 52.4% were good readers.

Table 201 on page 428 shows that there were significant positive correlations between reading ability and vocabulary tests, visual-motor perceptual tests, Piagetian tests and to a less degree, I.Q. The correlation between the degree of overall handicap as measured on Pultibec and Reading was low ($r=-0.03$ n.s., $r_{-age}=-.016$ n.s.). The correlations between reading and the two vocabulary tests were relatively high reflecting a substantial relationship between these measures (Reading with E.P.V.T. $r=0.76$ $p<.01$, $r_{-age}=0.46$ $p<.01$ and with C.V.S. $r=0.79$ $p<.01$, $r_{-age}=0.52$ $p<.01$).

A similar relationship is also seen between reading and the two perceptual tests (Raven's C.P. Matrices $r = 0.68$ $p<.01$, $r_{-age}=0.34$ $p<.01$ and Bender Gestalt $r=-0.64$ $p<.01$, $r_{-age}=-0.27$ $p<.01$). The correlation between reading and Piagetian tests also reflected a substantial relationship ($r=0.69$ $p<.01$, $r_{-age}=0.37$ $p<.01$).

Although it is not possible on the basis of this study to answer adquately Anderson's important and relevant question, "Which spina bifida children are likely to have reading difficulties or to be 'at risk' in this respect?" (p. 203), some interesting points nevertheless do emerge.

i. Although there were proportionately more children in the shunts group with reading problems than in the non-shunt group, the difference between the means was insignificant ($t=0.403$). Some shunts were fluent readers whereas some non-shunts were experiencing difficulty.

ii. There were consistent and substantial relationships between reading ability and tests of vocabulary, visual-motor perceptual ability, Piagetian tests and I.Q. with respect to the shunt group, these relationships persisting when the age factor was removed (Table 211, Appendix I, page 439).

iii. The relationships between reading ability and tests of vocabulary, visual-motor ability and Piagetian tests were similarly significantly high when the non-shunts were considered but, with the exception of Raven's C.P. Matrices ($r_{-age}=0.35$ $p<.05$), did not persist when the age factor was removed.

iv. The relationship between reading ability and I.Q. was significant when the shunts were considered ($r_{-age}=0.63$, $p<.01$) but insignificant with respect to the non-shunts ($r_{-age}=0.22$)

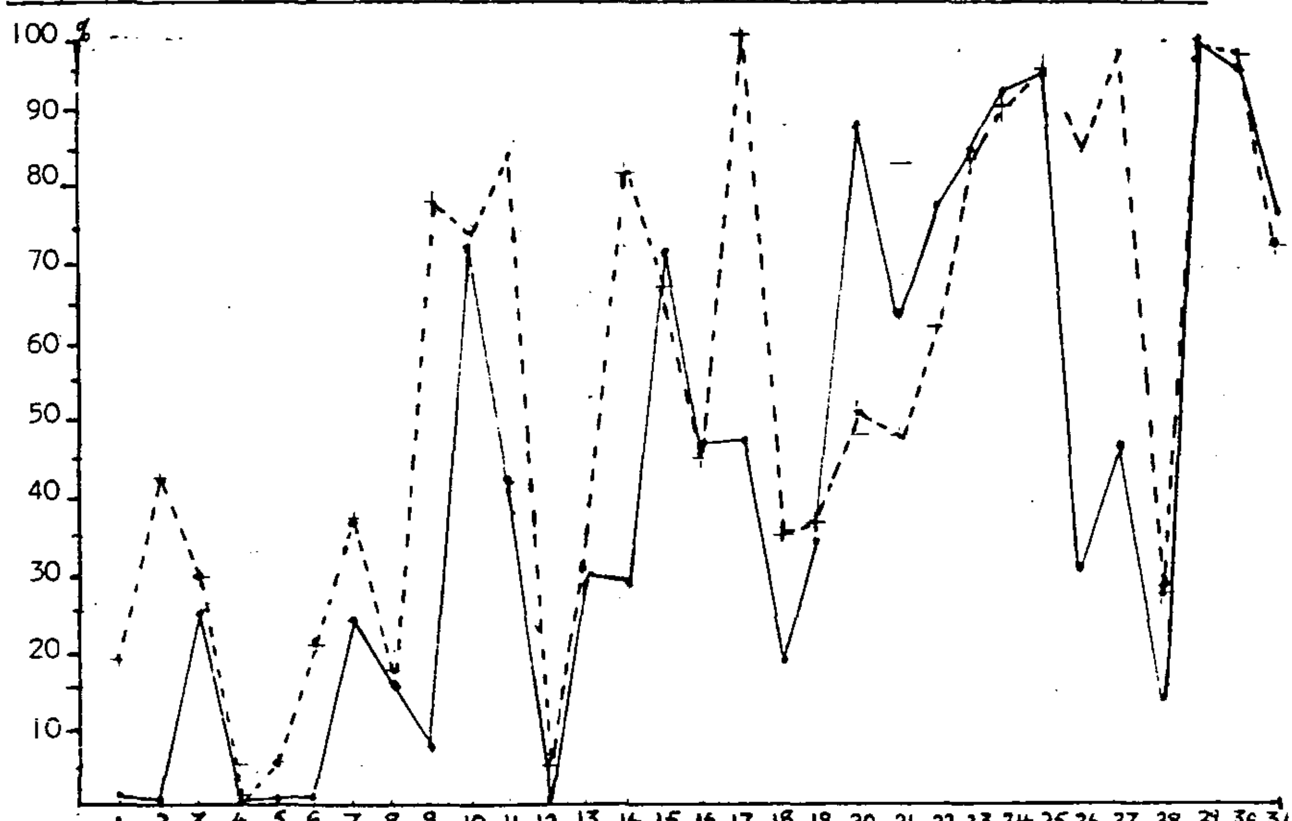
v. The correlations between reading and overall handicap were low with respect to the shunts and non-shunts ($r_{-age}=-0.21$ and -0.03 respectively).

At the conclusion of the three-year period, following on the Piagetian re-testing of School A, a sample comprising thirty-one children across the age range was tested on Young's Group Mathematical Test. If a substantial correlation between the original Piagetian score and the scores obtained on Young's was evident the author felt that the former might indicate a measure of predictive value. The correlation, r=0.73 p <.01 and r_{-age} = 0.58 p <.01, despite the smallness of the sample does give some support to the view that Piagetian tests, sensitively administered, would provide the teacher with useful information as to the particular stage at which the individual child was operating and would assist in curriculum planning and future strategy.

When this sub-sample was looked at in terms of secondary and junior, the former (mean C.A. 11.0 years) reflected a mathematical age of 7.5 years and the latter (mean 9.1. years) a mathematical age of 7.0 years.

Figure (xxiv)

Comparison of Young's Mathematics with three-year earlier Piagetian tests.



Subject No. in ascending age order. No. 1 = youngest.

Key ———— Piagetian Tests. - - - - Young's Mathematics Test.

Fig. (xxiv) on the previous page illustrates that in general the children who had reflected delayed number development in Piagetian terms had also done less well three years later on the standardised mathematics test. There were some interesting exceptions however, such as No. 9 whose Young's score was relatively high despite her immaturity three years previously in Piagetian terms and similarly No. 17 who although completely successful on Young's was 47.2% successful on the Piagetian tests previously.

The writer has summarised his conclusions, made tentative observations, briefly discussed implications for teachers and the community and suggested areas in need of further research in the next chapter.

CHAPTER 9.

Conclusions, Implications and Suggestions for Further Research.

A. Summary of conclusions.

The results of the tests have been analysed and discussed and the following conclusions have been reached.

1. Analysis of the data supports the hypothesis that spina bifida children pass through normal stages in the development of number concepts. There is evidence however that overall these children become operational in Piagetian terms at a later age than non-handicapped children. The average child attains operativity during the early years in the junior school but the children in this study were reaching a comparable level of maturity as they approached secondary-age. Most children of infant age were non-operational, the juniors reflected the transitional stage with a great deal of fluctuation between non-operativity and operativity. The children of secondary age were generally fully operational, although there were exceptions at most age levels. Overall there was a positive, significant and substantial correlation between increase in chronological age and operativity in the Piagetian tests. This movement was particularly evident in the three-year longitudinal study of the children in School A in which the progress toward operativiy was clearly seen.

The responses to the Piagetian test situations to which reference has been made in Chapter 8 were similar in kind to those given by the subjects recorded in Piaget's original work and by children in subsequent studies.

2. A comparison of the shunts' performance with the non-shunts' on the Piagetian tests overall showed the latter to be consistently more successful although not significantly so. When however the performances of the two groups on the fifteen individual Piagetian subtests were compared, significant differences were observed; the non-shunts being significantly

more successful on three, 'Seriation, 'Ordination and Cardination' and 'Relations betwen parts and wholes.'

3. The data indicated a significant, albeit low,negative correlation between operativity in the Piagetian number tests and degree of overall physical handicap as measured on the Pultibec Scale.

4. Although the boys were consistently more successful in both the standardised and Piagetian number tests the difference between the means in each instance was not significant.

5. The sample's performances on the perceptual tests reflected a measure of immaturity. The deviation from normal competence was more pronounced on the Bender Gestalt Visuo Motor Test than on Raven's Coloured Progressive Matrices, suggesting that the motor element in the former test was an important factor in this below-average performance. There was a high correlation between both tests. A significant difference was observed in the shunts' and non-shunts' performances on the Bender Gestalt, the former reflecting greater immaturity.

6. There was evidence in the study that the well-attested progress in the acquisition of vocabulary skills by young spina bifida children did not continue subsequently to the same extent. Performances on the English Picture and Crichton Vocabulary tests showed that despite the five year olds' vocabulary skills being within normal limits there was a marked falling away from this level between the ages of eight and fourteen. There was however a noticeable closing of the gap towards school-leaving age.

7. The results achieved on Burt's Word Reading Test (1974 Revision) indicated reading retardation throughout most of the school age-range. From the age of thirteen however there was a movement towards fluency, the fiteen and sixteen year olds generally being able readers, according to this test's determinants. There was neither a significant difference between the reading competence of the boys and girls nor between the shunts and non-shunts. Significant relationships were found between

reading and vocabulary tests, reading and Piagetian number tests and finally, reading and the perceptual tests. No significant correlation between reading and overall handicap was found.

B. Implications.

1. For the teacher.

The implications of this study for the teacher faced with the problem of teaching the spina bifida child at all ages and levels are both philosophical and practical.

There was evidence that despite considerable retardation in number concept formation and related educational skills which affect mathematical competence, the children had compensated for their considerable handicaps and there were encouraging signs of academic progress by school-leaving age.

Mathematical education, which begins before school and continues right through the age-range, needs to be considered from both the short and long-term points of view with respect to the spina bifida child. The short-term objective would aim to assist the child to feel secure, to be active, curious and confident in the classroom situation. To this end teacher and parental expectancy is clearly significant since it is not unreasonable to suppose that this is an important factor in the acquisition of mathematical skills. There is considerable evidence which substantiates the 'self-fulfilling prophecy' effect of teacher and pupil expectancy influencing school attainment. In this context an able sixteen year old pupil in this present study, discussing the tests with the investigator, remarked that during a previous I.Q. test, he and his parents had been told that spina bifda children were poor at mathematics. When asked if he considered this was so in his case, did not answer the question directly but observed that he might have been much better than he was if he had been able to give more time to the subject.

In the normal run of events most children acquire the basic concepts underlying number by a process of social osmosis, soaking up the ideas that they hear expressed around them in the home and street, playground and park without conscious effort or deliberate, methodical enquiry.

But because the procedure is so haphazard it is not uncommon for a child to miss out on some vital step in the sequence and to arrive at school poorly equipped to meet the challenge of formal mathematics. This is likely to be equally if not more true for the spina bifida child who, by reason of the particular handicap, will have been deprived of many natural learning experiences generally considered to be important factors in cognitive development. Although the extent to which concept formation is affected by physical exploration of the environment is uncertain, it is not unreasonable to suppose that inter-related skills acquired naturally such as those gained in crawling, toddling, walking, balancing, climbing and kicking play an important part in the child's development of spatial orientation, appreciation of distances and exploration of the immediate world around. The delay in concept formation however may be due to other factors, for example neurological impairment caused by the very nature of the condition, or, since having been understandably so well protected the child may have missed out in the cut-and-thrust of the peer group around. Motivation and 'drive' may have been unintentionally subdued and not allowed full expression because of medical care and the absorbing attention of the family. These children often depend heavily upon their parents at home, and other adults when in hospital, to meet their physical needs; to some extent therefore passivity may have been unwittingly encouraged.

In the long-term it is important for the teacher to provide realistic mathematical goals for each child and every effort should be made to ensure that these are attained.

Since the study has shown the likelihood that the spina bifida child entering school has delayed cognitive development which will affect the acquisition of number and other educational skills the teacher will rightly ask, "What can be done to materially help this child?" The following suggestions may be of value.

(i) <u>Exploitation of the environment.</u>

The teacher of the young experientially deprived spina bifida child needs to focus attention on the physical experiences which are considered to be pre-requisites for the development of number concepts. Although the extent to which concept formation can be accelerated by providing such experience is uncertain it seems reasonable to assume that a simulated natural environment is beneficial in laying foundations for later skills. The spina bifida child needs to be exposed to the same kind of activities which are experienced by the normal infant at home, in the street, in the park and in the early days at school. To this end the teacher and supporting staff should initiate and develop activities which will enable the child to gain valuable first-hand experience of movements involving positional change such as backward, forward, up, down, on, out, over and under. The playground, for example, particularly of the 'adventure' type, can provide many of the learning experiences which are part of the normal child's life. The momenta of the swing and the see-saw with their mathematical connotations are examples of physical learning experiences in which with help, the spina bifida child can participate. Movements through tunnels by arm-propulsion, pulling up on climbing frames and ropes are further experiences which may lead to later mathematical understanding. Although the extent to which conceptual development is affected by language or to what extent the former affects the latter is uncertain, it is valuable to use these occasions as vehicles for the encouragement of discussion, questioning and a general exposure to appropriate language related to the activities taking place. One of the advantages of the special school is that help can be elicited from occupational therapists and physiotherapists who possess diagnostic and remedial expertise to help in this important area and who, working as a team, can co-operate with the teacher in maximising a systematic attack on particular difficulties related to the child's educational as well as physical problems.

Imaginative and creative play should be encouraged. It was interesting to observe in the test situations that many of the children expressed a desire to play with the apparatus used. This was particularly noticeable in the situations concerned with the conservation of continuous and discontinuous quantities and notions of measurement. The children thoroughly enjoyed pouring liquids into different shaped and sized containers and making necklaces with the coloured beads. They also enjoyed sharing sweets, counters and buttons as between imaginary companions.

Discussions with the staff concerned confirmed personal observations that on entry into school the young spina bifida child is initially reluctant to participate in what might be termed 'messy' activities such as handling clay, finger painting and papier maché work, a reluctance which happily disappears later on. To what extent this observation reflects the influence of time spent in clinical and hospital situations is uncertain. In view of the great importance attached by many scholars to 'play' in its broadest sense in the development of educational skills, it is necessary for the teacher to provide ample scope for these activities in the early stages of the child's education. The sand and water tray, the Wendy House, cooking, construction sets and also drama, music and rhythm are essential activities which contribute to notions of number.

Play in the first instance needs to be essentially undirected so that the child can manipulate objects with as much freedom as possible leading on to more directed and purposeful activities. The teacher must continue to provide a great number of experiences of varying structures directed toward particular concepts ensuring constantly that they match the individual's conceptual development. A factor which inhibits learning is the failure to present concepts to individual children in the right order. It is necessary for the teacher to recognize that even within one group of spina bifida children there will be a variety of learning difficulties; consequently early identification of those problems which need remedial measures is necessary. With this information at hand it should be possible to select from a variety of materials and techniques, those most appropriate.

It is also important that the child in the classroom situation is encouraged to be as independent and self-reliant as possible so that he can explore the environment of the teaching area for himself. The general atmosphere of the classroom must be that which will extrinsically motivate the child, giving him a sense of adventure and freedom and allowing him the opportunity to develop 'drive'.

The teacher needs to exploit the environment in yet a wider sense so that opportunities for travel and discovery are encouraged. In the main the spina bifida child will not have the opportunities for travel and exploration to the same extent as his normal peer. Visits to museums, zoos, ancient buildings, rivers, mountains and castles provide enriching experience which can stimulate imagination and conversation and upon which valuable academic work can be based. Pursuits such as sailing, canoeing, horse-riding, swimming, archery and other competitive sports are included in the activities of some special schools and the educational environment is consequently enriched.

(ii) Perceptual ability.

The teacher should be fully aware of possible perceptual problems, frequently associated with neurological handicap, which will affect the performance of the spina bifida child. This study supports previous findings that spina bifida children, particularly those with shunts, are perceptually immature, and it is therefore essential that this particular problem area is diagnosed and remedial measures considered. The problem can be either visual or motor or a combination of both and can influence the child's analysis of words, recognition of letters, mathematical symbols, spelling, reading, recognition and drawing of geometrical and other shapes. The child may have great difficulty in finding a particular word on a given page and may easily lose his place. The writer observed in the study that some children for example had anchoring problems in the tests of spontaneous correspondence; there were frequent exclamations such as, "I have lost my place!" or questions such as "Where did I start?" Early use of such a test as the Marianne Frostig Test of Visual Perception enables the teacher to assess a perceptual age for the child and can thus note particular difficulties in the varying areas covered by the programme. Having ascertained what the precise problem is, a remedial programme such as Frostig's or one devised by the teacher can be used. Familiarity with Frostig's work sheets may suggest the kind of activities which could be prepared; making maps, diagrams, scaled drawings, detailed work in nature study and art are examples of activities which will help the child to concentrate, observe detail and to specifically apply himself to tasks which need perceptual and spatial skills.

(iii) Language.

Exposure to appropriate mathematical vocabulary at all stages of conceptual development should be encouraged. Such exposure can take place in a variety of situations. It was observed in the study that frequently the children used approximate language in answering certain questions. Although these replies were sufficiently adequate to convince the writer that the child understood the situation the explanations were nevertheless immature. Appropriate mathematical terms were rarely used; for example, a circle was infrequently referred to as such, words such as round or ring being preferred. It was also interesting to note the spontaneity with which many children affirmed, "We must measure", despite a complete inability to do so. The teacher should be aware of the fine balance which exists between the appropriateness of the language used and the child's cognitive state, and to be sensitive to the issues involved. For example, the word more was frequently used as a synonym for same as in "There are more men and more seats", the child's intention being to convey the thought that there was the same number of men as seats. It is also desirable to develop through activity and discussion the notion that objects may vary in two dimensions simultaneously, that is, they can be tall and fat or short and thin and that these dimensions can be combined to form new categories. Furthermore, the teacher should not assume that the terms he uses are necessarily understood by the child. There was evidence of this during the tests when words like share were not completely understood, the children being content to distribute the elements between the subjects of the test without the notion of equality being applied.

(iv) Reading.

Since later on in school life the development of mathematical skill depends upon reading and comprehension of the printed word the findings in the study of overall reading retardation, despite an encouraging move towards fluency at the latter end of school life, poses another important problem to the teacher of the spina bifida child. It follows that a child who finds difficulty in mastering the symbols necessary for reading is likely also to have problems with those appropriate to mathematics.

Although Piaget does not overtly support any established position with respect to the teaching of reading other than to stress the importance of motivation, his theories nevertheless suggest several considerations which may assist the teacher of the spina bifida child. Reading should be meaningful, in other words it is necessary for the child to have the relevant cognitive structure with which he can relate meaning to a particular word. This implies that the reading materials organized by the teacher, even though this is a time-consuming task, need to be appropriate to each individual child. Implicit in this approach is the notion that spina bifida children, in common with their peers, may be at different levels of readiness.

(v) Curriculum.

Of immediate and understandable concern to the teacher is curriculum content; this is so in every type of school. Discussion relating to core curriculum is of contemporary importance. The range of ability even in a group of spina bifida children in one school can be quite wide and therefore curriculum content which is appropriate for one is totally unsuited to another. Buckhardt (1977) echoes this thought in that the curriculum should be a personal one which develops with the student. He proceeds to remind his readers that core is about the balanced mixture of skills needed to face everyday problems, relating mathematics to the real world.

There are however, general principles which apply to all. While it is outside the remit of this study to outline suitable mathematical curricula for spina bifida children, some practical points have emerged. The most important point is, that by and large, no spina bifida child is unable to learn some concepts and certain mathematical skills; for example in matching, constructing a one-one correspondence, recognizing inequality, sorting and classifying objects into sets. An example of this in the study is an eleven year old very handicapped girl, with an I.Q. of 51, with a shunt and high Pultibec score, who, although not conserving even three years after the initial testing, was nevertheless capable of seriating and did quite well in the classification tests. It would seem in the writer's view, a common mis-conception that mathematics for the spina bifida child is a futile and disappointing occupation. This may be true if the wrong topics are chosen, if the approach is too formalistic or if the child's maturity is not considered. Given the many rightful demands made upon the child's time in the special school, it is most important to delineate which mathematical skills are considered necessary for the child and then to structure educational programmes consistent with his developing cognitive state. There is a wealth of literature available which outlines approaches to mathematics adopted in primary schools, many of the suggested ideas having been inspired by Piagetian theory. An example of such books are those published by the Nuffield Mathematics Project in the late sixties and early seventies, which with their emphasis upon activity and discovery, are good examples of an approach which would be of value to many spina bifida children.

Traditionally the secondary stage is viewed as a time during which children begin to follow subject disciplines and are increasingly expected, if not always able, to manifest abstract reasoning and critical thinking. The study shows that some spina bifida children, fully operational in Piagetian terms, are ready for this level of academic work. Some of these will benefit by a normal mathematical curriculum which will prepare them for external examinations such as C.S.E. Several children in the study have recently passed this examination and others are currently studying for it. As far as the remainder is concerned, as for below average children in normal secondary schools, there is less agreement about curriculum content. One obvious priority is to continue the process of acquiring basic numeracy skills as part of a programme aimed at social competence and independence, culminating in an intensive effort to prepare them for post-school demands. Elementary mathematical attainments of a practical nature such as time-keeping, reading and preparing graphs, comparison of sizes, use of measures and coping with money and allowances are examples of skills which will assist spina bifida children even those who, by reason of the severity of handicap will never be gainfully employed, to be socially competent.

2. Implications for the community.

Although the following observations are not directly relevant to the study, the development of mathematical skills has a bearing upon the degree to which these young people can become integrated in a wider community. During the next decade a sizeable group of surviving spina bifida children will have passed through school and joined adult society. This number based upon Newman's (1978) estimation to the author, of the current school spina bifida population, is likely to be in excess of three thousand. Clearly society has a responsiblility to ensure that these handicapped young people who have compensated so well for their disabilities are given the opportunity to fulfil their potential. Many of these have undergone 'heroic surgery' (Lorber's words, 1975) to correct gross deformities. Repeated fractures and dislocated hip joints have necessitated frequent absences from school.

Given therefore these obvious hindrances to sustained academic study and the extent of their handicap, it is not surprising that many spina bifida pupils are still educationally retarded by the time they leave school and may not possess the mathematical skills considered to be commensurate with social competence. It is therefore particularly desirable that opportunities are provided by the community for further education for many of these pupils.

In an experiment to integrate handicapped pupils into a local College of Further Education on one day a week, the writer has observed a marked spurt of academic and social interest which possibly has been the outcome of mixing with the normal students. The range of subject choices has permitted pupils to assess personal interests, discover new ones and find satisfaction in areas of learning previously unrealized.

Active consideration must be given to means whereby the spina bifida student's lack of mobility can be alleviated. A student in a wheel-chair may be scarcely handicapped at all in the educational setting if the building is suitable. If however the student finds himself in a building which has two or three floors, narrow corridors and no lift, then his handicap becomes a major disability.

Although it would be unrealistic to expect all the children in this sample to find gainful employment there is nevertheless a sizeable number who could be considered. Such young people need to be given every opportunity to fulfill their potential and to this end, further education, the problems of transport and the suitability of buildings need to be considered by a caring community.

It does not require a great deal of imagination to see in the changing pattern of industry both a threat to the marginally employable and also a challenge. The innovations of modern technology such as silicon chips, computers and calculators may contribute towards a more optimistic employment future for many.

There will be those, who by reason of their extreme physical handicap can only gainfully work from home, and then there will be those who are severely mentally retarded as well as physically handicapped that they will need community care. To be meaningful the quality of this care should reflect the standard of stimulation and incentive that the young person will have encountered during his school years.

It will be apparent that the implications for teacher and community which the writer has discussed are by no means exhaustive or independent of each other. The implications are intended as a framework for practical considerations related to the mathematical education of spina bifida children. How far the issues discussed will prove to be relevant to the questions in which the writer is interested is a matter that experience and future research must decide.

C. Tentative observations.

It is inevitable in any study connected with handicapped children that the person involved will become interested in broader issues arising out of the investigation; the present writer is no exception.

Although the following observations do not arise as a logical consequence to this particular study, they are, in the writer's view complementary to the broader implications concerned with the education of spina bifida children. The writer therefore concludes :-

Since the early diagnosis of learning problems is vital, there is an urgent need for nursery provision for the handicapped.

The present trend towards integration,as envisaged in the Warnock Report, is likely to be beneficial to the spina bifida child and enlightening to the non-handicapped.

The degree of physical impairment is not exclusively related to the level of adjustment achieved. In fact, the writer was surprised to observe how relatively successful even the most handicapped children with shunts were. Severity of physical handicap, although a significant factor is not the primary determinant in the level of adaptation attained by spina bifida children, rather social and emotional factors are crucial in the child's development.

Movement to a secondary-stage of education where the emphasis tends to be more on subject matter than on the child himself, might profitably be delayed until around thirteen years of age.

There is a high incidence of marital instability associated with the parents of spina bifida children. This is another hazard for the child since acceptance of and adaptation to the handicap by parents, culminating in a sense of security, are important factors in the child's adjustment. Constant community support is vital.

Incontinence is the great handicap. Concerted effort is needed by parents and others to focus attention on this problem assisting the child towards self-management.

Close liaison between home, school, paediatric assessment unit and para-medical services is essential. This co-operation across the disciplines can provide a maximum and systematic attack on the difficulties of the pupil. This indicates a more complex design of internal organization and a broadening of the approach to include not only specific remedial measures but the provision of realistic and appropriate goals.

The overall impression gained by the writer in both the study and his experience is that spina bifida children with and without shunts fully justify a positive, discriminatory and aggressive educational and social policy in their favour.

D. Suggestions for further research.

Finally, the study has raised certain questions which require further investigation.

(i) An investigation into the visual preferences of children as they relate to number would be valuable. It is recognized that preferences for colour, size and shape change with age; at what stage of development does number, where involved, assume priority over other attributes?

(ii) Since Piaget's stage of Formal Operations is reached by able children between 11 and 14, by average children at around 14, and later, if at all, by the less able, what is the position with respect to the spina bifida teen-ager? And as a corollary to this question; to what extent should teachers in a secondary school use methods appropriate to children who may be, and may continue to be for some time, at the stage of concrete operations?

(iii) A considerable number of spina bifida young people have left school, and more will be doing so in the near future. It would be of practical value to ascertain how they are coping with the mathematical demands of real-life situations.

(iv) In view of the motor-visual and spatial problems of spina bifida children further study along Piagetian lines would be valuable, for example :-

(a) Conservation of weight, length, and volume.

(b) Stationary and mobile perspectives.

(c) Spatial co-ordinates.

(d) Euclidian and topological views of space.

It is hoped that this study with its implications and tentative observations will contribute to a more accurate assessment of the spina bifida child and in some way assist towards a full realization of his potential.

GLOSSARY.

Aetiology	The science of the cause of disease.
Anal-sphincter mechanism	Ring shaped muscle, contraction of which closes the natural orifice of the anus.
Anencephaly	A condition thought to be related to spina bifida in which the bones of the skull fail to fuse and the underlying brain tissue is very abnormal.
Arnold-Chiari malformation	An abnormality commonly found in association with spina bifida in which the structures of the lower brain stem and the cerebellum herniate or protrude downwards through the foramen magnum.
Atrophy	Wasting of any part of the body, due to degeneration of the cells from disuse, lack of nourishment or of nerve supply.
Brain-stem	A part of the brain near its base which helps to control life-supporting functions such as breathing and through which nerve impulses from the body and sensory receptors pass before being processed by the cerebral lobes.
Catheter	A fine hollow tube for removing or inserting fluid into a body cavity or organ.
Caudal-end	The end of the bundle of sacral and lumbar nerves with which the spinal cord terminates.
Cerebro-spinal fluid	A clear fluid being produced continually within the ventricles of the brain. After circulating around the brain and spinal cord it is reabsorbed into the blood stream. Its function is to protect the brain and spinal cord from external shocks by providing it with an aqueous cushion, and to help remove waste products from the brain.
Coccygeal	Pertaining to or located in the region of the coccyx, that is the caudal extremity of the vertebral column.
Congenital	Applied to conditions existing at or before birth.
Dysraphism	A collective term describing malformations affecting the mid-line tissues at the lower back.

Encephalocele	A condition similar to, but much less common than spina bifida, where the abnormality is at the back of the skull rather than in the spine. It is also called cranium bifidum.
Familial	Affecting several members of one family.
Foramen-magnum	A hole in the base of the skull through which nerves of the spinal column ascend and descend from the brain.
Hydrocephalus	A condition where too much cerebral-spinal fuid is being produced relative to the system's ability to reabsorb it into the blood stream. It occurs frequently with myelomeningocele and less often with meningocele.
Hydronephrosis	A collection of urine in the pelvis or the kidney, resulting in atrophy of the kidney structure, due to the constant pressure of the fluid, until finally the whole organ becomes one large cyst.
Lesion	An injury, wound or morbid structural change in an organ.
Lumbar	Pertaining to the loins.
Meninges	A name given to the membranes covering the brain and the spinal cord which protect and enclose it, and which carry, among other things, the blood supply for the nervous tissue.
Meningocele	A protrusion of the meninges through the skull or spinal column appearing as a cyst filled with cerebro-spinal fluid.
Meningomyelocele	A protrusion of the spinal cord and meninges through a defect in the vertebral column.
Myelocele	Synonymous with meningomyelocele.
Myelomeningocele	Synonymous with meningomyelocele.
Neural-tube defect	A term used to cover both spina bifida and a few other rare related defects.
Polygenic	A genetic factor which operates through the action of a number of different genes acting cumulatively rather than through only one or two genes.
Posterior	Placed at the back.

Pudenz-Heyer	The name of a type of valve used.
Rachischisis	Spina bifida in its extreme form in which the whole vertebral column is affected.
Sacral	Relating to the sacrum which is a tri-angular bone composed of five united vertebrae, situated between the lowest lumbar vertebra and the coccyx.
Shunt	A device to control hydrocephalus. It consists of a thin plastic tube, one end of which is placed in one of the cavities within the brain where the cerebro-spinal fluid is formed. This is called the proximal catheter down which the fluid flows into a uni-directional valve mechanism through which the excess fluid is reabsorbed into the blood stream.
Sinus	A cavity in the bone.
Spina bifida cystica	A term covering both meningocele and myelomeningocele where the meninges protrude through the 'bifid' (split) spina column forming a sac or cyst filled with cerebro-spinal fluid.
Spina bifida occulta	A condition where the bones of the spine (vertebrae) are split or 'bifid' at some point but all the other underlying structures are quite normal. There may be no external change visible and the defect may be unknown or it may be marked by a hairy patch of skin or some mark on the skin.
Spina bifida	A defect in development of the vertebral column. The condition often affects several vertebrae, and is most common in the lumbar region.
Valve	Strictly that part of the shunt system which controls the direction and rate of flow of cerebro-spinal fluid. It is also commonly used as synonymous with 'shunt'.
Ventricles	Cavities within the brain around which the nerve tissue is folded and which secrete cerebro-spinal fluid.

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APPENDIX A.

General data with respect to sample.

The following details which were taken from medical files give examples of the degree of handicap of the children in the sample. Although due to different medical administrative arrangements in each of the local authorities it was not possible to have access to all the relevant medical data, nevertheless discussion with the medical and paramedical staff indicated that the details given below present a fair picture of the degree of handicap throughout the sample.

School A.

1b Spina bifida - meningomyelocele with multiple skeletal abnormalities- apparent scoliosis - restricted neck movements - Perthe's disease closure operation in both hips in infancy - born 1961. Closure of lesion 1963. I.Q. 87.

2b Spina bifida - myelomeningocele with hydrocephalus - extensive surgery to left hip - blind in one eye - born Valve fitted 10.4.67 - ilea loop ureterostomy - below average I.Q.

3b Spina bifida - meningomyelocele - below knee calipers. Educational psychologist's report - below average. Medical Officer's report - 10 to 15 points above average.

4b Spina bifida - meningocele with hydrocephalus - below knee calipers and elbow crutches - meningocele closed on first day - Spitz-Holter valve not fitted - average I.Q.

5b Spina bifida.

6b Spina bifida - myelomeningocele - hydrocephalic - back repaired on first day of life - valve fitted at three months - paraplegic limited left hand function - slight defect in hearing - low average I.Q.

7b Spina bifida - moderate hydrocephalus not requiring a valve - low average I.Q. assessed by educational psychologist - average I.Q. as assessed by medical officer.

8b Spina bifida - meningocele - dislocated right hip - bilateral talipes - operated upon at three to four weeks.

9b Spina bifida - meningocele - hydrocephalus -valve fitted at twenty months - paraplegic - epilepsy - above average I.Q. as assessed by medical officer. I.Q. 70 by educational psychologist.

10b Spina bifida - meningomyelocele - bilateral talipes - paralysis of left leg - congenital dislocated hip - average I.Q.

11b Spina bifida - meningomyelocele, repaired during first twenty-four hours - arrested hydrocephalus -wears glasses to compensate a squint - average I.Q.

12b Spina bifida - meningomyelocele - hydrocephalus - average I.Q.

13b Spina bifida - meningomyelocele, operated on first day - valve fitted at four months to arrest developing hydrocephalus. good average I.Q.

14b Spina bifida - meningomyelocele, repaired at birth - strabismus - good average I.Q.

15b Spina bifida - meningomyelocele, repaired at birth - hydrocephalus, valve fitted in infancy but later removed - below average I.Q.

16b Spina bifida - meningomyelocele, repaired at four months - hydrocephalus with Spitz Holter valve - deformed ankle bones.

1g Spina bifida - meningomyelocele - gross kyphosis - hydrocephalus - bilateral ileal loops - completely flaccid legs - below average I.Q.

2g Spina bifida - meningomyelocele - hydrocephalus with valve - has a squint - below average I.Q.

3g Spina bifida - meningomyelocele - below average I.Q.

4g Spina bifida - meningomyelocele repaired in second week - post-lateral talipes - deformity of right foot - tendency to bilateral convergent squint - complete paralysis of both legs - below average I.Q.

5g Spina bifida - meningomyelocele repaired in second week - post-lateral talipes - deformity of right foot - tendency to bilateral convergent squint - complete paralysis of both legs - below average I.Q.

6g Spina bifida, closed at twelve months - low average I.Q.

7g Spina bifida - meningomyelocele - hydrocephalus, valve fitted but changed after one year - E.S.N. range of ability.

8g Spina bifida - meningomyelocele which was treated three hours after birth - hydrocephalus with valve fitted after six weeks - visual loss - below average I.Q.

9g Spina bifida - meningomyelocele which was closed within first twenty-four hours - hydrocephalus with Spitz-Holter valve fitted - epileptic - low average I.Q.

10g Spina bifida - meningomyelocele - hydrocephalus with Spitz-Holter valve fitted - epileptic - low average I.Q.

11g Spina bifida - myelomeningocele - hydrocephalic with valve - low average I.Q.

12g Spina bifida - myelomeningocele - severe hydrocephalus with Spitz-Holter valve which had been changed five times - below average I.Q.

Table 73

Classification of physical disability.

School A

No.	1	2	3	4
1				X
2	X			
3				X
4		X		
5		X		
6				X
7			X	
8	X			
9			X	
10		X		
11		X		
12		X		
13	X			
14		X		
15			X	
16		X		
17		X		
18	X			
19		X		
20				X
21		X		
22		X		
23		X		
24				X
25				X
26				X
27				X
28				X

School B

No.	1	2	3	4
1				X
2			X	
3		X		
4				X
5				X
6				X
7				X
8		X		
9				X
10				X
11				X
12				X
13		X		
14		X		
15				X
16				X
17				X
18				X
19				X
20		X		
21				X
22				X
23	X			
24			X	
25				X
26				X
27	X			

School C

No.	1	2	3	4
1	X			
2				X
3		X		
4			X	
5		X		
6			X	
7	X			
8			X	
9			X	
10	X			
11				X
12		X		
13	X			
14	X			
15			X	
16		X		
17			X	
18			X	
19		X		
20			X	
21			X	
22		X		
23	X			
24		X		
25	X			
26		X		
27		X		
28			X	
29		X		

School D

No.	1	2	3	4
1				X
2		X		
3				X
4		X		
5		X		
6				X
7				X
8				X
9				X
10				X
11				X
12		X		
13				X
14		X		
15		X		
16			X	
17			X	
18				X
19				X
20		X		
21		X		
22		X		
23		X		
24		X		
25		X		
26				X
27		X		
28				X
29			X	
30				X
31		X		
32	X			
33			X	
34			X	
35				X
36		X		
37		X		
38	X			
39			X	
40			X	
41			X	
42			X	
43		X		
44				X
45				X
46			X	

1 = Minimal
2 = Moderate
3 = Severe
4 = Very severe

Table 74

Chronological age of sample.

School A.

Subject No.	C.A.
1	15.5
2	12.8
3	12.2
4	11.6
5	11.4
6	11.3
7	10.1
8	9.8
9	9.0
10	9.0
11	8.9
12	8.5
13	8.0
14	8.0
15	7.8
16	7.8
17	7.8
18	7.5
19	7.4
20	6.8
21	6.7
22	6.2
23	6.1
24	5.5
25	5.2
26	5.2
27	5.0
28	5.0
Mean	8.4
s.d.	2.6

School B.

Subject No.	C.A.
1	14.9
2	13.5
3	13.4
4	12.9
5	11.7
6	11.6
7	10.7
8	10.0
9	9.9
10	9.8
11	9.1
12	9.0
13	9.0
14	8.8
15	7.9
16	7.5
17	7.2
18	6.9
19	6.9
20	6.8
21	6.8
22	6.0
23	5.8
24	5.7
25	5.6
26	5.4
27	5.2
Mean	8.8
s.d.	2.8

School C.

Subject No.	C.A.
1	13.7
2	12.7
3	11.5
4	11.5
5	11.4
6	11.2
7	9.4
8	8.7
9	8.6
10	8.4
11	7.8
12	7.7
13	7.2
14	7.0
15	7.0
16	6.7
17	6.6
18	6.6
19	6.6
20	5.9
21	5.9
22	5.5
23	5.3
24	5.2
25	5.2
26	5.0
27	5.0
28	5.0
29	5.0
Mean	7.7
s.d.	2.6

School D.

Subject No.	C.A.
1	16.0
2	16.0
3	16.0
4	15.8
5	15.5
6	15.4
7	15.1
8	15.0
9	14.9
10	14.6
11	14.1
12	13.8
13	13.8
14	13.8
15	13.5
16	13.3
17	13.4
18	13.2
19	13.1
20	13.1
21	12.6
22	12.5
23	12.5
24	11.9
25	11.8
26	11.7
27	11.3
28	11.0
29	10.9
30	10.7
31	10.7
32	10.3
33	10.3
34	10.2
35	10.1
36	9.7
37	9.6
38	8.9
39	8.5
40	7.3
41	6.9
42	6.7
43	6.7
44	6.0
45	5.8
46	5.3
Mean	11.7
s.d.	3.0

Table 75

Chronological age by schools. Boys.

School A.

Subject No.	C.A. yrs.
1	12.8
2	12.2
3	11.6
4	11.4
5	10.1
6	9.0
7	8.5
8	7.8
9	7.5
10	7.4
11	6.8
12	6.7
13	6.2
14	6.1
15	5.2
16	5.0
Mean	8.4
s.d.	2.5

School B.

Subject No.	C.A. yrs.
1	14.9
2	13.5
3	13.4
4	11.7
5	10.7
6	9.9
7	9.0
8	8.8
9	7.2
10	6.9
11	6.8
12	5.7
13	5.6
14	5.4
15	5.2
Mean	8.9
s.d.	3.2

School C.

Subject No.	C.A. yrs.
1	11.5
2	11.5
3	11.4
4	7.8
5	7.7
6	7.0
7	6.7
8	6.6
9	6.6
10	5.9
11	5.2
12	5.1
Mean	7.7
s.d.	2.4

School D.

Subject No.	C.A. yrs.
1	16.5
2	16.0
3	15.8
4	15.5
5	14.9
6	13.8
7	13.8
8	13.3
9	13.2
10	13.1
11	12.6
12	11.9
13	11.3
14	10.3
15	10.3
16	10.2
17	8.9
18	8.5
19	6.9
20	6.0
21	5.4
Mean	9.5
s.d.	3.3

Table 76

Chronological age by schools. Girls.

School A.

1	15.5
2	11.3
3	9.8
4	9.0
5	8.9
6	8.0
7	8.0
8	7.8
9	7.8
10	5.5
11	5.2
12	5.0
Mean	8.5
s.d.	2.9

School B.

1	12.9
2	11.6
3	10.0
4	9.8
5	9.1
6	9.0
7	7.9
8	7.5
9	6.9
10	6.8
11	6.0
12	5.8
Mean	8.6
s.d.	2.2

School C.

1	13.7
2	15.7
3	11.2
4	9.4
5	8.7
6	8.6
7	8.4
8	7.2
9	7.0
10	6.6
11	5.9
12	5.5
13	5.3
14	5.2
15	5.1
16	5.0
17	5.0
Mean	7.7
s.d.	2.8

School D.

1	16.0
2	15.4
3	15.1
4	15.0
5	14.6
6	14.1
7	13.8
8	13.5
9	13.4
10	13.1
11	12.5
12	12.5
13	11.8
14	11.7
15	11.0
16	10.9
17	10.7
18	10.7
19	10.1
20	9.7
21	9.6
22	7.3
23	6.7
24	6.7
25	5.8
m.	11.7
s.d	2.9

Table 77

Chronological ages of whole sample.

Subject No.	C.A. yrs.	Subject No.	C.A. yrs.	Subject No.	C.A. yrs.	Subject No.	C.A. yrs.
1	16.0	34	11.8	67	9.0	100	6.7
2	16.0	35	11.7	68	8.9	101	6.7
3	16.0	36	11.7	69	8.9	102	6.6
4	15.8	37	11.6	70	8.8	103	6.6
5	15.5	38	11.6	71	8.7	104	6.6
6	15.5	39	11.5	72	8.6	105	6.2
7	15.4	40	11.4	73	8.5	106	6.1
8	15.1	41	11.4	74	8.5	107	6.0
9	15.0	42	11.4	75	8.4	108	6.0
10	14.9	43	11.3	76	8.0	109	5.9
11	14.9	44	11.3	77	8.0	110	5.9
12	14.6	45	11.2	78	7.9	111	5.8
13	14.1	46	11.0	79	7.8	112	5.8
14	13.8	47	10.9	80	7.8	113	5.7
15	13.8	48	10.7	81	7.8	114	5.6
16	13.8	49	10.7	82	7.8	115	5.5
17	13.7	50	10.7	83	7.7	116	5.5
18	13.5	51	10.3	84	7.5	117	5.3
19	13.5	52	10.3	85	7.5	118	5.3
20	13.4	53	10.2	86	7.4	119	5.3
21	13.4	54	10.1	87	7.3	120	5.2
22	13.3	55	10.1	88	7.2	121	5.2
23	13.2	56	10.0	89	7.2	122	5.2
24	13.1	57	9.9	90	7.0	123	5.2
25	13.1	58	9.8	91	7.0	124	5.2
26	12.9	59	9.8	92	6.9	125	5.1
27	12.8	60	9.7	93	6.9	126	5.1
28	12.7	61	9.6	94	6.9	127	5.0
29	12.6	62	9.4	95	6.8	128	5.0
30	12.5	63	9.1	96	6.8	129	5.0
31	12.5	64	9.0	97	6.8	130	5.0
32	12.2	65	9.0	98	6.7		
33	11.9	66	9.0	99	6.7		

Mean = 9.5 years; s.d. 3.2 Range 5.0 to 16.0 years.

Table 78

Chronological Ages of whole sample (Boys).

Subject No.	C.A. (yrs.)	Subject No.	C.A. (yrs.)	Subject No.	C.A. (yrs.)	Subject No.	C.A. (yrs.)
1	16.0	17	11.9	33	8.9	49	6.7
2	16.0	18	11.7	34	8.8	50	6.6
3	15.8	19	11.6	35	8.5	51	6.6
4	15.5	20	11.5	36	8.5	52	6.2
5	14.9	21	11.4	37	7.8	53	6.1
6	14.9	22	11.4	38	7.8	54	6.0
7	13.8	23	11.4	39	7.7	55	5.9
8	13.8	24	11.3	40	7.5	56	5.7
9	13.5	25	10.7	41	7.4	57	5.6
10	13.4	26	10.3	42	7.2	58	5.4
11	13.3	27	10.3	43	7.0	59	5.4
12	13.2	28	10.2	44	6.9	60	5.2
13	13.1	29	10.1	45	6.9	61	5.2
14	12.8	30	9.9	46	6.8	62	5.2
15	12.6	31	9.0	47	6.8	63	5.1
16	12.2	32	9.0	48	6.7	64	5.0

Mean = 9.5 years, s.d., 3.3 years. Range 5.0 - 16.0 years.

Table 79

Chronological Ages of whole sample (Girls).

1	16.0	18	11.7	35	9.0	52	6.7
2	15.5	19	11.6	36	8.9	53	6.6
3	15.4	20	11.3	37	8.7	54	6.0
4	15.1	21	11.2	38	8.6	55	5.9
5	15.0	22	11.0	39	8.4	56	5.8
6	14.6	23	10.9	40	8.0	57	5.8
7	14.1	24	10.7	41	8.0	58	5.5
8	13.8	25	10.7	42	7.9	59	5.5
9	13.7	26	10.1	43	7.8	60	5.3
10	13.5	27	10.0	44	7.8	61	5.2
11	13.4	28	9.8	45	7.5	62	5.2
12	13.1	29	9.8	46	7.3	63	5.1
13	12.9	30	9.7	47	7.2	64	5.0
14	12.7	31	9.6	48	7.0	65	5.0
15	12.5	32	9.4	49	6.9	66	5.0
16	12.5	33	9.1	50	6.8		
17	11.8	34	9.0	51	6.7		

Mean = 9.5 years, s.d., 3.2 years. Range 5.0 - 16.0 years.

Table 80

Chronological ages - Groups according to shunt.

Without shunt.				With shunt.			
No.	Boys	No.	Girls	No.	Boys	No.	Girls
1	16.0	1	15.5	1	15.8	1	16.0
2	16.0	2	15.4	2	14.9	2	15.0
3	15.5	3	15.1	3	14.9	3	14.6
4	13.5	4	14.1	4	13.8	4	13.8
5	13.4	5	13.7	5	13.8	5	13.5
6	12.8	6	9.8	6	13.4	6	13.4
7	12.6	7	9.4	7	13.2	7	13.1
8	11.6	8	9.0	8	13.1	8	12.9
9	10.1	9	9.0	9	12.2	9	12.7
10	9.0	10	8.9	10	11.9	10	12.5
11	8.9	11	8.0	11	11.7	11	12.5
12	8.8	12	7.0	12	11.5	12	11.8
13	8.5	13	6.7	13	11.5	13	11.7
14	7.8	14	6.0	14	11.4	14	11.6
15	7.4	15	5.5	15	11.4	15	11.3
16	6.8	16	5.0	16	11.3	16	11.2
17	6.8			17	10.7	17	11.0
18	6.7			18	10.3	18	10.9
19	6.6			19	10.3	19	10.7
20	6.1			20	10.2	20	10.7
21	5.3			21	9.9	21	10.1
22	5.2			22	9.0	22	10.0
23	5.2			23	8.5	23	9.8
24	5.0			24	7.8	24	9.7
				25	7.7	25	9.6
				26	7.5	26	9.1
				27	7.2	27	8.7
				28	7.0	28	8.6
				29	6.9	29	8.4
				30	6.9	30	8.0
				31	6.7	31	7.9
				32	6.6	32	7.8
				33	6.2	33	7.8
				34	6.0	34	7.5
				35	5.9	35	7.3
				36	5.7	36	7.2
				37	5.6	37	6.9
				38	5.3	38	6.8
				39	5.0	39	6.7
				40	5.0	40	6.6
						41	5.9
						42	5.8
						43	5.8
						44	5.5
						45	5.3
						46	5.2
						47	5.2
						48	5.0
						49	5.0
						50	5.0
Mean =	8.7	Mean =	9.9	Mean =	9.6	Mean =	9.4
s.d. =	3.8	s.d. =	3.7	s.d. =	3.2	s.d. =	3.1

Table 81

Year of birth.

Year	School	Boys A	Boys B	Boys C	Boys D	Boys Total	Girls A	Girls B	Girls C	Girls D	Girls Total	Whole sample.
1959		0	0	0	0	0	1	0	0	0	1	1
1960		0	1	0	3	4	0	0	0	1	1	5
1961		1	2	0	2	5	0	0	0	3	3	8
1962		2	0	0	2	4	0	1	2	3	6	10
1963		1	1	0	3	5	1	1	0	3	5	10
1964		1	1	3	2	7	1	0	1	2	4	11
1965		2	1	0	1	4	2	2	0	4	8	12
1966		3	2	0	3	8	4	2	2	3	11	19
1967		2	1	2	1	6	0	2	2	2	6	12
1968		2	2	2	1	7	1	2	2	0	5	12
1969		2	2	3	1	8	2	2	2	1	7	15
1970		0	2	2	1	5	0	0	6	3	9	14
1971		0	0	0	1	1	0	0	0	0	0	1
Total		16	15	12	21	64	12	12	17	25	66	130

Table 82

Chronological ages
Number of children in each age group by schools.

Age group	School A Boys	School A Girls	School A Total	School B Boys	School B Girls	School B Total
5.0- 5.9	2	3	5	4	1	5
6.0- 6.9	4	0	4	2	3	5
7.0- 7.9	3	2	5	1	2	3
8.0- 8.9	1	3	4	1	0	1
9.0- 9.9	1	2	3	2	3	5
10.0-10.9	1	0	1	1	1	2
11.0-11.9	2	1	3	1	1	2
12.0-12.9	2	0	2	0	1	1
13.0-13.9	0	0	0	2	0	2
14.0-14.9	0	0	0	1	0	1
15.0-15.9	0	1	1	0	0	0
16.0-16.9	0	0	0	0	0	0
	16	12	28	15	12	27

Table 82 continued.

Age group	School C Boys	School C Girls	School C Total	School D Boys	School D Girls	School D Total
5.0- 5.9	3	7	10	1	1	2
6.0- 6.9	3	1	4	2	2	4
7.0- 7.9	3	2	5	0	1	1
8.0- 8.9	0	3	3	2	0	2
9.0- 9.9	0	1	1	0	2	2
10.0-10.9	0	0	0	3	4	7
11.0-11.9	3	1	4	2	3	5
12.0-12.9	0	1	1	1	2	3
13.0-13.9	0	1	1	5	4	9
14.0-14.9	0	0	0	1	2	3
15.0-15.9	0	0	0	2	3	5
16.0-16.9	0	0	0	2	1	3
	12	17	29	21	25	46

Table 83

Chronological ages.
Number of children in each age group - whole sample.

Age Group	Boys	Girls	All
5.0- 5.9	10	12	22
6.0- 6.9	11	6	17
7.0- 7.9	7	7	14
8.0- 8.9	4	6	10
9.0- 9.9	3	8	11
10.0-10.9	5	5	10
11.0-11.9	8	6	14
12.0-12.9	3	4	7
13.0-13.9	7	5	12
14.0-14.9	2	2	4
15.0.15.9	2	4	6
16.0-16.9	2	1	3
	64	66	130

Table 84

Chronological age. School Department.

Dept.	n.	m. C.A.	s.d.
Infants	53	6.3	0.9
Juniors	45	10.1	1.2
Secondary	32	14.0	1.2

Table 85

Intelligence - Means and standard deviations (By schools).

School A.

Subject	I.Q.
1	74
2	96
3	71
4	80
5	97
6	51
7	82
8	75
9	88
10	88
11	80
12	93
13	87
14	64
15	79
16	71
17	75
18	70
19	90
20	99
21	92
22	110
23	110
24	90
25	69
26	92
27	78
28	75

Mean = 83.1
s.d. = 13.4

School B.

Subject	I.Q.
1	78
2	63
3	73
4	63
5	53
6	58
7	53
8	93
9	53
10	48
11	78
12	78
13	80
14	80
15	78
16	48
17	53
18	53
19	80
20	78
21	70
22	53
23	94
24	95
25	105
26	72
27	70

Mean = 70.4
s.d. = 15.8

School C.

Subject	I.Q.
1	110
2	85
3	97
4	89
5	90
6	71
7	92
8	70
9	74
10	63
11	81
12	78
13	104
14	112
15	88
16	80
17	80
18	56
19	89
20	80
21	99
22	85
23	100
24	84
25	100
26	101
27	96
28	80
29	115

Mean = 87.9
s.d. = 14.2

School D.

Subject	I.Q.
1	79
2	132
3	84
4	79
5	110
6	56
7	90
8	83
9	83
10	82
11	86
12	83
13	64
14	67
15	61
16	100
17	109
18	88
19	47
20	86
21	83
22	80
23	62
24	93
25	78
26	87
27	77
28	77
29	80
30	59
31	86
32	70
33	58
34	82
35	91
36	85
37	102
38	79
39	80
40	69
41	75
42	100
43	66
44	64
45	87
46	46

Mean = 80.1
d.f. = 16.4

Table 86

Intelligence - whole sample (Boys)

Subject	I.Q.	Subject	I.Q.	Subject	I.Q.	Subject	I.Q.
1.	132	17	93	33	79	49	80
2	84	18	53	34	80	50	89
3	79	19	80	35	80	51	56
4	110	20	83	36	93	52	110
5	83	21	89	37	81	53	110
6	78	22	90	38	75	54	64
7	83	23	97	39	78	55	80
8	67	24	77	40	70	56	105
9	63	25	53	41	90	57	72
10	73	26	70	42	53	58	115
11	109	27	58	43	88	59	53
12	88	28	82	44	85	60	69
13	47	29	82	45	80	61	70
14	96	30	53	46	99	62	100
15	83	31	88	47	78	63	101
16	71	32	78	48	92	64	75

Mean = 81.6
s.d. = 16.9

Table 87

Intelligence - whole sample (Girls)

Subject	I.Q.	Subject	I.Q.	Subject	I.Q.	Subject	I.Q.
1	79	18	87	35	88	52	66
2	74	19	58	36	80	53	78
3	56	20	51	37	70	54	94
4	90	21	71	38	74	55	99
5	83	22	77	39	63	56	87
6	82	23	80	40	87	57	95
7	86	24	59	41	64	58	90
8	64	25	86	42	78	59	85
9	110	26	91	43	79	60	100
10	61	27	93	44	71	61	92
11	100	28	75	45	48	62	84
12	86	29	48	46	69	63	96
13	63	30	85	47	93	64	80
14	85	31	102	48	112	65	78
15	80	32	92	49	53	66	115
16	62	33	78	50	70		
17	78	34	78	51	100		

Mean = 80.1
s.d. = 15.2

Table 88

Intelligence (whole sample).

Subject	I.Q.	Subject	I.Q.	Subject	I.Q.	Subject	I.Q.	Subject	I.Q.
1	79	27	96	53	82	79	79	105	110
2	132	28	85	54	82	80	81	106	110
3	84	29	83	55	91	81	71	107	64
4	79	30	80	56	93	82	75	108	53
5	110	31	62	57	53	83	78	109	80
6	74	32	71	58	75	84	48	110	99
7	56	33	93	59	48	85	70	111	87
8	90	34	78	60	85	86	90	112	94
9	83	35	87	61	102	87	69	113	95
10	83	36	53	62	92	88	93	114	105
11	78	37	58	63	78	89	53	115	90
12	82	38	80	64	78	90	112	116	85
13	86	39	83	65	88	91	88	117	115
14	83	40	89	66	88	92	53	118	100
15	64	41	90	67	80	93	85	119	72
16	67	42	97	68	79	94	80	120	69
17	110	43	77	69	80	95	99	121	92
18	61	44	51	70	80	96	78	122	70
19	63	45	71	71	70	97	70	123	84
20	73	46	77	72	74	98	100	124	100
21	100	47	80	73	80	99	66	125	101
22	109	48	53	74	93	100	92	126	96
23	88	49	59	75	63	101	80	127	80
24	47	50	86	76	87	102	78	128	78
25	86	51	70	77	64	103	56	129	75
26	63	52	58	78	78	104	89	130	115

Mean = 80.9
s.d. = 16.0 Range = 47 - 132

Table 89

Intelligence.

Without shunt.

Subject	I.Q.	Subject	I.Q.
2	132	69	80
3	84	70	80
5	110	74	93
6	74	76	87
7	56	82	75
8	90	86	90
13	86	90	112
17	110	95	99
19	63	96	78
20	73	99	66
27	96	100	92
29	83	104	89
38	80	106	110
54	82	108	94
58	75	116	85
62	92	117	115
64	80	122	70
66	88	124	100
67	78	125	101
68	79	126	96

With shunt.

Subject	I.Q.	Subject	I.Q.	Subject	I.Q.
1	79	44	51	87	69
4	79	45	71	88	93
9	83	46	77	89	53
10	83	47	80	91	88
11	78	48	53	92	53
12	82	49	59	93	75
14	83	50	86	94	80
15	64	51	70	97	70
16	67	52	58	98	100
18	61	53	82	101	80
21	100	55	91	102	78
22	109	56	93	103	56
23	88	57	53	105	110
24	47	59	48	107	64
25	86	60	85	109	80
26	63	61	102	110	99
28	85	63	78	111	87
30	80	65	88	112	95
31	62	71	70	113	105
32	71	72	74	114	72
33	93	73	80	115	90
34	78	75	63	118	100
35	87	77	64	119	53
36	53	78	78	120	69
37	58	79	79	121	92
39	83	80	81	123	84
40	89	81	71	127	80
41	90	83	78	128	78
42	97	84	48	129	75
43	77	85	70	130	115

Without shunt:

Range = 56 - 132

Mean = 88.1

s.d. = 15.4

With shunt:

Range = 47 - 115

Mean = 77.7

s.d. = 15.3

Table 90

Intelligence.

	I.Q.	Boys	Girls	Total	Percentage
Between	40-49	1	2	3	2.3
	50-59	7	5	12	9.2
	60-69	4	8	12	9.2
	70-79	16	15	31	23.8
	80-89	19	18	37	28.5
	90-99	8	11	19	14.6
	100-109	4	4	8	6.2
	110-119	4	3	7	5.4
	120-129	0	0	0	0
	130-139	1	0	1	0.8
		64	66	130	

Table 91

Intelligence (by schools)

	School A			School B			School C			School D		
	B	G	T	B	G	T	B	G	T	B	G	T
40- 49	0	0	0	0	2	2	0	0	0	1	0	1
50- 59	0	1	1	5	2	7	1	0	1	1	2	3
60- 69	1	1	2	1	1	2	0	1	1	2	5	7
70- 79	4	5	9	6	3	9	1	4	5	5	3	8
80- 89	3	3	6	2	1	3	7	4	11	7	10	17
90- 99	6	2	8	0	3	3	1	4	5	1	2	3
100-109	0	0	0	1	0	1	2	1	3	1	3	4
110-119	2	0	2	0	0	0	0	3	3	2	0	2
120-129	0	0	0	0	0	0	0	0	0	0	0	0
130-139	0	0	0	0	0	0	0	0	0	1	0	1
	16	12	28	15	12	27	12	17	29	21	25	46

CODE FOR PULTIBEC RATINGS.

P = Physical

U = Upper limbs

L = Lower limbs

T = Toilet

I = Intelligence

B = Behaviour

E = Eyes

C = Communication, hearing and speech

R = Right

L = Left

R.H = Right hand

R.A = Right arm

L.H = Left hand

L.A = Left arm

H.S = Hearing and speech

Table 92

Pultibec Scale. Summary of means and standard deviations.

	A		B		C		D	
	m.	s.d.	m.	s.d.	m.	s.d.	m.	s.d.
Boys	31.5	8.4	33.9	5.2	31.3	7.0	33.3	6.3
Girls	33.4	6.4	33.4	8.1	30.8	6.9	35.6	5.3
All	32.4	7.4	33.7	6.5	30.3	6.8	34.5	5.8

Table 93

Pultibec Scale. Means and standard deviations. Shunts and non-shunts.

	Without shunt		With shunt	
	m.	s.d.	m.	s.d.
Boys	30.1	5.6	34.0	7.0
Girls	29.1	6.8	34.6	6.2
All	29.7	6.0	34.3	6.5

Table 94

Pultibec Scale. Whole sample.

Boys		Girls		All	
m.	s.d.	m.	s.d.	m.	s.d.
32.6	6.7	33.2	6.7	32.9	6.7

Table 95

Pultibec Scale. School departments.

	Infants		Junior		Secondary	
	m.	s.d.	m.	s.d.	m.	s.d.
Boys	32.8	7.6	31.6	5.4	33.5	6.8
Girls	32.4	6.9	32.3	6.5	36.0	6.6
All	32.6	7.3	31.9	5.9	34.7	6.7

Table 96

Pultibec Scale. Means of scores.

	P	U					L	T	I	B	E		C	
School		R.H.	R.A.	L.H.	L.A.	R.	L.				R.	L.	H.	S.
A	81	41	43.5	41.5	44	114	116	120	84	70	51	46	28	29
B	91	35	35	37	37	136	136	86	97	79	43	41	42	41
C	65	52.5	45.5	49.5	45.5	101	101	118	87	72	38	38	31	29
D	136	80	66	74	62	225	225	58	143	125	102	107	46	46
	373	208.5	190	202	88.5	576	578	482	411	346	234	232	147	145
m.	2.9	1.6	1.5	1.6	1.4	4.4	4.5	3.7	3.2	2.7	1.8	1.8	1.1	1.1

Table 97

Pultibec Ratings. School A.

No.	P	U				L		T	I	B	E		C		Total
		RH	RA	LH	LA	R	L				R	L	H	S	
1	3	1	1	1	1	6	6	5	4	3	2	2	1	1	37
2	2	1	1	1	1	2	2	4	3	2	4	4	1	1	29
3	4	2	2	2	2	6	6	5	4	3	6	1	1	1	45
4	3	1	1	1	1	4	4	4	3	2	1	1	1	1	28
5	3	1	1	1	1	4	4	4	2	1	1	1	1	1	26
6	3	2	2	2	2	6	6	4	4	3	3	3	1	1	42
7	3	2	2	2	2	4	4	4	4	3	1	1	1	1	34
8	2	1	1	1	1	3	3	5	3	3	1	1	1	1	27
9	3	2	2	4	4	4	4	5	3	2	1	1	1	1	37
10	2	1	1	1	1	3	3	2	3	2	1	1	1	1	23
11	3	1.5	1.5	1.5	1.5	3	3	5	3	3	1	1	1	1	30
12	2	1	1	1	1	3	3	4	3	2	1	1	1	1	25
13	2	1	1	1	1	2	2	6	3	3	1	1	1	1	26
14	3	3	3	2	2	3	3	4	2	3	3	3	1	1	36
15	3	1	1	1	1	5	5	2	4	3	3	3	1	1	34
16	3	1.5	1.5	1.5	1.5	6	6	6	2	3	1	1	1	1	36
17	2	1	1	1	1	3	2	3	2	2	1	1	1	1	22
18	3	1	1	1	1	2	2	1	3	3	1	1	1	1	22
19	3	1	1	1	1	2	4	4	2	2	1	1	1	1	25
20	4	2	3.5	2	3.5	6	6	6	3	3	3	3	1	2	48
21	3	2	2	1.5	1.5	3	3	4	3	2	1	1	1	1	29
22	3	1	1	1	1	3	3	1	2	2	1	1	1	1	22
23	3	1.5	2	1.5	2	4	5	2	2	2	3	3	1	1	33
24	3	1.5	1.5	1.5	1.5	5	5	6	3	3	3	3	1	1	39
25	3	1	1	1	1	5	5	6	4	4	1	1	1	1	35
26	4	2	2.5	2	2.5	6	6	6	3	2	1	1	1	1	40
27	3	2	2	2	2	5	5	6	3	2	1	1	1	1	36
28	3	2	2	2	2	6	6	6	4	2	3	3	1	1	43

Table 98

Pultibec Ratings. School B.

No.	P	U				L		T		B	E		C		Total
		RH	RA	LH	LA	R.	L				R.	L	H.	S	
1	4	1	1	1	1	6	6	3	3	2	2	2	1	1	34
2	3	1	1	1	1	4	4	3	4	2	2	2	1	1	30
3	3	1	1	1	1	4	4	3	4	3	2	2	1	1	31
4	4	1	1	1	1	4	4	3	4	2	1	1	1	1	29
5	4	2	2	2	2	5	5	2	4	3	1	1	2	1	36
6	4	1	1	1	1	4	4	3	4	3	1	1	1	1	30
7	4	1	1	3	3	5	5	3	4	4	2	2	1	2	40
8	3	1	1	1	1	3	3	3	3	3	1	1	1	1	26
9	4	1	1	1	1	6	6	4	4	4	2	2	1	2	39
10	4	5	5	3	3	6	6	3	5	4	2	2	2	1	51
11	3	1	1	1	1	6	6	3	3	2	1	1	1	1	31
12	4	1	1	1	1	5	5	2	3	3	1	1	1	1	30
13	3	1	1	1	1	3	3	4	3	3	2	2	1	1	29
14	2	1	1	1	1	4	4	4	3	2	1	1	1	1	27
15	3	1	1	1	1	6	6	3	3	3	1	1	1	1	32
16	4	3	3	3	3	6	6	3	5	4	2	2	1	1	46
17	3	1	1	1	1	6	6	4	4	3	2	2	1	1	36
18	4	1	1	1	1	6	6	4	4	4	3	2	1	1	39
19	3	1	1	1	1	6	6	4	3	3	1	1	1	1	33
20	3	1	1	1	1	6	6	3	3	3	1	1	1	1	32
21	3	1	1	1	1	6	6	4	4	3	1	1	1	1	34
22	4	2	2	4	4	6	6	3	4	4	3	3	1	1	47
23	1	1	1	1	1	4	4	2	3	2	1	1	1	1	24
24	3	1	1	1	1	4	4	3	3	3	2	2	1	1	30
25	3	1	1	1	1	6	6	4	2	2	1	1	1	1	31
26	4	1	1	1	1	6	6	4	4	2	1	1	1	1	34
27	3	1	1	1	1	3	3	2	4	3	2	2	1	1	28

Table 99

Pultibec Ratings. School C.

No.	P	U				L	T	I	B	E	C	Total
		RH	RA	LH	LA	R.L				R.L	H.S	
1	2	1	1	1	1	2 2	3	2	1	1 1	1 1	20
2	2	2	1	1	1	6 6	6	3	3	1 1	3 1	36
3	3	1	1	1	1	3 3	5	3	2	1 1	1 1	27
4	3	1	1	1	1	3 3	5	3	2	1 1	1 1	27
5	2	1	1	1	1	3 3	2	3	2	1 1	1 1	23
6	2	3	2	3	2	4 4	6	4	3	1 1	1 1	37
7	2	2	2	2	2	2 2	3	3	2	1 1	1 1	26
8	3	2	2	2	2	4 4	4	4	2	1 1	1 1	34
9	3	2	2	2	2	4 4	6	4	2	1 1	1 1	35
10	2	2	1	2	1	2 2	2	4	3	1 1	1 1	25
11	2	1	1	1	1	5 5	5	3	3	1 2	1 1	32
12	2	1	1	1	1	2 2	2	3	3	3 1	1 1	24
13	2	1	1	1	1	2 2	1	3	2	1 1	1 1	20
14	2	1	1	1	1	2 2	3	3	3	2 3	1 1	26
15	2	3	3	3	3	5 5	5	3	3	1 1	1 1	39
16	2	1	1	1	1	3 3	2	3	3	1 1	1 1	24
17	2	3	2	3	2	4 4	6	2	3	1 1	1 1	35
18	4	4	3	4	3	5 5	5	4	4	1 1	1 1	34
19	3	2	2	2	2	4 4	5	3	3	1 1	1 1	34
20	2	3	2	3	2	4 4	5	3	3	3 3	1 1	39
21	2	2	2	2	2	4 4	6	3	3	1 1	1 1	34
22	2	2	1	1	1	3 3	3	3	3	3 3	1 1	30
23	2	1	1	1	1	3 3	3	3	2	1 1	1 1	24
24	2	2	2	2	2	3 3	3	2	4	3 3	1 1	33
25	2	2.5	2.5	2.5	2.5	3 3	5	2	4	1 1	1 1	33
26	2	1	1	1	1	5 5	5	2	2	1 1	1 1	29
27	1	1	1	1	1	3 3	3	3	3	1 1	1 1	24
28	3	3	3	3	3	5 5	6	4	3	1 1	1 1	42
29	2	1	1	1	1	3 3	3	2	2	1 1	1 1	23

Table 100

Pultibec Ratings. School D.

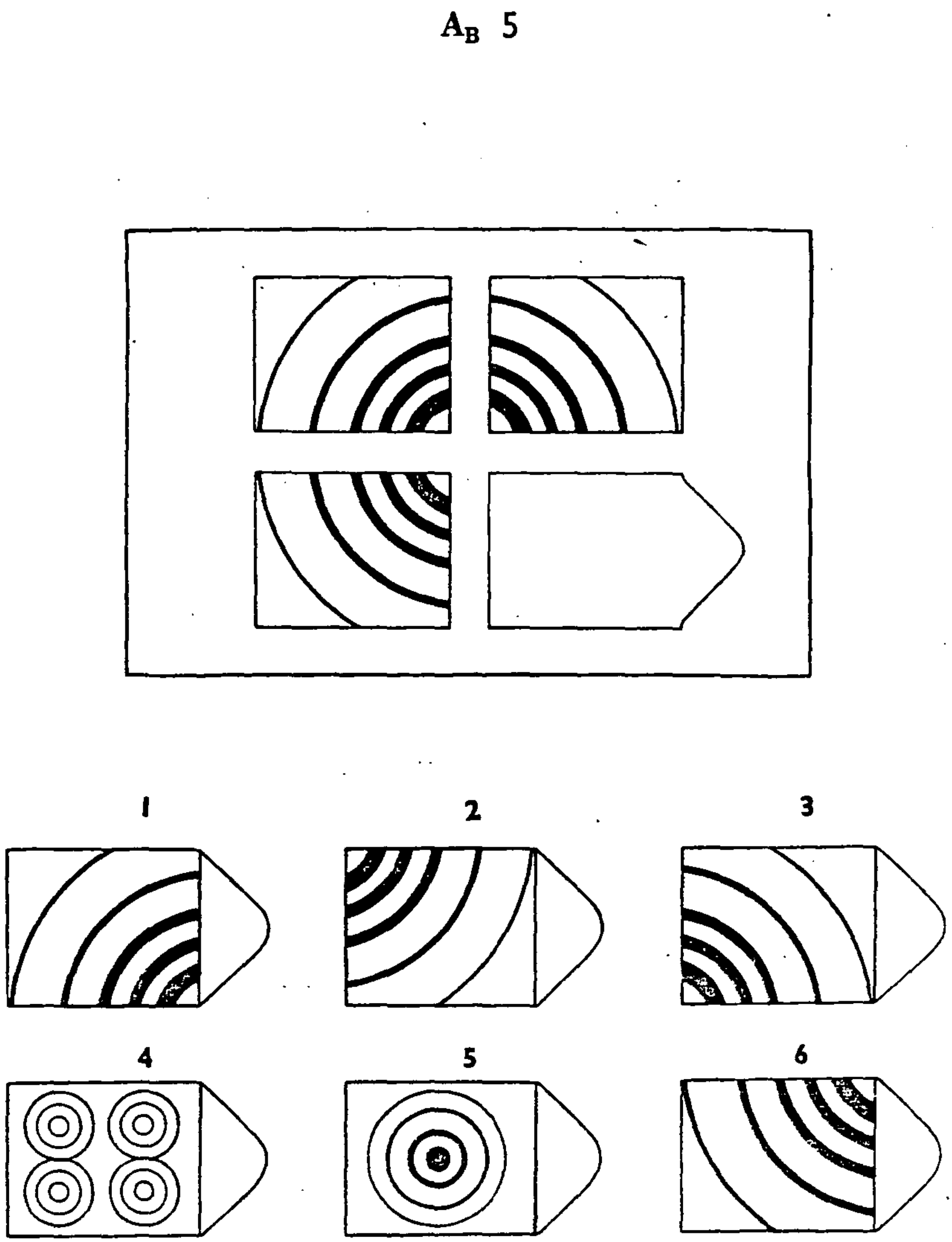
No.	P	U				L		T	I	B	E		C		Total
		RH	RA	LH	LA	R.	L				R.	L	H.	S	
1	2	2	2	2	2	6	6.	3	3	3	1	1	1	1	35
2	2	2	1	2	1	4	4	2	1	1	1	1	1	1	24
3	3	2	1	2	1	6	6	4	3	3	4	4	1	1	41
4	2	1	1	1	1	3	3	2	3	2	2	2	1	1	25
5	3	1	1	1	1	3	3	2	2	1	2	2	1	1	24
6	2	3	2	3	2	6	6	2	4	3	3	4	1	1	42
7	2	1	1	1	1	6	6	2	3	3.	3	3	1	1	34
8	3	2	2	2	2	6	6	3	3	2	3	3	1	1	39
9	4	2	2	2	2	6	6	3	3	2.	4	4	1	1	42
10	4	3	3	3	3	6	6	4	3	2	3	3	1	1	45
11	5	3	3	2	2	6	6	4	3	3	2	2	1	1	43
12	3	3	2	1	1	6	6	3	3	2	2	2	1	1	36
13	4	2	1	2	1	6	6	3	4	1	1	1	1	1	34
14	3	1	1	1	1	5	5	4	4	2	2	2	1	1	33
15	4	4	3	3	2	3	3	3	4	4	3	3	1	1	41
16	4	1	1	1	1	6	6	4	2	3	1	1	1	1	33
17	3	1	1	1	1	6	6	3	2	3	1	1	1	1	31
18	4	1	1	1	1	6	6	4	3	3	3	3	1	1	40
19	3	2	2	2	2	6	6	3	5	3	3	3	1	1	42
20	4	3	3	3	3	4	4	3	3	2	3	3	1	1	40
21	3	1	1	1	1	3	3	4	3	3	2,	2	1	1	29
22	3	1	1	1	1	3	3	4	3	3	1	1	1	1	27
23	3	3	2	3	2	4	4	4	4	2	4	4	1	1	41
24	3	2	1	2	1	4	4	2	3	3	3	3	1	1	33
25	3	1	1	1	1	6	6	3	3	3	3	4	1	1	37
26	4	1	1	1	1	6	6	3	3	3	2	2	1	1	35
27	4	1	1	1	1	6	6	4	3	3	2	3	1	1	37
28	3	1	1	1	1	6	6	3	3	2	1	1	1	1	31
29	3	1	1	1	1	6	6	3	3	3	2	2	1	1	34
30	4	2	1	2	1	6	6	4	4	2	4	4	1	1	42
31	4	1	1	1	1	4	4	3	3	3	1	1	1	1	29
32	3	1	1	1	1	3	3	3	4	3	1	1	1	1	27
33	4	3	2	3	2	4	4	4	4	3	2	2	1	1	39
34	4	2	2	2	2	4	4	3	3	2	4	4	1	1	38
35	4	2	1	2	1	5	5	5	3	3	2	2	1	1	37
36	3	3	2	1	1	4	4	3	3	3	1	1	1	1	31
37	3	1	1	1	1	3	3	4	2	3	3	3	1	1	30
38	3	1	1	1	1	3	3	4	3	3	3	3	1	1	31
39	3	1	1	1	1	3	3	5	3	4	3	3	1	1	33
40	3	2	1	2	1	5	5	3	4	3	1	1	1	1	33
41	2	1	1	1	1	6	6	5	3	4	1	1	1	1	34
42	2	1	1	1	1	4	4	5	2	3	1	1	1	1	28
43	2	2	1	2	1	4	4	5	4	4	2	2	1	1	35
44	4	2	2	2	2	6	6	4	4	4	2	2	1	1	42
45	3	2	2	2	2	6	6	4	3	3	3	3	1	1	41
46	2	1	1	1	1	5	5	3	2	2	1	1	1	1	27

APPENDIX B.

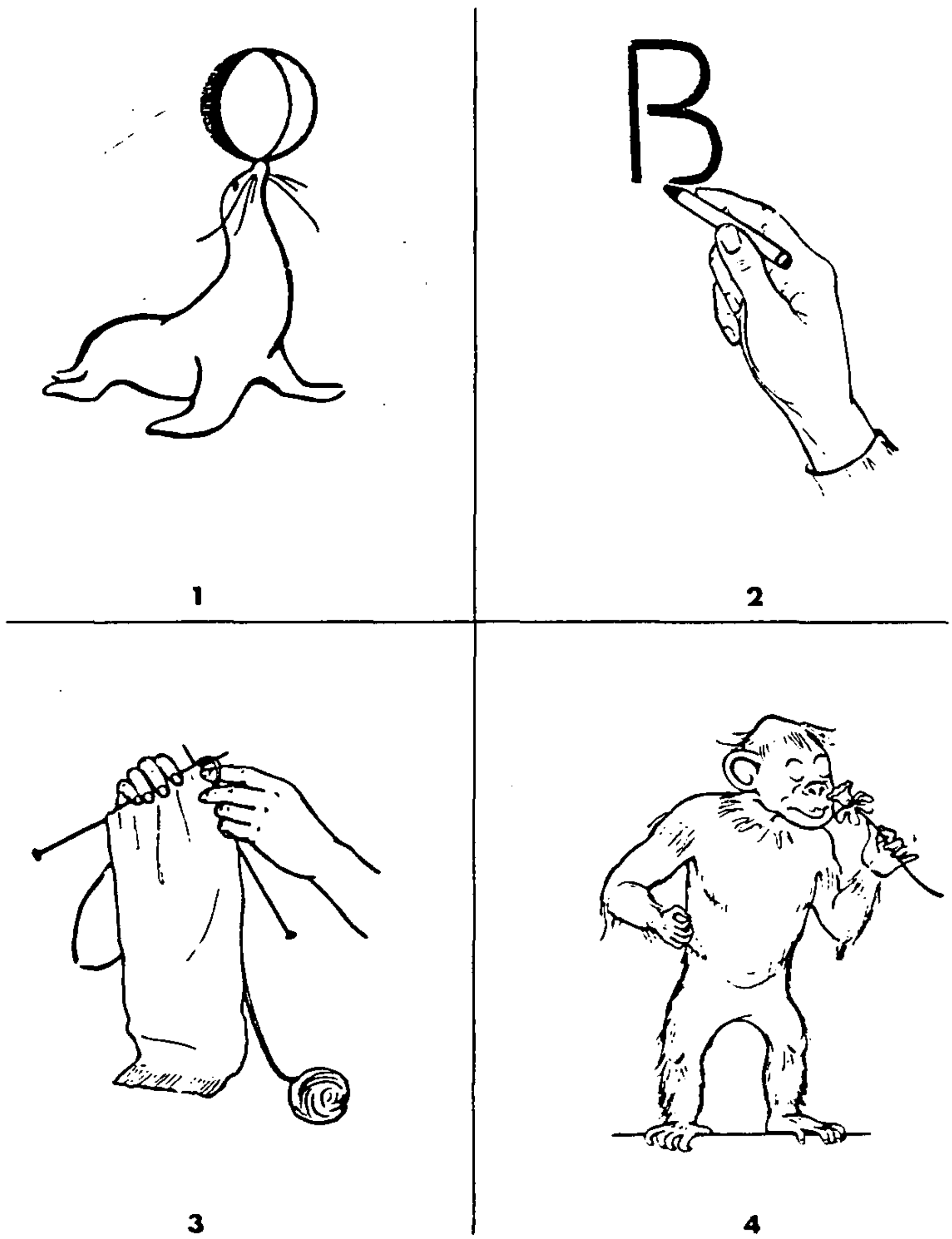
Visual illustrations of all tests.

Contents: Page

Example from Raven's Coloured Progressive Matrices.



Example from English Picture Vocabulary Scale



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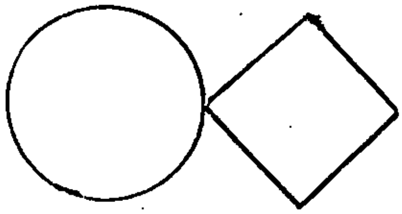
Crichton Vocabulary Scale.

Set 1.

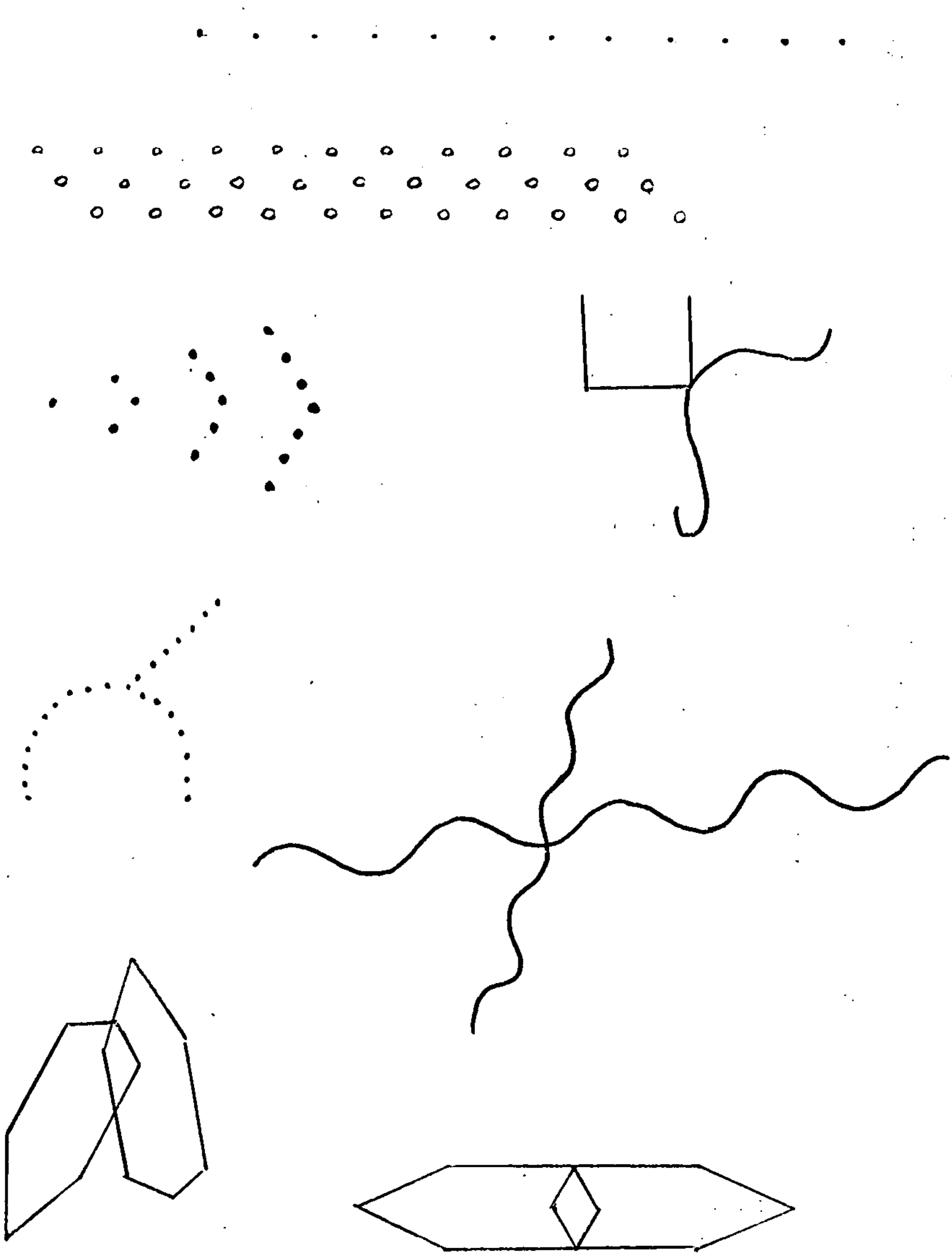
1.	Cap	21.	startle
2.	tomato	22.	connect
3.	frock	23.	stubborn
4.	rest	24.	provide
5.	patch	25.	squabble
6.	damp	26.	shrivel
7.	loaf	27.	malaria
8.	cruel	28.	schóoner
9.	afraid	29.	resemblance
10.	blaze	30.	brag
11.	near	31.	anonymous
12.	battle	32.	liberty
13.	rage	33.	mingle
14.	disturb	34.	fascinated
15.	unhappy	35.	courteous
16.	perfume	36.	prosper
17.	ache	37.	elevate
18.	view	38.	thrive
19.	receive	39.	precise
20.	continue	40.	verify

Set 2.

1.	bed	21.	cargo
2.	garden	22.	effort
3.	dog	23.	slender
4.	house	24.	vacant
	hurry	25.	triumph
6.	parcel	26.	applaud
7.	lock	27.	progress
8.	warm	28.	select
9.	funny	29.	reveal
10.	small	30.	chasm
11	thief	31.	tornado
12.	search	32.	fatigue
13.	sob	33.	interpret
14.	vanish	34.	reluctant
15.	echo	35.	arduous
16.	rescue	36.	variable
17.	entrance	37.	subdue
18.	dawn	38.	irksome
19.	reply	39.	chastise
20.	release	40.	inevitable



Bender Gestalt Figures.



to	is	up	he	at
for	my	sun	one	of
big	some	his	or	an
went	boys	that	girl	water
just	day	wet	pot	things
no	told	love	now	sad
nurse	carry	quickly	village	scramble
journey	terror	return	twisted	shelves
beware	explorer	known	projecting	tongue
serious	domineer	obtain	belief	luncheon
emergency	events	steadiness	nourishment	fringe
formulate	scarcely	universal	commenced	overwhelmed
circumstances	destiny	urge	labourers	exhausted
trudging	refrigerator	melodrama	encyclopaedia	apprehend
motionless	ultimate	atmosphere	reputation	binocular
economy	theory	humanity	philosopher	contemptuous
autobiography	excessively	champagne	terminology	perambulating
efficiency	unique	perpetual	mercenary	glycerine
influential	atrocious	fatigue	exorbitant	physician
microscopical	contagion	renown	hypocritical	fallacious
phlegmatic	melancholy	palpable	eccentricity	constitutionally
alienate	phthisis	poignancy	ingratiating	subtlety

THE BURT WORD READING TEST (1974 REVISION)

NAME ____________________ SCORE ____________________

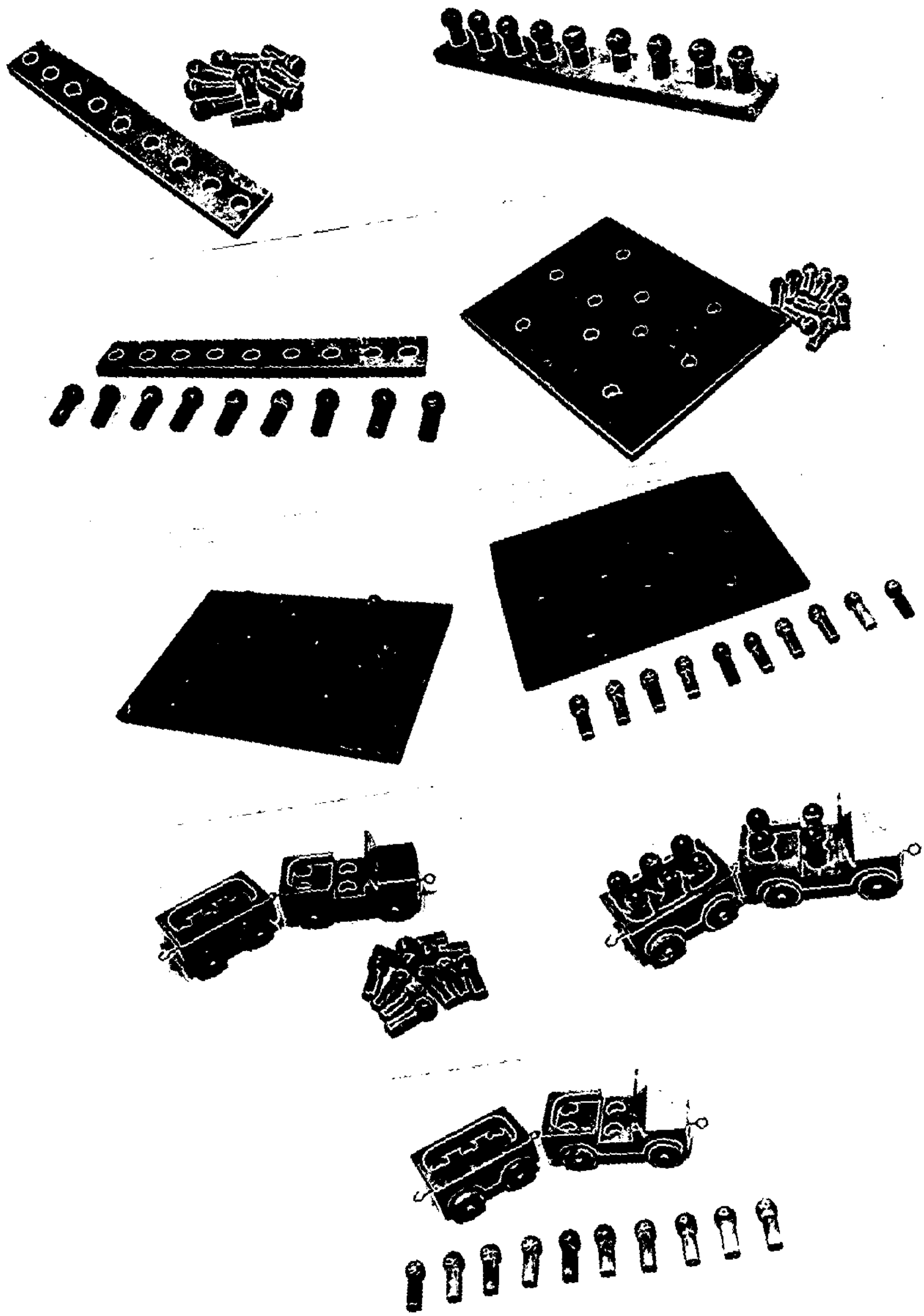
SCHOOL ____________________ READING AGE ____________________

DATE OF TEST ____________ AGE ________ MENTAL AGE (IF KNOWN) ____________________

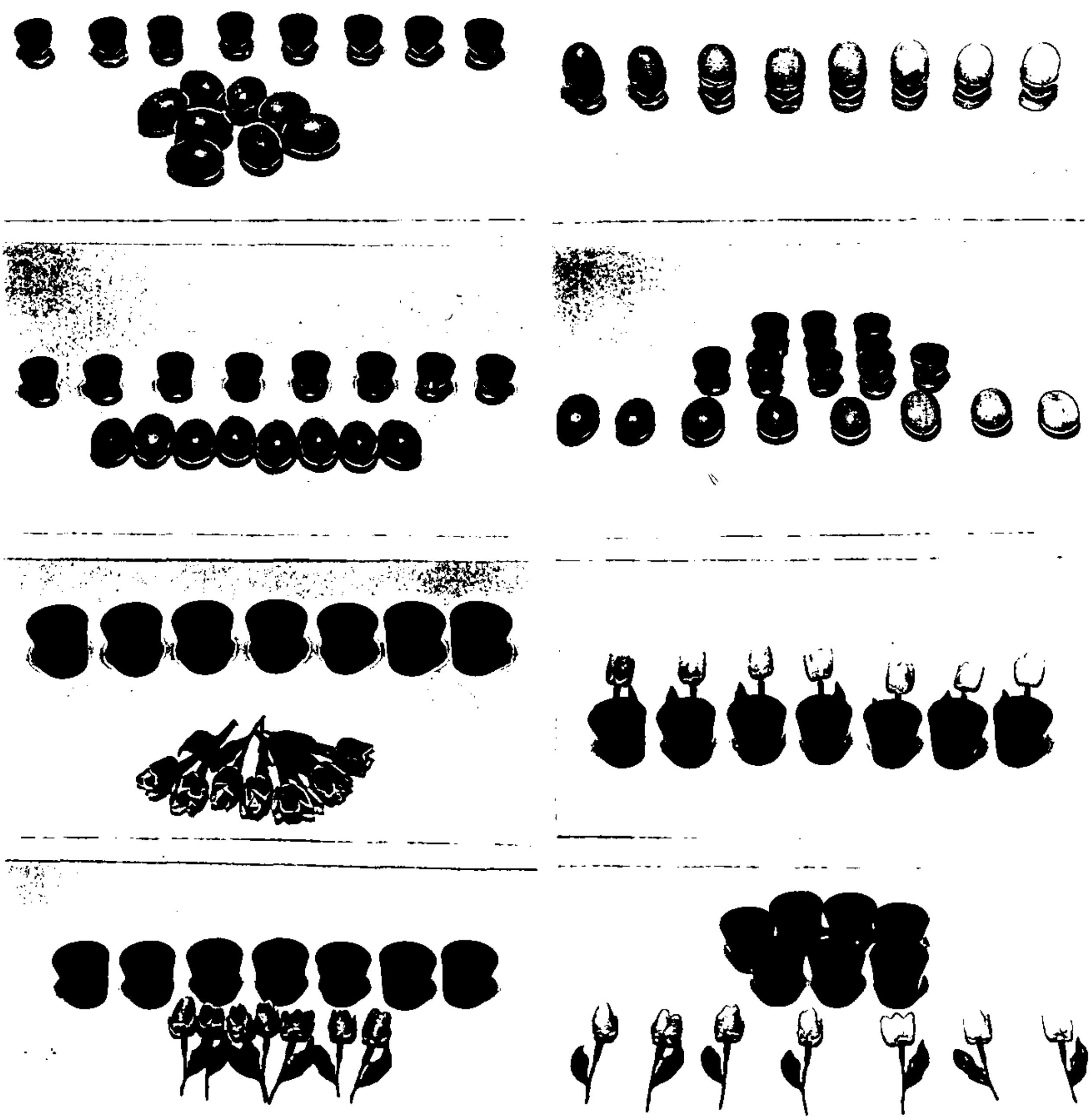
DATE OF BIRTH ____________________ EXAMINER'S INITIALS ____________________

Photographs of Piagetian Tests.

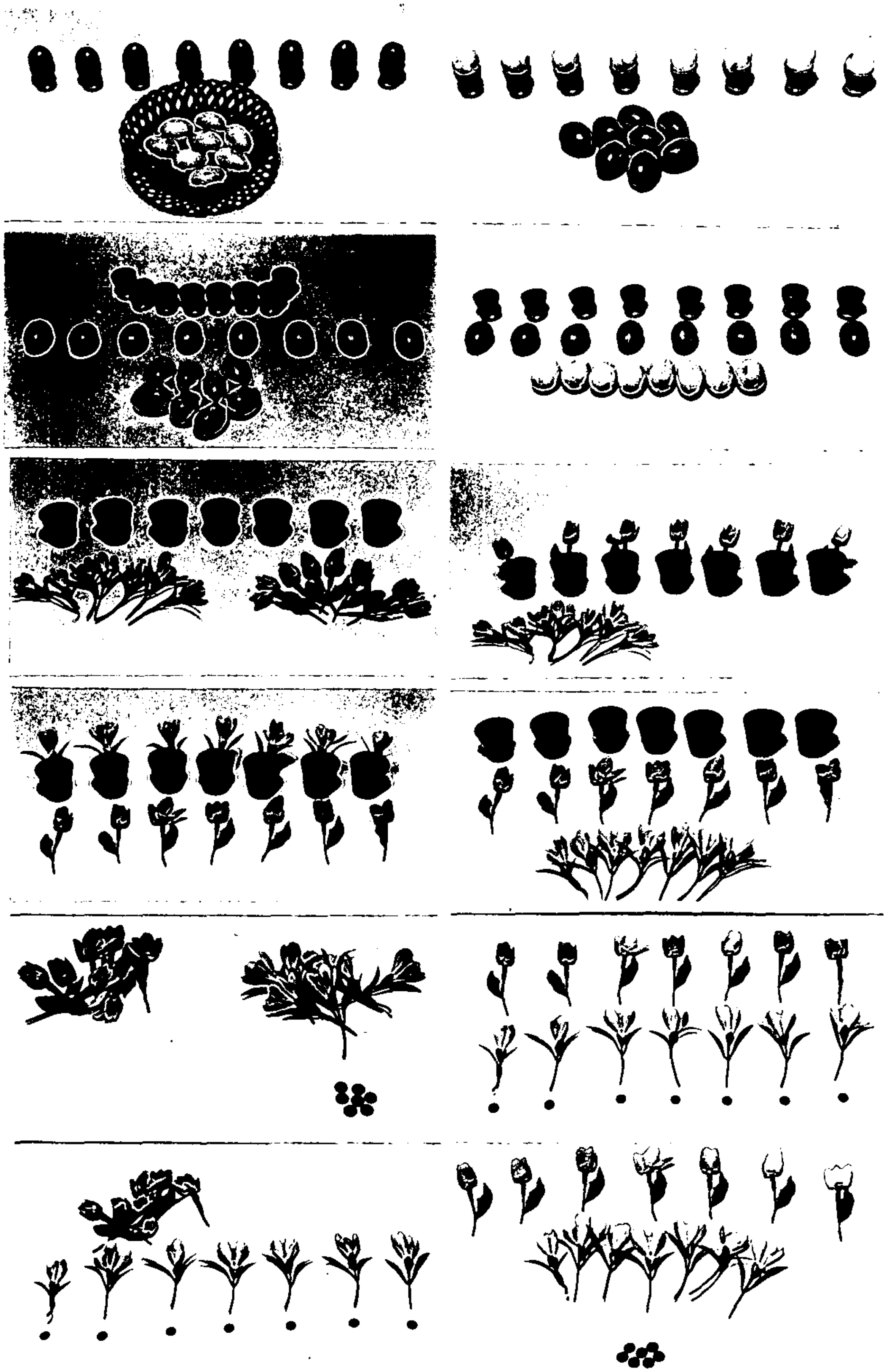
TEST 1A PROVOKED CORRESPONDENCE (ONE STATIC SET).



TEST 1B PROVOKED CORRESPONDENCE.

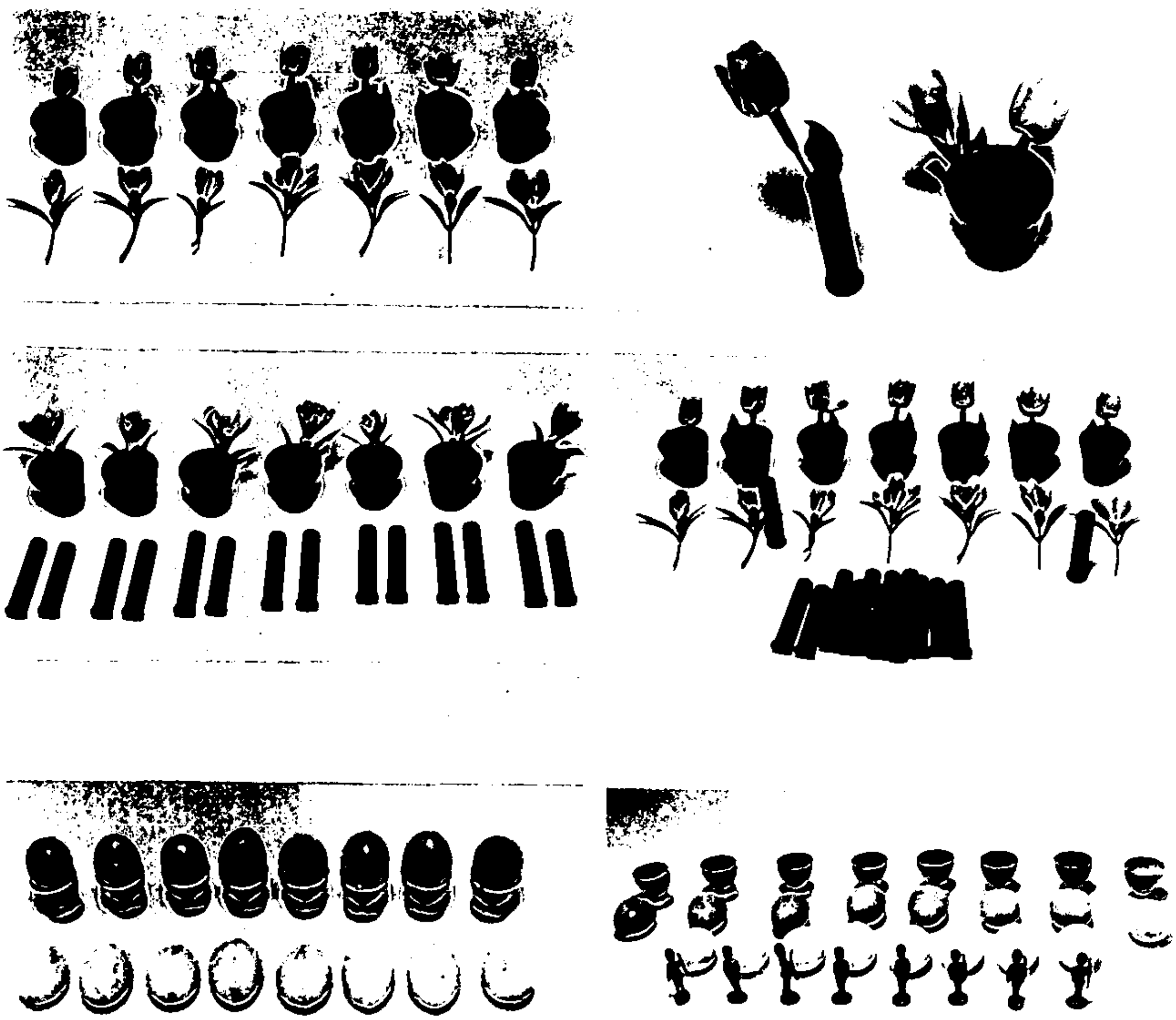


TEST 2A CORRESPONDENCE BETWEEN SEVERAL SETS.



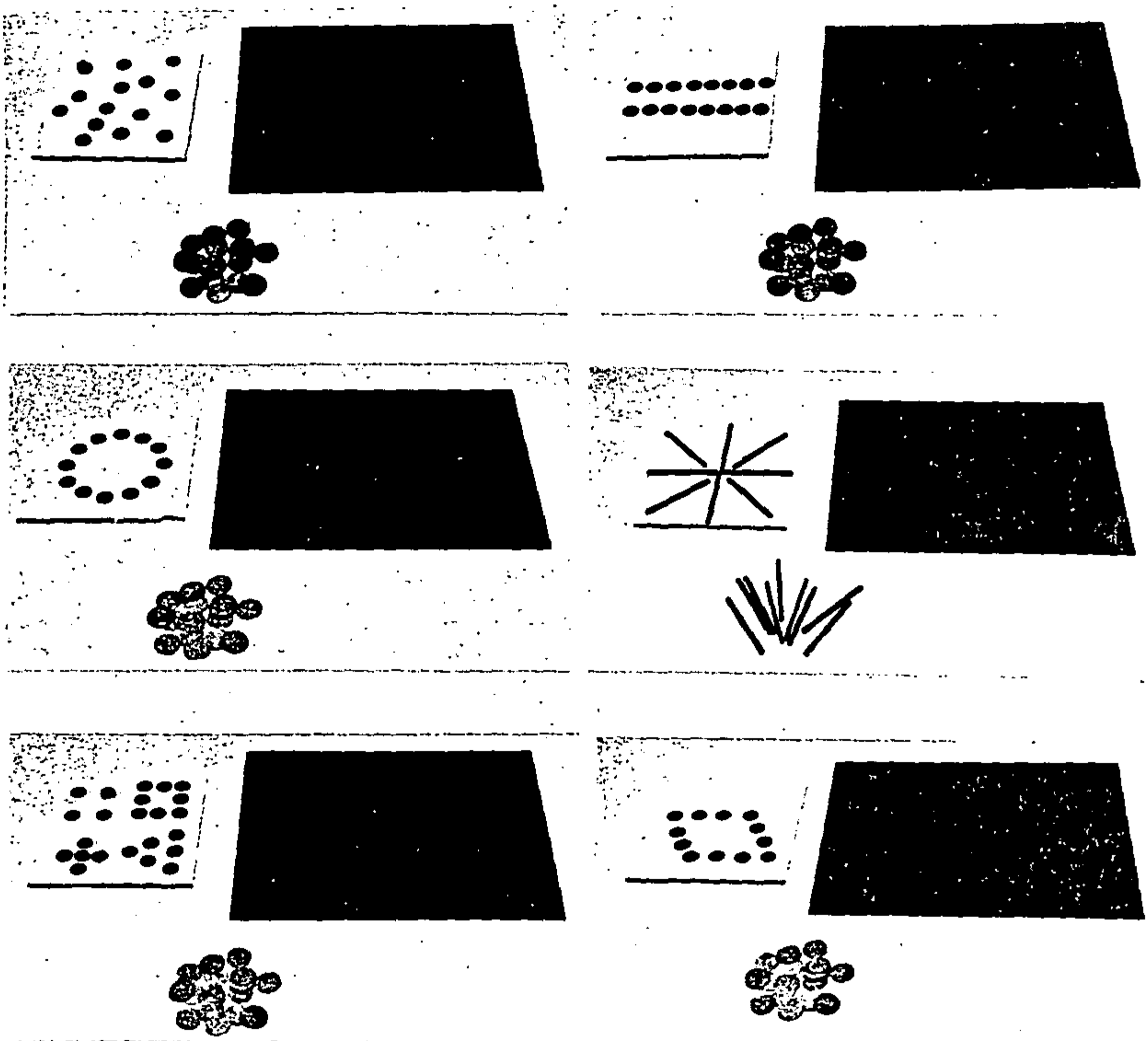
TEST 2B MULTIPLE CORRESPONDENCE

(a) One to one correspondence between 'n' sets.
(b) Two to one correspondence.

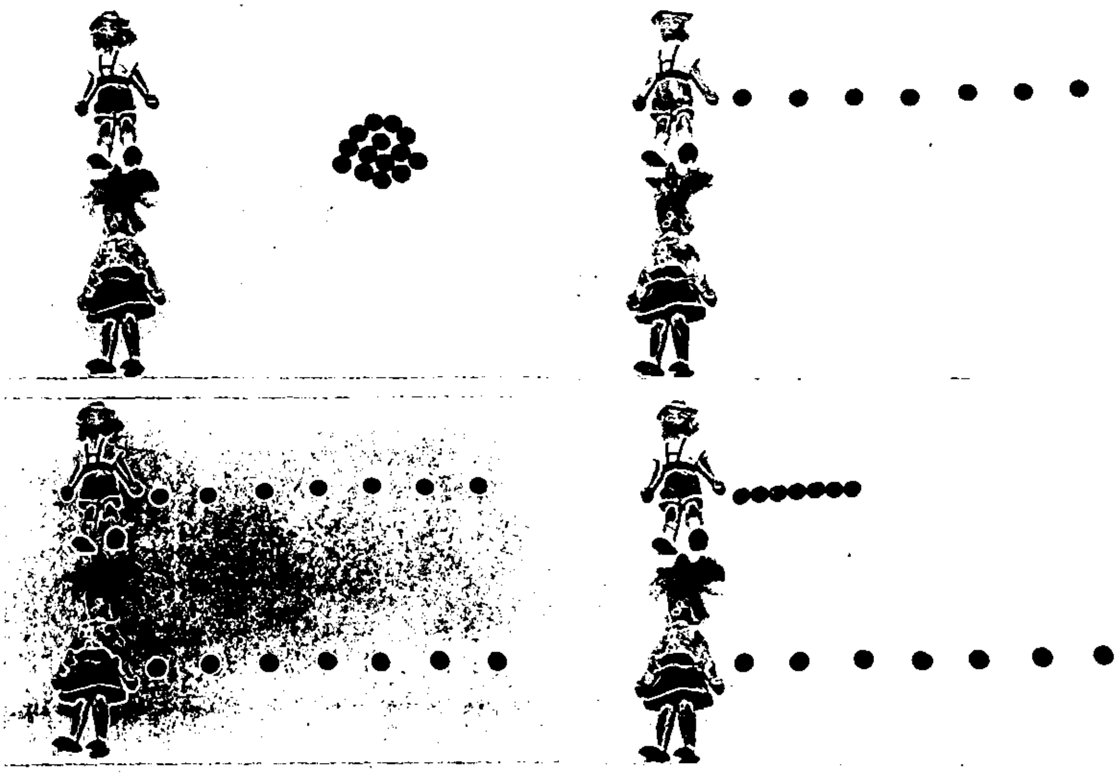


TEST 3A SPONTANEOUS CORRESPONDENCE

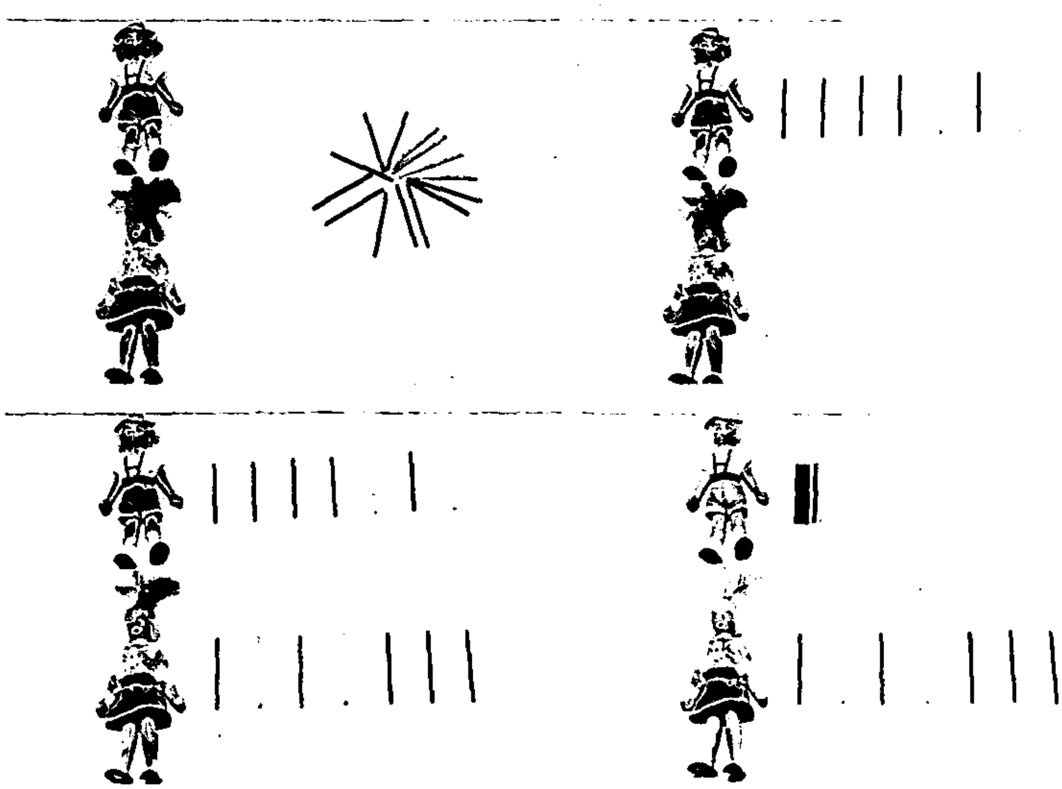
Reproduction of Figures.



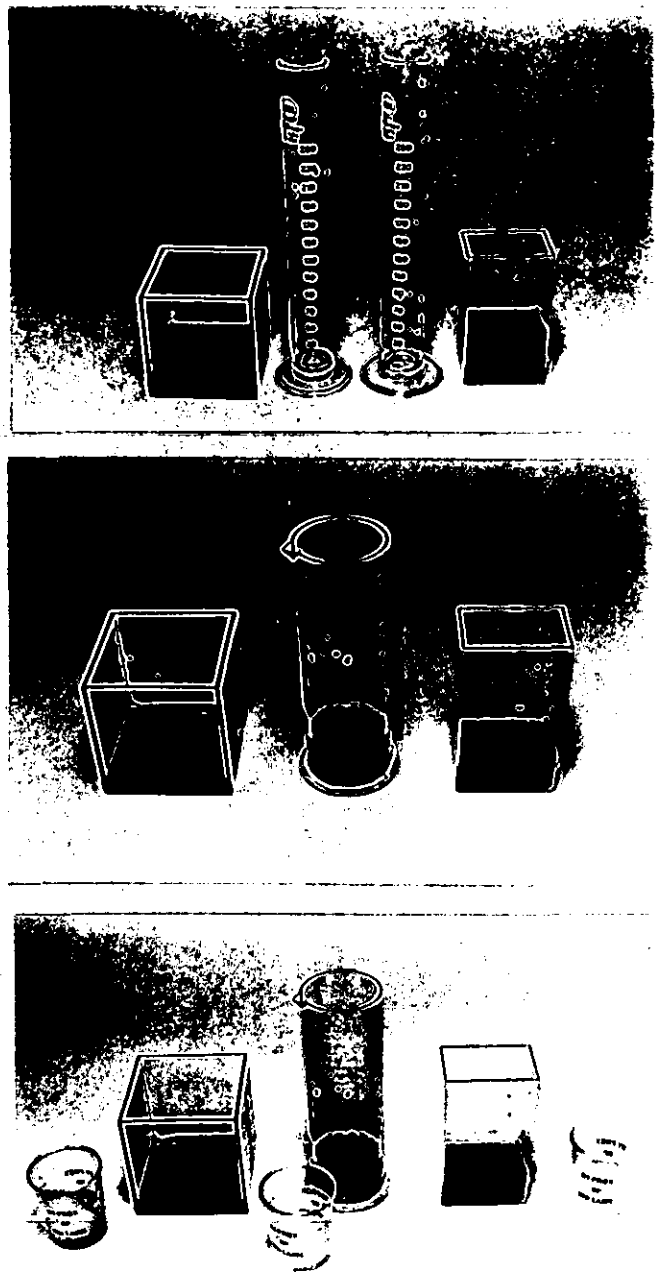
TEST 3B SPONTANEOUS CORRESPONDENCE - SINGLE ROWS.



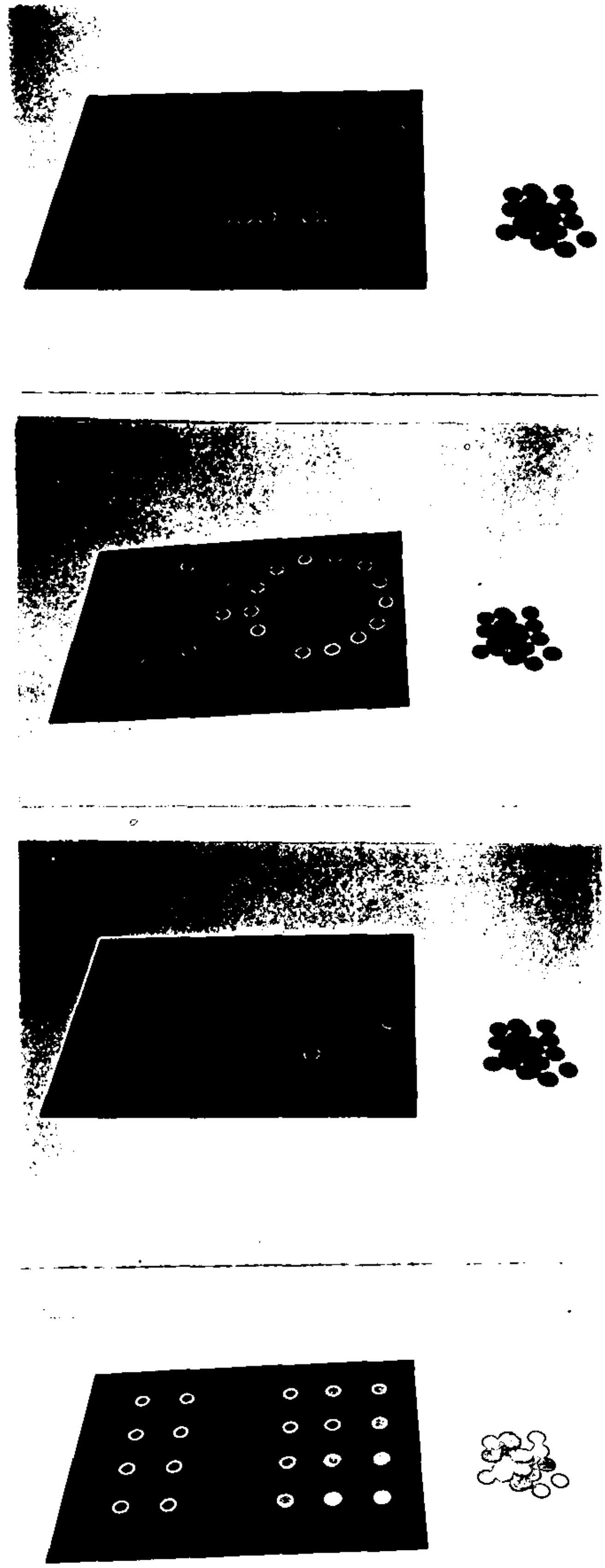
Note:-the following sub tests are similar but using counters and buttons instead of pennies.



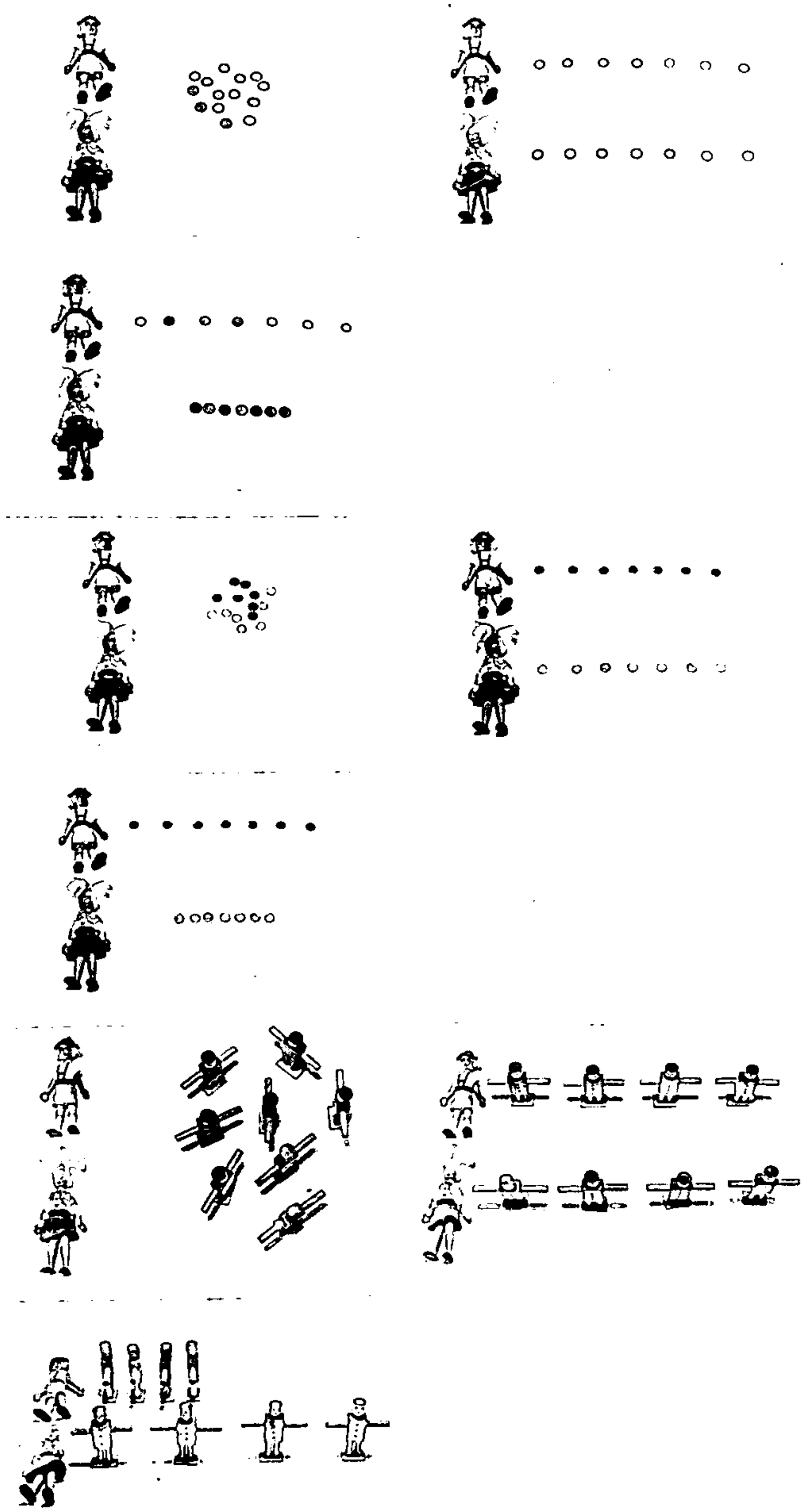
TEST 4 DEVELOPMENT OF THE NOTION OF MEASUREMENT.



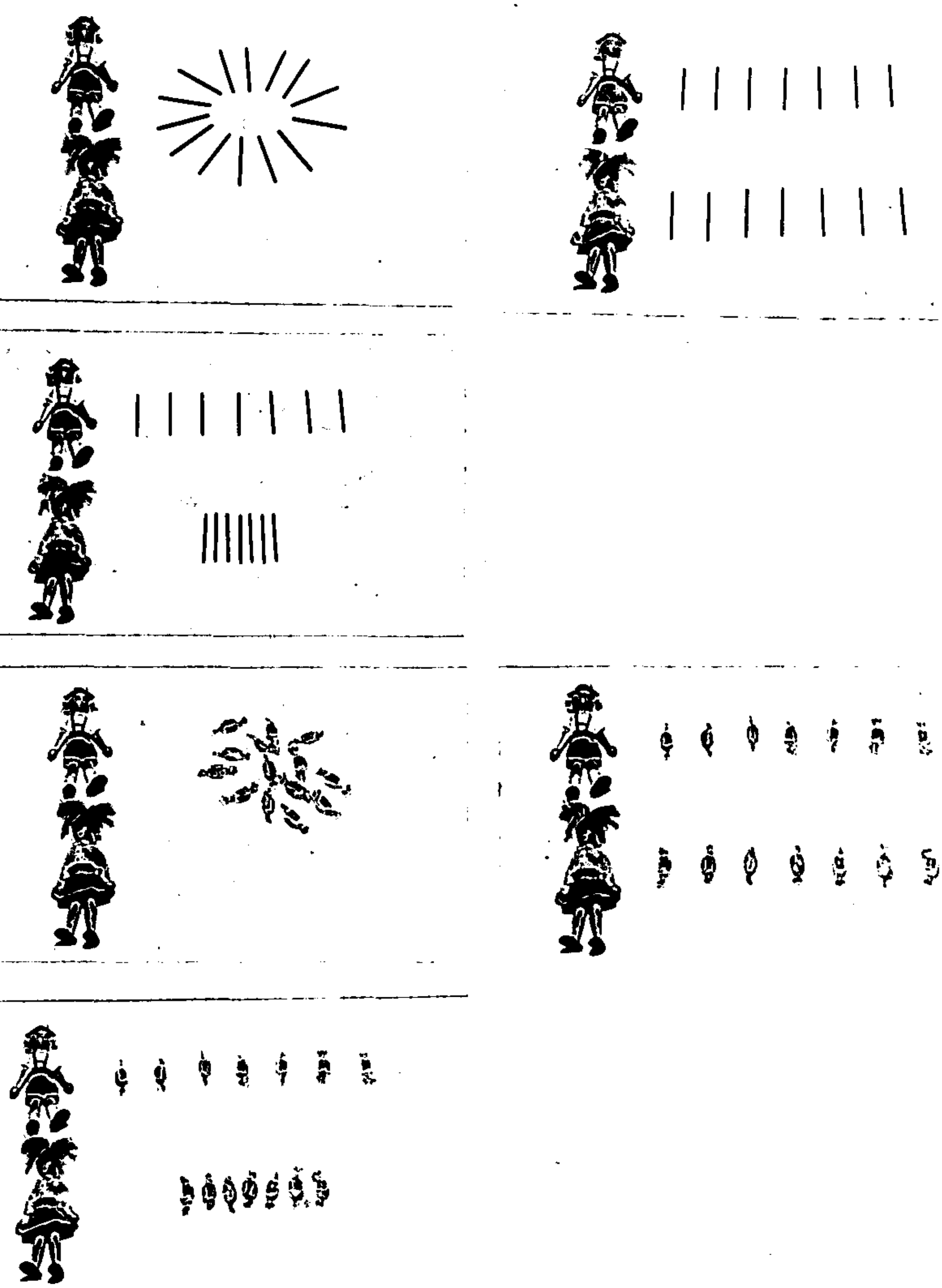
TEST 5A EQUATING OF QUANTITIES - UNEQUAL SETS.



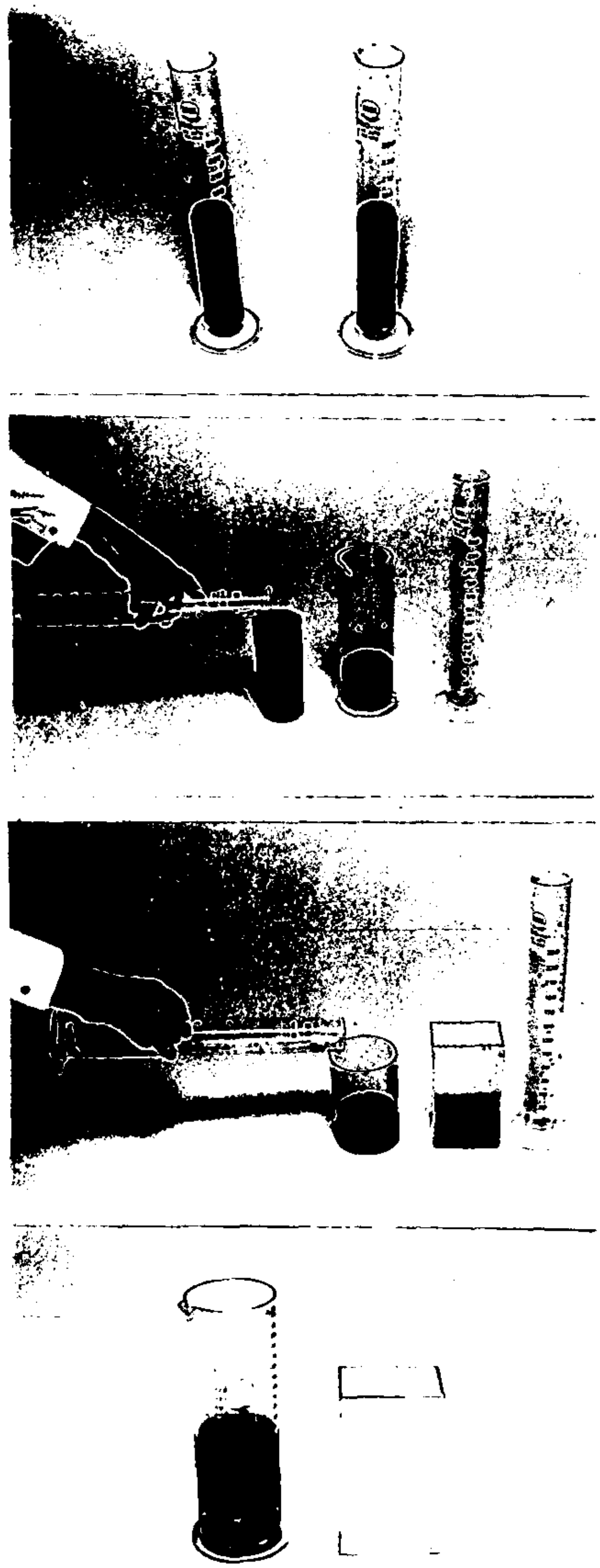
TEST 5B EQUATING OF QUANTITIES - EQUAL SETS.



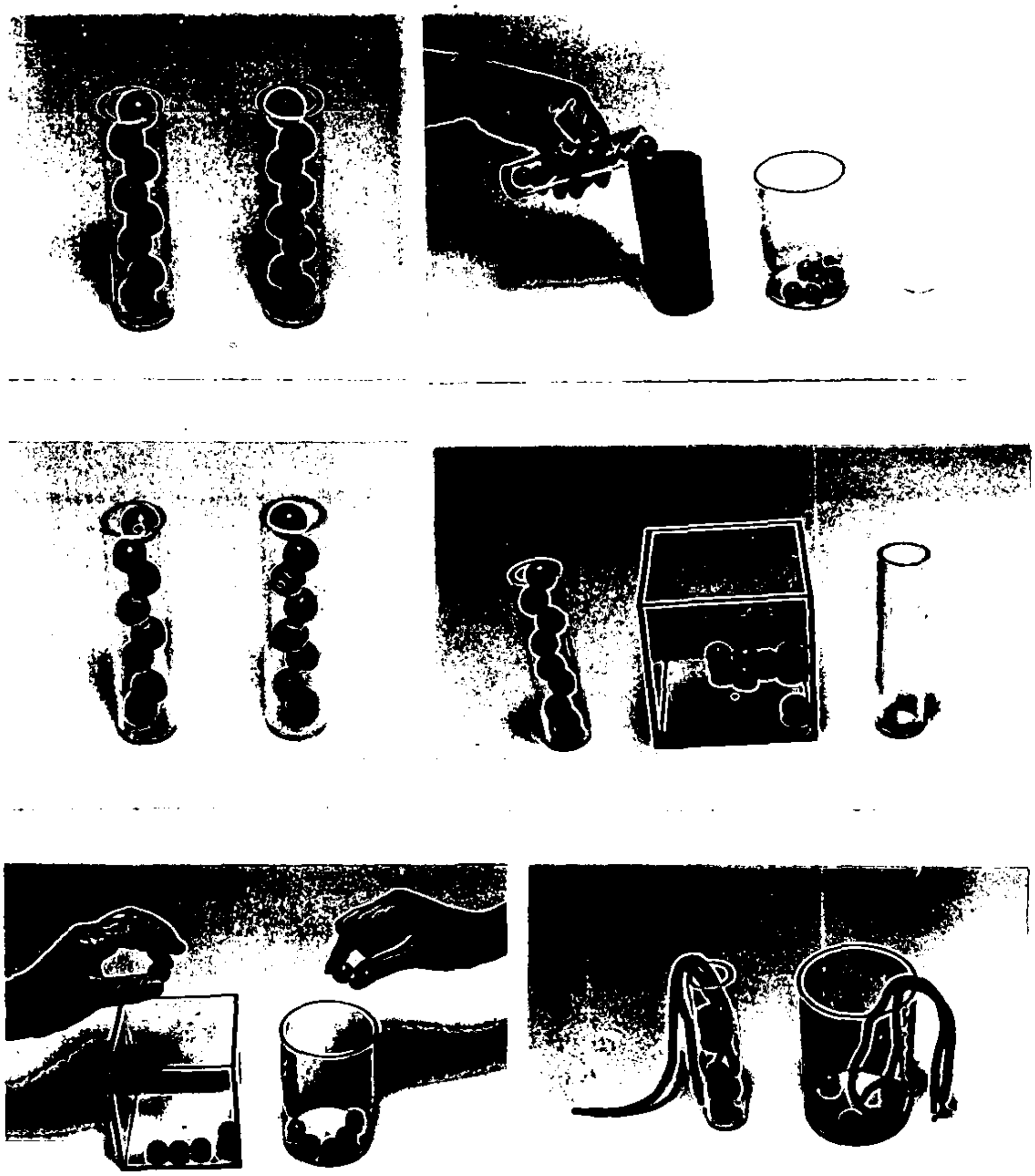
TEST 5B EQUATING OF QUANTITIES - EQUAL SETS.



TEST 6 CONSERVATION OF CONTINUOUS QUANTITY.

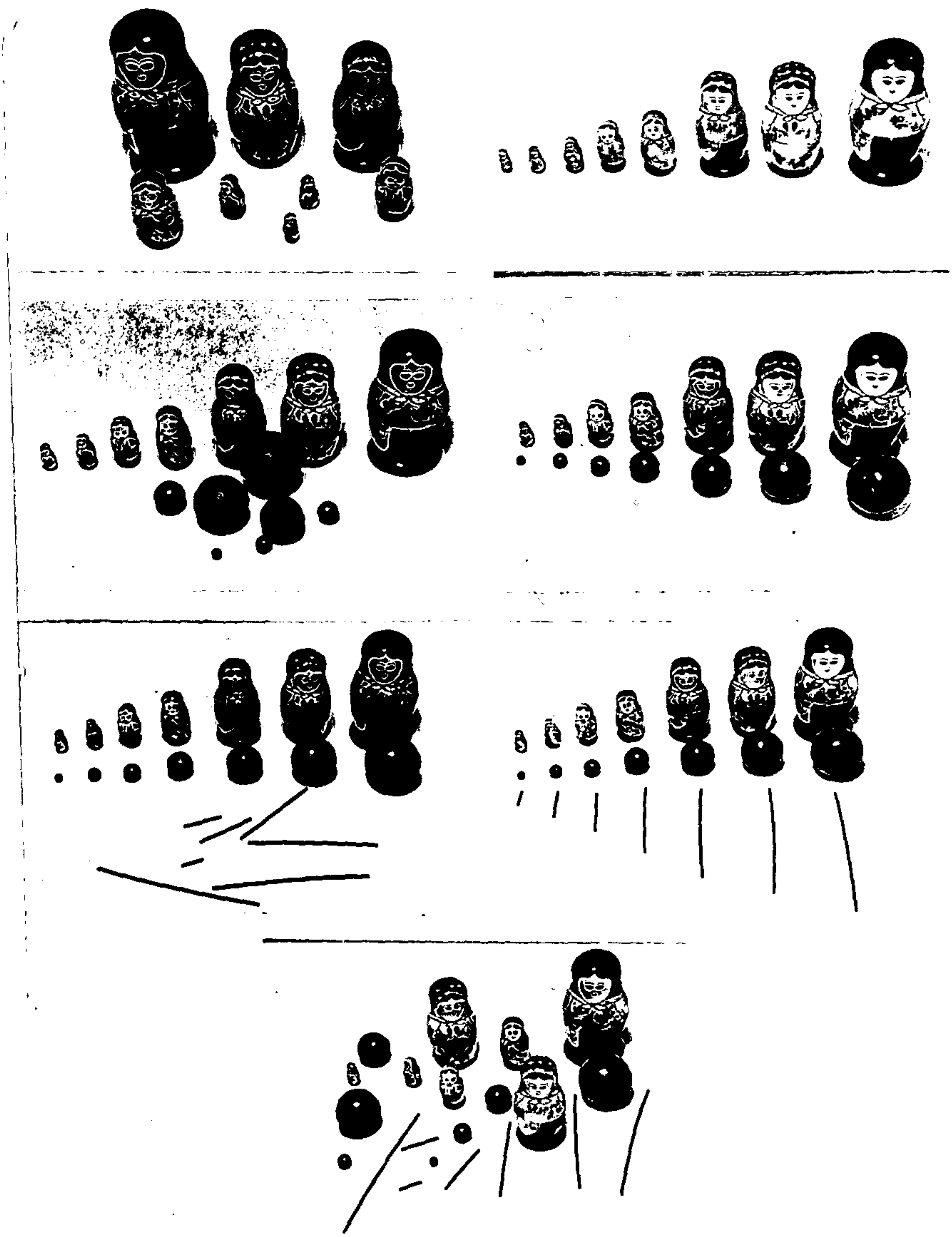


TEST 7 CONSERVATION OF DISCONTINUOUS QUANTITY.

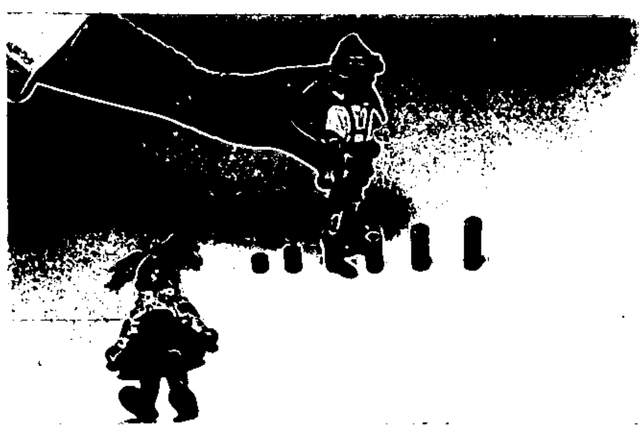


TEST 8 RELATIONS BETWEEN PARTS AND WHOLES.

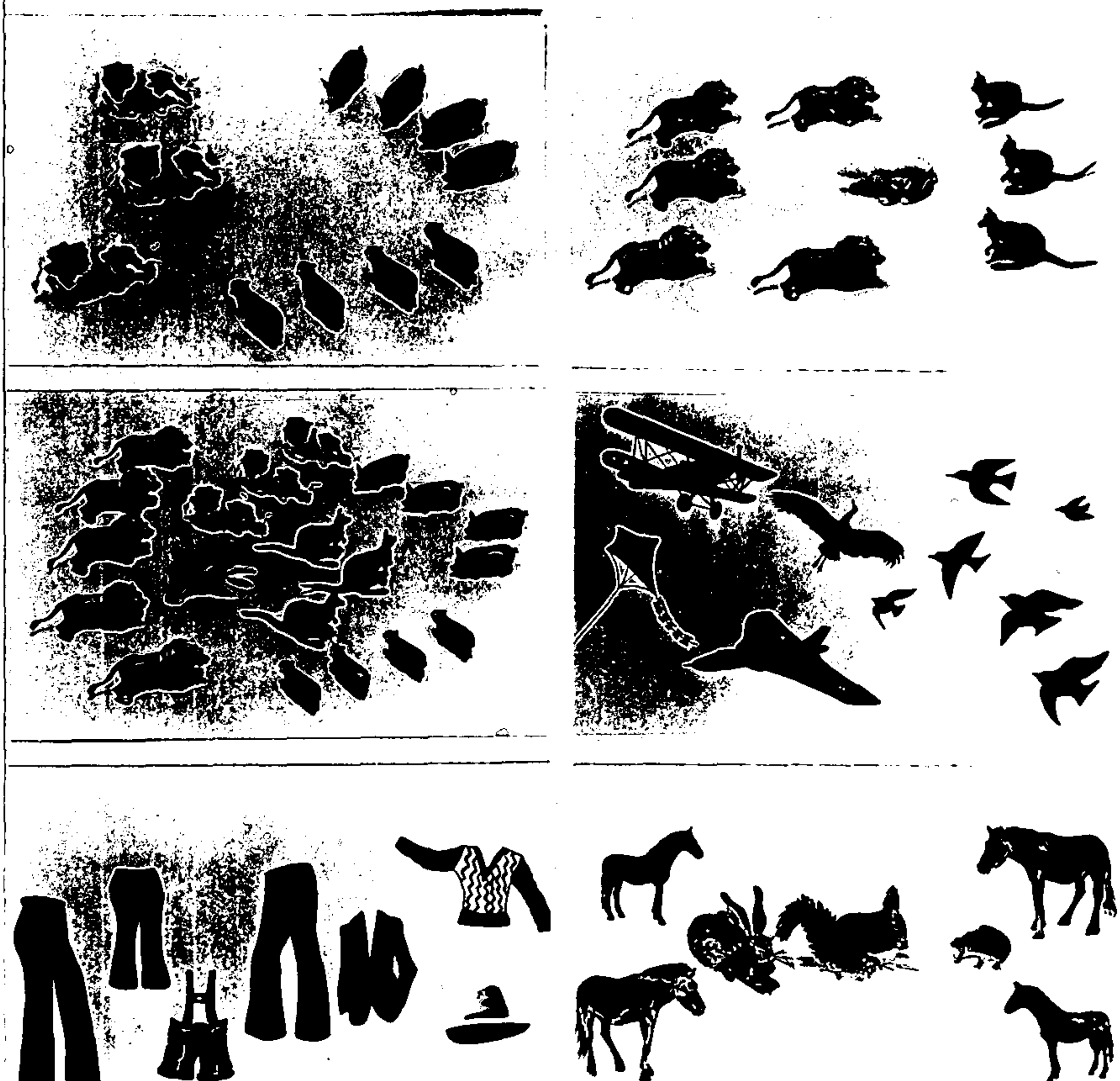
TEST 9 SERIATION.



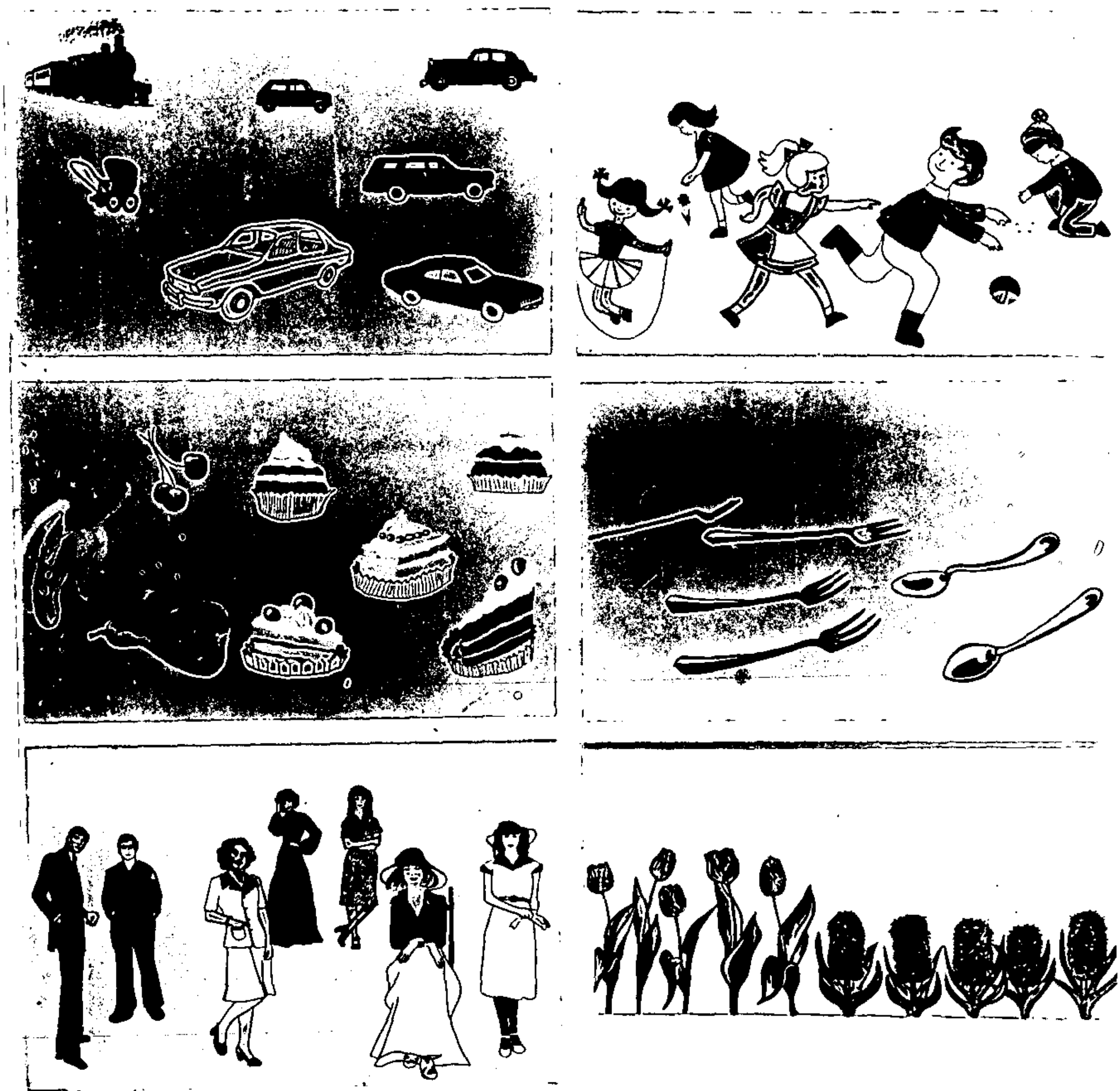
TEST 10 ORDINATION AND CARDINATION



TEST 11 INCLUSION



TEST 11 INCLUSION



APPENDIX C.

Details of results in standardized tests.

Contents:

Table 101
Raven's Coloured Progressive Matrices. By schools.

School A Sub. No.	School A Raw Score	School B Sub. No.	School B Raw Score	School C Sub. No.	School C Raw Score	School D Sub. No.	School D Raw Score
1	18	1	28	1	32	1	28
2	34	2	20	2	17	2	35
3	32	3	18	3	20	3	23
4	26	4	13	4	18	4	34
5	27	5	21	5	20	5	33
6	21	6	14	6	28	6	21
7	20	7	8	7	17	7	20
8	19	8	16	8	13	8	21
9	23	9	11	9	16	9	32
10	24	10	8	10	13	10	20
11	15	11	16	11	14	11	28
12	19	12	17	12	13	12	32
13	20	13	7	13	14	13	22
14	11	14	16	14	16	14	21
15	11	15	20	15	17	15	12
16	9	16	7	16	17	16	29
17	21	17	11	17	20	17	36
18	16	18	13	18	15	18	23
19	14	19	13	19	17	19	17
20	11	20	14	20	10	20	23
21	10	21	0	21	9	21	30
22	21	22	5	22	12	22	28
23	15	23	13	23	15	23	16
24	14	24	8	24	15	24	19
25	10	25	13	25	14	25	25
26	9	26	9	26	14	26	21
27	11	27	8	27	14	27	19
28	6			28	14	28	24
				29	13	29	21
						30	19
						31	14
						32	23
						33	18
						34	16
						35	16
						36	23
						37	21
						38	19
						39	24
						40	19
						41	6
						42	20
						43	17
						44	8
						45	15
						46	14
m. 17.4		m. 12.9		m. 16.1		m. 21.8	
s.d. 7.1		s.d. 5.8		s.d. 4.7		s.d. 6.7	

Table. 102.
Raven's Coloured Progressive Matrices. Whole sample.

No.	Score	No.	Score	No.	Score	No.	Score	No.	Score
1	28	27	34	53	16	79	11	105	21
2	35	28	17	54	20	80	14	106	15
3	23	29	30	55	16	81	9	107	8
4	34	30	28	56	16	82	21	108	13
5	33	31	16	57	11	83	13	109	10
6	18	32	32	58	19	84	7	110	9
7	21	33	19	59	8	85	16	111	15
8	20	34	25	60	23	86	14	112	8
9	21	35	21	61	21	87	19	113	13
10	32	36	21	62	17	88	14	114	9
11	28	37	14	63	16	89	11	115	14
12	20	38	26	64	7	90	16	116	12
13	28	39	20	65	23	91	17	117	14
14	32	40	18	66	24	92	13	118	15
15	22	41	20	67	17	93	6	119	5
16	21	42	27	68	19	94	13	120	10
17	32	43	19	69	15	95	11	121	9
18	12	44	21	70	16	96	14	122	8
19	20	45	28	71	13	97	0	123	15
20	18	46	24	72	16	98	20	124	14
21	29	47	21	73	24	99	17	125	14
22	36	48	8	74	19	100	10	126	14
23	23	49	19	75	13	101	17	127	14
24	17	50	14	76	20	102	17	128	11
25	23	51	23	77	11	103	20	129	6
26	13	52	18	78	20	104	15	130	13

m. 17.7

s.d. 7.1

Table 103

Raven's Coloured Progressive Matrices. Boys and girls.

Girls.

Sub. No.	Raw Score	Sub. No.	Raw Score	Sub. No.	Raw Score	Sub. No.	Raw Score
1	28	18	21	35	24	52	17
2	18	19	14	36	15	53	20
3	21	20	21	37	13	54	13
4	20	21	28	38	16	55	9
5	21	22	24	39	13	56	15
6	20	23	21	40	20	57	8
7	28	24	19	41	11	58	14
8	22	25	14	42	20	59	12
9	32	26	16	43	11	60	15
10	12	27	16	44	9	61	11
11	29	28	19	45	7	62	15
12	23	29	8	46	19	63	14
13	13	30	23	47	14	64	14
14	17	31	21	48	16	65	11
15	28	32	17	49	13	66	13
16	16	33	16	50	0		
17	25	34	7	51	20		

Boys.

Sub. No.	Raw Score	Sub. No.	Raw Score	Sub. No.	Raw Score	Sub. No.	Raw Score
1	35	17	19	35	19	49	17
2	23	18	21	34	16	50	17
3	34	19	26	35	24	51	15
4	33	20	20	36	19	52	21
5	32	21	18	37	14	53	15
6	28	22	20	38	21	54	8
7	32	23	27	39	13	55	10
8	21	24	19	40	16	56	13
9	20	25	8	41	14	57	9
10	18	26	23	42	11	58	14
11	36	27	18	43	17	59	5
12	23	28	16	44	6	60	10
13	17	29	20	45	13	61	8
14	34	30	11	46	11	62	14
15	30	31	23	47	14	63	14
16	32	32	17	48	10	64	6

Boys m. 18.6 s.d. 7.8

Girls m. 16.9 s.d. 6.1

Table 104
English Picture Vocabulary Test. By schools.

School A Sub. No.	School A Raw Score	School B Sub. No.	School B Raw Score	School C Sub. No.	School C Raw Score	School D Sub. No.	School D Raw Score
1	96	1	102	1	99	1	93
2	84	2	61	2	77	2	121
3	85	3	56	3	87	3	116
4	99	4	59	4	78	4	98
5	83	5	61	5	73	5	116
6	40	6	31	6	81	6	54
7	57	7	52	7	57	7	95
8	60	8	67	8	30	8	103
9	65	9	36	9	40	9	111
10	61	10	26	10	27	10	113
11	50	11	63	11	44	11	52
12	63	12	68	12	41	12	91
13	57	13	43	13	50	13	73
14	49	14	37	14	22	14	40
15	59	15	61	15	63	15	53
16	54	16	38	16	55	16	104
17	43	17	34	17	27	17	117
18	49	18	42	18	24	18	77
19	56	19	20	19	34	19	19
20	54	20	44	20	30	20	78
21	54	21	36	21	50	21	76
22	50	22	6	22	20	22	75
23	52	23	38	23	30	23	62
24	42	24	44	24	25	24	102
25	17	25	59	25	9	25	45
26	18	26	20	26	30	26	59
27	21	27	20	27	32	27	59
28	8			28	15	28	61
				29	56	29	52
						30	33
m.	54.3	m.	45.3	m.	45.0	31	52
s.d.	22.2	s.d.	19.9	s.d.	23.7	32	74
						33	54
						34	66
						35	50
						36	48
						37	70
						38	64
						39	41
						40	44
						41	12
						42	46
						43	10
						44	9
						45	28
						46	72
						m.	67.1
						s.d.	30.2

Table 105
English Picture Vocabulary Test. Whole sample.

No.	Score	No.	Score	No.	Score	No.	Score	No.	Score
1	93	27	84	53	66	79	43	105	50
2	121	28	77	54	57	80	44	106	52
3	116	29	76	55	50	81	59	107	9
4	98	30	75	56	67	82	54	108	38
5	116	31	62	57	36	83	41	109	30
6	96	32	85	58	60	84	38	110	50
7	54	33	102	59	26	85	49	111	28
8	95	34	45	60	48	86	56	112	44
9	103	35	59	61	70	87	44	113	57
10	111	36	61	62	57	88	50	114	20
11	102	37	31	63	63	89	34	115	42
12	113	38	99	64	43	90	22	116	20
13	52	39	87	65	65	91	63	117	72
14	91	40	78	66	61	92	42	118	30
15	73	41	73	67	68	93	12	119	6
16	40	42	83	68	64	94	20	120	21
17	99	43	59	69	50	95	4	121	8
18	53	44	40	70	37	96	44	122	20
19	61	45	81	71	30	97	0	123	25
20	56	46	61	72	40	98	46	124	9
21	104	47	52	73	41	99	10	125	30
22	117	48	52	74	63	100	54	126	32
23	77	49	33	75	27	101	55	127	15
24	21	50	52	76	57	102	34	128	17
25	78	51	74	77	49	103	27	129	18
26	59	52	54	78	61	104	24	130	56

m = 54.9

s.d.= 26.8

Table 106

English Picture Vocabulary Test (Girls)

Subject No.	Raw Score	Subject No.	Raw Score	Subject No.	Raw Score	Subject No.	Raw Score
1	93	18	59	35	61	52	10
2	96	19	31	36	50	53	27
3	54	20	40	37	30	54	38
4	95	21	81	38	40	55	50
5	103	22	61	39	27	56	28
6	113	23	52	40	57	57	44
7	52	24	33	41	49	58	42
8	73	25	52	42	61	59	20
9	99	26	50	43	59	60	30
10	53	27	67	44	54	61	18
11	104	28	60	45	38	62	25
12	78	29	26	46	44	63	32
13	59	30	48	47	50	64	15
14	77	31	70	48	22	65	21
15	75	32	57	49	42	66	56
16	62	33	63	50	0		
17	45	34	43	51	46		

Table 107

English Picture Vocabulary Test (Boys)

1	121	17	102	33	64	49	55
2	116	18	61	34	37	50	34
3	98	19	99	35	41	51	24
4	116	20	87	36	63	52	50
5	111	21	78	37	44	53	52
6	102	22	73	38	43	54	9
7	91	23	83	39	41	55	30
8	40	24	59	40	49	56	57
9	61	25	52	41	56	57	20
10	56	26	74	42	34	58	72
11	117	27	54	43	63	59	6
12	77	28	66	44	12	60	17
13	21	29	57	45	20	61	20
14	84	30	36	46	54	62	9
15	76	31	65	47	44	63	30
16	85	32	68	48	54	64	8

Girls m. 52.2 s.d. 23.3

Boys m. 57.7 s.d. 29.9

Table 108

Crichton Vocabulary Scale. Schools.

School A. No.	School A. Raw score	School B. No.	School B. Raw score	School C. No.	School C. Raw score	School D. No.	School D. Raw score
1	56	1	54	1	66	1	47
2	43	2	33	2	35	2	79
3	48	3	34	3	55	3	73
4	59	4	25	4	55	4	72
5	56	5	26	5	65	5	77
6	9	6	18	6	51	6	46
7	31	7	11	7	37	7	62
8	30	8	32	8	21	8	69
9	35	9	9	9	30	9	73
10	36	10	3	10	21	10	71
11	33	11	33	11	25	11	50
12	45	12	34	12	31	12	66
13	28	13	17	13	21	13	46
14	31	14	17	14	22	14	32
15	32	15	22	15	31	15	49
16	27	16	3	16	30	16	74
17	26	17	7	17	21	17	78
18	29	18	42	18	21	18	58
19	31	19	13	19	18	19	26
20	17	20	18	20	17	20	49
21	20	21	10	21	40	21	38
22	22	22	18	22	19	22	55
23	29	23	15	23	15	23	47
24	18	24	18	24	18	24	73
25	17	25	35	25	19	25	28
26	15	26	12	26	21	26	50
27	11	27	6	27	21	27	45
28	0			28	14	28	30
				29	22	29	40
						30	24
m.	29.8	m.	20.0	m.	29.7	31	32
						32	35
s.d.	14.3	s.d.	12.0	s.d.	15.6	33	34
						34	42
						35	44
						36	35
						37	51
						38	39
						39	33
						40	33
						41	13
						42	28
						43	19
						44	15
						45	15
						46	37
						m.	46.3
						s.d.	18.7

Table 109

Crichton Vocabulary Scale. Whole sample.

SN	RS	SN	RS	SN	RS	SN	RS	SN	RS
1	47	27	43	53	42	79	26	105	22
2	79	28	35	54	31	80	25	106	29
3	73	29	38	55	44	81	32	107	15
4	72	30	55	56	32	82	27	108	15
5	77	31	47	57	9	83	31	109	17
6	56	32	48	58	30	84	3	110	40
7	46	33	73	59	3	85	29	111	15
8	62	34	28	60	35	86	31	112	18
9	69	35	50	61	51	87	33	113	35
10	73	36	26	62	37	88	21	114	12
11	54	37	18	63	33	89	7	115	18
12	71	38	59	64	17	90	22	116	19
13	50	39	55	65	35	91	31	117	37
14	66	40	55	66	36	92	16	118	15
15	46	41	65	67	34	93	13	119	18
16	32	42	56	68	39	94	13	120	11
17	66	43	45	69	33	95	17	121	0
18	49	44	9	70	17	96	18	122	6
19	33	45	51	71	21	97	10	123	18
20	34	46	30	72	30	98	28	124	19
21	74	47	40	73	33	99	19	125	21
22	78	48	11	74	45	100	20	126	21
23	58	49	24	75	21	101	30	127	14
24	26	50	32	76	28	102	18	128	17
25	49	51	35	77	31	103	21	129	15
26	25	52	34	78	22	104	21	130	22

SN = Subject No. m. = 33.6

RS = Raw score. s.d. = 18.6

Table 110

Crichton Vocabulary Scale (Boys).

Subject No.	Raw score	Subject No.	Raw score	Subject No.	Raw score	Subject No.	Raw score
1	79	17	73	33	39	49	30
2	73	18	26	34	17	50	18
3	72	19	59	35	33	51	21
4	77	20	55	36	45	52	22
5	73	21	55	37	25	53	29
6	54	22	65	38	26	54	15
7	66	23	56	39	23	55	17
8	32	24	45	40	29	56	35
9	33	25	11	41	31	57	12
10	34	26	35	42	7	58	37
11	78	27	34	43	31	59	18
12	58	28	42	44	13	60	17
13	26	29	31	45	13	61	6
14	43	30	9	46	17	62	19
15	38	31	35	47	18	63	21
16	48	32	34	48	20	64	0

Table 111

Crichton Vocabulary Scale (Girls).

1	47	18	50	35	36	52	19
2	56	19	18	36	33	53	21
3	46	20	9	37	21	54	15
4	62	21	51	38	30	55	40
5	69	22	30	39	21	56	15
6	71	23	40	40	28	57	18
7	50	24	24	41	31	58	18
8	46	25	32	42	22	59	19
9	71	26	44	43	32	60	15
10	73	27	32	44	27	61	15
11	74	28	30	45	3	62	18
12	49	29	3	46	33	63	21
13	25	30	35	47	21	64	14
14	35	31	51	48	22	65	11
15	55	32	37	49	16	66	22
16	47	33	33	50	10		
17	28	34	17	51	28		

Boys m. 35.3 s.d. 20.3

Girls m. 31.9 s.d. 16.8

Table 112

Bender Gestalt (error scores). School A.

BOYS

Card	A				1			2			3				4		5			
Error	1		2	3	4	5	6	7	8	9	10	11	12		13	14	15	16	17	
	a	b											a	b					a	b
No.																				
1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2	0	0	1	0	1	1	0	0	0	0	1	1	0	0	1	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
4	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0
7	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
8	0	1	0	0	1	0	0	0	0	0	1	1	1	0	0	0	1	0	0	0
9	0	0	0	0	1	0	0	0	0	1	0	1	1	1	1	1	0	0	0	0
10	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0
11	1	1	1	1	1	0	0	0	1	0	1	0	1	0	1	1	1	0	0	0
12	1	1	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0
13	0	1	1	0	0	0	0	0	0	1	0	1	1	0	1	1	0	0	0	0
14	1	0	1	0	0	0	1	0	1	0	0	1	1	0	1	1	1	0	0	0
15	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1
16	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	11	1	0
Total	6	6	8	4	6	3	3	2	7	5	6	11	11	2	8	7	7	5	2	1

GIRLS.

No.	1a	1b	2	3	4	5	6	7	8	9	10	11	12a	12b	13	14	15	16	17a	17b
1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2	1	0	0	0	0	0	1	0	0	1	0	0	0	0	1	1	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
4	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
6	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1
7	1	0	1	1	1	0	0	0	1	1	1	0	1	0	1	1	1	1	0	0
8	0	1	0	0	0	0	1	0	0	0	0	1	1	0	0	0	1	1	0	0
9	1	0	1	1	1	0	0	0	1	0	0	1	1	0	1	1	0	1	1	0
10	0	1	1	0	0	0	1	0	0	0	0	1	1	0	1	0	0	1	1	1
11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
12	0	0	1	1	0	1	1	0	1	1	1	1	1	0	1	1	0	1	0	1
Total	5	3	6	4	4	1	5	0	4	4	3	5	9	2	8	6	3	8	3	4

Table 112 continued

Bender Gestalt (error scores). School A.

BOYS..

Card	6				7				8	
Error No.	18 a	18 b	19	20	21 a	21 b	22	23	24	25
1	0	0	0	0	0	0	0	0	0	0
2	0	0	1	0	0	0	1	0	0	0
3	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	1	0	0	1	0
5	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	1	1	1	0	0
7	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	1	0	1	1	0
9	1	0	0	1	0	1	1	1	1	0
10	0	0	0	1	0	1	1	1	1	0
11	0	0	0	1	1	1	1	1	1	0
12	0	0	0	1	1	1	1	1	1	0
13	0	0	0	1	0	1	0	0	1	1
14	1	0	0	1	0	1	0	1	1	0
15	1	1	1	1	1	1	1	1	1	1
16	1	1	1	1	1	1	1	1	1	1
Total	4	2	3	8	4	11	8	9	10	3

Boys' mean error score = 10.7, s.d = 8.3 for Cards A to 8.

GIRLS.

Error No.	18 a	18 b	19	20	21 a	21 b	22	23	24	25
1	0	0	0	0	0	1	0	0	0	0
2	0	0	0	1	1	1	1	1	1	0
3	0	0	1	0	0	1	0	0	0	0
4	0	0	0	1	0	1	0	0	0	0
5	0	0	0	0	0	1	1	1	1	0
6	0	0	0	0	0	1	0	0	0	0
7	0	0	1	1	0	1	1	1	1	0
8	0	0	0	1	1	1	1	1	1	0
9	0	0	0	1	1	1	1	1	1	1
10	1	0	0	1	0	1	1	1	1	0
11	1	1	1	1	1	1	1	1	1	0
12	0	1	1	0	1	1	1	1	1	1
Total	2	2	4	7	5	12	8	8	8	2

Girls' mean error score = 12.1, s.d., = 7.8 for Cards A to 8.

Table 113

School A — Bender Gestalt (error scores)

Subject No.	Card A 1a	1b	2	3	Card 1 4	5	6	Card 2 7	8	9	Card 3 10	11	12a	12b	Card 4 13	14	Card 5 15	16	17a	17b	Card 6 18a	18b	19	20	Card 7 21a	21b	22	23	Card 8 24	25	Total
1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	3
2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
3	0	0	1	0	1	1	0	0	0	0	1	1	0	0	1	0	1	1	0	0	0	0	1	0	0	0	1	0	0	0	10
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
5	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	5
6	1	0	0	0	0	0	1	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	1	1	1	1	0	11
7	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
8	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	3
9	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	0	0	6
10	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	1	0	1	0	0	0	0	7
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	5
12	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
13	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	5
14	1	0	1	1	1	0	0	0	1	1	1	0	1	0	1	1	1	1	0	0	0	0	1	1	0	1	1	1	1	0	18
15	0	1	0	0	0	0	1	0	0	0	0	1	1	0	0	0	1	1	0	0	0	0	0	1	1	1	1	1	1	0	12
16	1	0	1	1	1	0	0	0	1	0	0	1	1	0	1	1	0	1	1	0	0	0	0	1	1	1	1	1	1	1	18
17	0	1	0	0	1	0	0	0	0	0	1	1	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	0	9
18	0	0	0	0	1	0	0	0	0	1	0	1	1	1	1	1	0	0	0	0	1	0	0	1	0	1	1	1	1	0	13
19	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0	0	0	0	1	0	1	1	1	1	0	11
20	1	1	1	1	1	0	0	0	1	0	1	0	1	0	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1	0	17
21	1	1	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	12
22	0	1	1	0	0	0	0	0	0	1	0	1	1	0	1	1	0	0	0	0	0	0	0	1	0	1	0	0	1	1	11
23	1	0	1	0	0	0	1	0	1	0	0	1	1	0	1	1	1	0	0	0	1	0	0	1	0	1	0	1	1	0	14
24	0	1	1	0	0	0	1	0	0	0	0	1	1	0	1	0	0	1	1	1	1	0	0	1	0	1	1	1	1	0	15
25	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	28
26	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	27
27	0	0	1	1	0	1	1	0	1	1	1	1	1	0	1	1	0	1	0	1	0	1	1	0	1	1	1	1	1	1	21
28	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	28
Σ	11	9	14	7	10	4	8	2	11	9	9	16	20	4	16	13	10	13	5	5	6	4	7	15	9	23	16	17	18	5	316

m. = 11.3

s.d. = 8.0

Table 114

Bender Gestalt (error scores). School B.

BOYS.

Card	A				1			2			3				4		5			
Error No.	1 a	1 b	2	3	4	5	6	7	8	9	10	11	12 a	12 b	13	14	15	16	17 a	17 b
1.	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	1	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0
3	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
4	1	0	0	1	0	0	1	0	1	0	1	0	1	0	1	1	1	1	1	1
5	1	1	1	1	1	0	0	0	1	0	0	0	1	0	1	1	0	1	1	1
6	1	1	1	1	1	1	0	0	1	0	0	1	1	1	1	1	0	1	1	1
7	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
8	0	1	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0
9	1	0	1	1	0	0	1	1	1	0	0	1	1	0	0	1	1	1	1	1
10	1	1	0	1	0	0	0	1	1	0	0	1	1	0	1	1	1	1	1	1
11	1	1	0	1	0	0	0	0	1	0	0	0	1	0	0	1	1	1	1	1
12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
13	0	0	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1
14	1	0	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1
15	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	10	8	7	10	6	6	6	6	11	4	7	9	11	4	8	10	9	10	10	10

Boys' mean error score = 17.1, s.d., = 9.7 for cards A to 8.

GIRLS.

Error No.	1 a	1 b	2	3	4	5	6	7	8	9	10	11	12 a	12 b	13	14	15	16	17 a	17 b
1	0	1	0	1	1	0	1	0	0	0	1	0	1	0	0	1	0	0	0	0
2	0	0	0	0	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	1
3	0	0	0	0	1	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1
4	1	1	1	1	0	0	0	0	1	0	0	1	1	0	1	1	0	1	1	1
5	0	0	1	0	1	0	1	0	0	1	1	0	1	0	0	0	0	0	0	1
6	1	1	1	1	0	0	0	1	1	0	0	1	1	0	0	0	0	1	1	1
7	0	1	1	0	0	0	1	0	0	0	0	1	1	0	0	1	0	0	0	0
8	1	1	1	1	1	1	0	1	1	0	0	0	1	0	1	1	1	1	1	1
9	1	1	0	1	1	1	0	1	1	0	0	1	1	0	1	1	1	1	1	1
10	1	1	1	1	0	0	0	1	1	1	0	1	1	0	1	1	1	1	1	1
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
12	1	1	0	0	1	0	1	0	1	1	0	1	1	1	0	1	0	1	1	1
	6	8	6	6	7	2	6	4	8	3	3	7	9	1	4	8	3	6	6	10

Girls' mean error score = 16.4, s.d. = 8.6 for cards A to 8.

Table 114 continued .

Bender Gestalt (error scores). School B.

BOYS.

Card	6				7				8	
Error	18a	18b	19	20	21a	21b	22	23	24	25
No.										
1	0	0	0	0	0	0	0	1	0	0
2	0	0	0	0	0	0	0	0	0	0
3	1	0	0	1	0	0	0	1	1	0
4	1	0	1	1	0	1	1	1	1	0
5	0	0	1	1	1	1	1	1	1	0
6	0	1	1	0	1	1	1	1	1	1
7	0	0	1	0	1	0	0	0	0	0
8	0	0	0	0	1	1	1	1	0	0
9	1	1	1	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1	1	1
11	0	0	1	1	0	1	0	1	1	0
12	1	1	1	1	1	1	1	1	1	1
13	1	0	1	1	1	1	1	1	1	0
14	1	0	1	1	1	1	1	1	1	1
15	1	1	1	1	1	1	1	1	1	1
Totals	8	5	11	10	10	11	10	13	11	6

Boys' mean error score = 17.1, s.d. = 9.7 for cards A to 8.

GIRLS.

Card	6				7				8	
Error	18a	18b	19	20	21a	21b	22	23	24	25
1	0	0	0	0	0	1	1	1	1	0
2	1	0	0	1	0	1	0	1	1	0
3	1	0	0	0	0	1	0	0	1	0
4	0	1	1	1	1	1	1	1	1	1
5	0	0	1	0	0	0	1	1	1	0
6	0	1	1	0	1	1	1	0	1	1
7	0	0	0	0	0	1	0	1	1	0
8	1	1	0	0	1	1	1	1	1	1
9	0	1	1	0	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1	1	1
11	0	0	0	0	0	1	1	0	1	0
12	0	1	1	1	1	1	1	1	1	1
Totals	4	6	6	4	6	11	9	9	12	6

Girls' mean error score = 16.4, s.d., = 8.6 for cards A to 8.

Table 115

Bender Gestalt (error scores.) School B.

No.	Card A Error 1 a	1 b	2	3	1 4	5	6	2 7	8	9	3 10	11	12 a	12 b	4 13	14
1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	1	0	0	0	0	0	0	0	0	1	1	0	0	1	0
3	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
4	0	1	0	1	1	0	1	0	0	0	1	0	1	0	0	1
5	1	0	0	1	0	0	1	0	1	0	1	0	1	0	1	1
6	0	0	0	0	1	0	1	0	1	0	1	0	0	0	0	0
7	1	1	1	1	1	0	0	0	1	0	0	0	1	0	1	1
8	0	0	0	0	1	0	1	0	1	0	0	1	0	0	0	0
9	1	1	1	1	1	1	0	0	1	0	0	1	1	1	1	1
10	1	1	1	1	0	0	0	0	1	0	0	1	1	0	1	1
11	0	0	1	0	1	0	1	0	0	1	1	0	1	0	0	0
12	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0
13	1	1	1	1	0	0	0	1	1	0	0	1	1	0	0	0
14	0	1	0	0	0	1	0	0	0	0	0	1	1	0	0	0
15	0	1	1	0	0	0	1	0	0	0	0	1	1	0	0	1
16	0	1	0	1	1	1	0	1	1	0	0	0	1	0	1	1
17	1	0	1	1	0	0	1	1	1	0	0	1	1	0	0	1
18	1	1	0	1	1	1	0	1	1	0	0	1	1	0	1	1
19	1	1	0	1	0	0	0	1	1	0	0	1	1	0	1	1
20	1	1	0	1	0	1	0	0	1	0	0	0	1	0	0	1
21	1	1	0	1	0	0	0	1	1	1	0	1	1	0	1	1
22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
24	1	1	0	0	1	0	1	0	1	1	0	1	1	1	0	1
25	0	0	1	1	1	0	1	1	1	1	1	1	1	1	0	1
26	1	0	1	0	1	1	1	1	1	1	1	1	1	0	1	1
27	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Totals	15	16	11	16	13	9	12	10	19	7	10	16	20	5	12	18

Table 115 continued.

Bender Gestalt (error scores). School B.

		5				6				7				8	
No.	Error	15	16	17		18		19	20	21		22	23	24	25
				a	b	a	b			a	b				
1		0	0	0	0	0	0	0	0	0	0	0	1	0	0
2		0	0	0	0	0	0	0	0	0	0	0	0	0	0
3		1	0	0	0	1	0	0	1	0	0	0	1	1	0
4		0	0	0	0	0	0	0	0	0	1	1	1	1	0
5		1	1	1	1	1	0	1	1	0	1	1	1	1	0
6		0	0	0	1	1	0	0	1	0	1	0	1	1	0
7		0	1	1	1	1	0	1	1	1	1	1	1	1	0
8		0	0	0	1	1	0	0	0	0	1	0	0	1	0
9		0	1	1	1	0	1	1	0	1	1	1	1	1	1
10		0	1	1	1	0	1	1	1	1	1	1	1	1	1
11		0	0	0	1	0	0	1	0	1	0	1	1	1	0
12		0	0	0	0	0	0	1	0	1	0	0	0	0	0
13		0	1	1	1	0	1	1	0	1	1	1	0	1	1
14		0	0	0	0	0	0	0	0	1	1	1	1	0	0
15		0	0	0	0	0	0	0	0	0	1	0	1	1	0
16		1	1	1	1	1	1	0	0	1	1	1	1	1	1
17		1	1	1	1	1	1	1	1	1	1	1	1	1	1
18		1	1	1	1	0	1	1	0	1	1	1	1	1	1
19		1	1	1	1	0	1	1	1	1	1	1	1	1	1
20		1	1	1	1	0	0	1	1	0	1	0	1	1	0
21		1	1	1	1	0	0	1	1	0	1	0	1	1	0
22		1	1	1	1	1	1	1	1	1	1	1	1	1	1
23		1	1	1	1	1	1	1	1	1	1	1	1	1	1
24		0	0	0	1	0	0	0	0	0	1	1	0	1	0
25		0	1	1	1	0	1	1	1	1	1	1	1	1	1
26		1	1	1	1	1	0	1	1	1	1	1	1	1	0
27		1	1	1	1	1	0	1	1	1	1	1	1	1	1
Totals		12	16	16	20	11	10	17	14	16	22	18	22	23	11

m = 16.3, s.d. = 8.1

Table 116

Bender Gestalt (Errors Scores)

School C..boys

Subject No.	Card: A				1			2			3				4		5				6				7				8		Σ
	1a	1b	2	3	4	5	6	7	8	9	10	11	12a	12b	13	14	15	16	17a	17b	18a	18b	19	20	21a	21b	22	23	24	25	
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
2	0	0	1	0	1	1	0	0	0	1	1	1	0	0	1	1	1	1	1	0	0	0	0	0	0	1	0	0	1	0	13
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	1	0	1	1	0	6
4	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	1	1	0	8
5	1	1	1	1	0	0	0	0	0	0	1	0	1	0	0	1	0	1	1	0	0	0	1	0	0	1	0	1	1	1	14
6	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	0	1	0	1	1	1	13
7	1	1	0	1	1	1	0	0	1	0	0	1	1	1	1	1	0	1	1	1	1	0	0	0	1	1	0	1	1	1	20
8	1	1	1	1	0	0	0	0	1	0	0	1	1	0	0	1	0	1	1	0	1	0	0	0	1	1	1	1	1	1	17
9	1	1	1	1	0	1	0	0	0	0	0	0	1	0	0	1	1	0	1	0	1	0	0	0	1	1	0	1	1	1	15
10	1	1	1	1	1	0	0	0	1	0	0	1	1	1	0	1	1	0	1	0	1	0	1	1	1	1	0	1	1	0	19
11	1	1	1	1	0	0	0	0	1	0	0	1	1	0	1	1	0	0	1	1	0	1	1	0	1	1	1	1	1	0	18
12	0	1	0	1	0	1	0	0	1	0	0	1	1	1	0	1	0	0	0	1	1	1	0	1	1	1	0	1	1	0	16
Σ:	7	8	7	9	3	4	2	0	5	1	3	6	7	3	3	10	3	5	9	4	5	2	4	4	7	11	2	10	11	5	160

m. = 13.3
s.d. = 5.7

girls.

Subject No.	Card: A				1			2			3				4		5				6				7				8		Σ
	1a	1b	2	3	4	5	6	7	8	9	10	11	12a	12b	13	14	15	16	17a	17b	18a	18b	19	20	21a	21b	22	23	24	25	
1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2	0	1	0	1	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	8
3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
5	1	0	1	1	0	0	0	1	1	0	0	1	1	0	0	1	0	1	1	1	0	0	0	0	0	1	0	0	1	0	13
6	1	0	1	0	1	0	1	0	1	0	1	1	1	0	1	1	1	1	0	0	0	0	0	1	0	1	0	0	1	0	15
7	0	0	1	1	1	0	1	0	0	0	1	0	0	0	0	0	0	1	1	0	1	0	1	1	0	1	0	1	1	0	13
8	1	1	1	1	0	0	0	0	1	0	0	1	1	0	1	1	0	1	1	0	0	1	1	1	1	1	1	1	1	0	19
9	0	1	1	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	1	0	8
10	1	0	1	1	1	0	0	0	1	0	1	1	1	0	1	1	1	0	1	1	1	1	0	0	1	1	1	1	1	1	21
11	1	1	1	0	0	0	0	0	0	0	1	1	1	0	1	1	1	0	0	0	0	0	0	1	1	1	0	1	1	0	14
12	1	0	1	1	0	0	0	0	1	0	0	0	0	0	1	0	0	1	1	1	1	1	0	0	0	1	1	1	1	0	14
13	0	1	0	1	0	0	1	0	0	1	0	1	1	1	1	1	0	1	1	1	0	0	0	1	1	1	1	1	1	1	19
14	1	1	1	1	1	0	0	0	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	24
15	1	1	0	1	0	0	0	0	1	0	0	0	1	0	1	1	0	1	1	0	0	1	1	1	1	1	0	1	1	0	16
16	1	1	1	1	0	1	0	1	1	0	0	1	1	0	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	23
17	1	1	1	1	0	1	0	0	1	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	1	1	0	1	1	1	17
Σ =	10	9	11	11	4	2	5	2	9	1	5	11	11	1	10	11	6	11	10	6	5	6	5	7	8	15	6	11	14	5	228

mean = 13.4, S.d. = 7.3

Table 117

Bender Gestalt (error scores)

School C.

Subject No.	Card:- A				:- 1			:- 2			:- 3				:- 4		:- 5				:- 6				:- 7				:- 8		Total
		1	2	3	4	5	6	7	8	9	10	11	12		13	14	15	16	17		18		19	20	21		22	23	24	25	
No.	a	b											a	b					a	b	a	b			a	b					
1.	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2.	0	1	0	1	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	8
3.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
4.	0	0	1	0	1	1	0	0	0	1	1	1	0	0	1	1	1	1	1	0	0	0	0	0	0	1	0	0	1	0	13
5.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	1	0	1	1	0	6
6.	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
7.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
8.	1	0	1	1	0	0	0	1	1	0	0	1	1	0	0	1	0	1	1	1	0	0	0	0	0	1	0	0	1	0	13
9.	1	0	1	0	1	0	1	0	1	0	1	1	1	0	1	1	1	1	0	0	0	0	0	1	0	1	0	0	1	0	15
10.	0	0	1	1	1	0	1	0	0	0	1	0	0	0	0	0	0	1	1	0	1	0	1	1	0	1	0	1	1	0	13
11.	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	1	1	0	8
12.	1	1	1	1	0	0	0	0	0	0	1	0	1	0	0	1	0	1	1	0	0	0	1	0	0	1	0	1	1	1	14
13.	1	1	1	1	0	0	0	0	1	0	0	1	1	0	1	1	0	1	1	0	0	1	1	1	1	1	1	1	1	0	19
14.	0	1	1	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	1	0	8
15.	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	0	1	0	1	1	1	13
16.	1	1	0	1	1	1	0	0	1	0	0	1	1	1	1	1	0	1	1	1	1	0	0	0	1	1	0	1	1	1	20
17.	1	0	1	1	1	0	0	0	1	0	1	1	1	0	1	1	1	0	1	1	1	1	0	0	1	1	1	1	1	1	21
18.	1	1	1	1	0	0	0	0	1	0	0	1	1	0	0	1	0	1	1	0	1	0	0	0	1	1	1	1	1	1	17
19.	1	1	1	1	0	1	0	0	0	0	0	0	1	0	0	1	1	0	1	0	1	0	0	0	1	1	0	1	1	1	15
20.	1	1	1	1	1	0	0	0	1	0	0	1	1	1	0	1	1	0	1	0	1	0	1	1	1	1	0	1	1	0	19
21.	1	1	1	0	0	0	0	0	0	0	1	1	1	0	1	1	1	0	0	0	0	0	0	1	1	1	0	1	1	0	14
22.	1	0	1	1	0	0	0	0	1	0	0	0	0	0	1	0	0	1	1	1	1	1	0	0	0	1	1	1	1	0	14
23.	0	1	0	1	0	0	1	0	0	1	0	1	1	1	1	1	0	1	1	1	0	0	0	1	1	1	1	1	1	1	19
24.	1	1	1	1	1	0	0	0	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	24
25.	1	1	1	1	0	0	0	0	1	0	0	1	1	0	1	1	0	0	1	1	0	1	1	0	1	1	1	1	1	0	18
26.	0	1	0	1	0	1	0	0	1	0	0	1	1	1	0	1	0	0	0	1	1	1	0	1	1	1	0	1	1	0	16
27.	1	1	0	1	0	0	0	0	1	0	0	0	1	0	1	1	0	1	1	0	0	1	1	1	1	1	0	1	1	0	16
28.	1	1	1	1	0	1	0	1	1	0	0	1	1	0	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	23
29.	1	1	1	1	0	1	0	0	1	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	1	1	0	1	1	1	17
Σ	17	17	18	20	7	6	7	2	14	2	8	17	18	4	13	21	9	16	19	10	10	8	9	11	15	26	8	21	25	10	388

m. = 16.3

s.d. = 8.1

Table 118

School D. boys

Bender Gestalt (Error scores)

Subject	Card: A				1			2			3				4		5				6				7				8		Σ
	1a	1b	2	3	4	5	6	7	8	9	10	11	12a	12b	13	14	15	16	17a	17b	18a	18b	19	20	21a	21b	22	23	24	25	Σ
1.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
3.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	1	0	0	1	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	7
5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	4
6	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
7	0	0	0	0	0	1	0	1	1	0	1	0	0	0	1	1	0	1	0	0	0	1	0	0	1	1	0	1	1	0	12
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	0	5
10	0	1	1	1	0	0	0	0	1	0	0	0	1	0	0	1	0	1	1	0	1	1	0	0	1	1	1	1	1	0	15
11	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
12	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2
13	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	1	0	5
14	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	0	0	0	6
15	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	1	0	6
16	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	1	1	1	1	1	1	0	11
17.	1	1	1	0	1	0	0	0	1	0	1	1	1	0	1	1	1	1	1	0	1	0	0	1	1	1	0	1	0	0	18
18.	1	1	1	0	0	1	0	1	1	0	0	1	0	0	1	1	0	1	1	0	1	0	0	1	1	1	0	1	0	1	17
19.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	30
20.	1	1	1	1	1	1	0	0	1	0	0	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	23
21.	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	1	1	1	1	1	0	11
Σ =	7	7	7	4	3	5	1	4	10	1	6	5	4	1	7	8	6	9	7	1	7	5	3	7	10	15	5	10	10	4	179

mean = 8.5

s.d = 8.1

girls.

Subject	Card: A				1			2			3				4		5				6				7				8		Σ
	1a	1b	2	3	4	5	6	7	8	9	10	11	12a	12b	13	14	15	16	17a	17b	18a	18b	19	20	21a	21b	22	23	24	25	Σ
1.	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	3
2.	0	0	0	0	0	0	0	0	1	1	1	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	7
3.	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	5
4.	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	0	1	0	7
5.	0	0	0	1	0	0	0	0	0	0	1	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	7
6.	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	1	1	6
7.	1	1	0	0	1	0	1	0	0	1	1	1	0	0	1	1	1	0	0	0	1	0	0	1	1	1	0	1	1	0	16
8	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	1	0	7
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
10.	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
11	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
12.	0	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	0	1	0	0	1	0	10
13.	0	1	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	6
14	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	0	0	1	1	1	0	1	1	0	11
15.	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	6
16	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	3
17.	1	1	1	0	0	1	0	0	1	0	0	0	1	0	1	1	0	1	1	1	1	0	0	1	0	1	0	1	1	1	17
18	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	4
19.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	0	4
20.	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	1	0	7
21	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	4
22.	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	4
23.	1	1	0	0	1	0	0	0	1	0	1	0	0	0	0	1	0	1	1	0	0	0	1	0	1	1	0	1	1	0	13
24.	1	0	1	1	1	1	0	0	1	0	1	1	1	0	1	1	0	1	1	1	0	0	1	0	0	1	1	1	1	1	20
25.	1	1	0	0	0	0	0	0	1	0	0	0	1	0	1	1	0	1	0	0	0	1	0	0	0	1	1	1	1	1	13
	8	11	4	7	5	2	1	2	8	3	10	6	6	0	9	8	5	12	5	2	4	1	3	7	4	18	4	10	15	4	184

mean = 7.4. s.d. = 5.1

Table 119

School D — **Bender Gestalt (error scores)**

Subject No	Card A 1	2 a	2 b	3	Card 1 4	5	6	Card 2 7	8	9	Card 3 10	11	12 a	12 b	Card 4 13	14	Card 5 15	16	17 a	17 b	Card 6 18 a	18 b	19	20	Card 7 21 a	21 b	22	23	Card 8 24	25	TOTAL
1.	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	3
2.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.	0	0	1	0	0	1	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	7
6.	0	0	0	0	0	0	0	0	1	1	1	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	7
7.	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	5
8.	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	0	1	0	7
9.	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	4
10.	0	0	0	1	0	0	0	0	0	0	1	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	7
11.	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	1	1	6
12.	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
13.	1	1	0	0	1	0	1	0	0	1	1	1	0	0	1	1	1	0	0	0	1	0	0	1	1	1	0	1	1	0	16
14.	0	0	0	0	0	1	0	1	1	0	1	0	0	0	1	1	0	1	0	0	0	1	0	0	1	1	0	1	1	0	12
15.	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	1	0	7
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
17.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
18.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	0	5
19.	0	1	1	1	0	0	0	0	1	0	0	0	1	0	0	1	0	1	1	0	1	1	0	0	1	1	1	1	1	0	15
20.	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
21.	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
22.	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
23.	0	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	0	1	0	0	1	0	10
24.	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2
25.	0	1	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	6
26.	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	0	0	1	1	1	0	1	1	0	11
27.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	1	0	5
28.	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	6
29.	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	3
30.	1	1	1	0	0	1	0	0	1	0	0	0	1	0	1	1	0	1	1	1	1	0	0	1	0	1	0	1	1	1	17
31.	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	4
32.	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	0	0	0	6
33.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	1	0	6
34.	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	1	1	1	1	1	1	0	11
35.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	0	4
36.	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	1	0	7
37.	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	4
38.	1	1	1	0	1	0	0	0	1	0	1	1	1	0	1	1	1	1	1	0	1	0	0	1	1	1	0	1	0	0	18
39.	1	1	1	0	0	1	0	1	1	0	0	1	0	0	1	1	0	1	1	0	1	0	0	1	1	1	0	1	0	1	17
40.	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	4
41.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	30
42.	1	1	0	0	1	0	0	0	1	0	1	0	0	0	0	1	0	1	1	0	0	0	1	0	1	1	0	1	1	0	13
43.	1	0	1	1	1	1	0	0	1	0	1	1	1	0	1	1	0	1	1	1	0	0	1	0	0	1	1	1	1	1	20
44.	1	1	1	1	1	1	0	0	1	0	0	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	23
45.	1	1	0	0	0	0	0	0	1	0	0	0	1	0	1	1	0	1	0	0	0	1	0	0	0	1	1	1	1	1	13
46	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	1	1	1	1	1	0	11
Σ	15	18	11	11	8	7	2	6	18	4	16	11	10	1	16	16	11	21	12	3	11	6	6	14	14	33	9	20	25	8	363

m. = 7.9 s.d. 6.6

Table 120

Bender Gestalt (Error scores). School A.

Subject No.	Error score	Chron. age	Norm for age	Difference
1	3	15.5	0	- 3
2	1	12.8	0	- 1
3	10	12.2	0	-10
4	1	11.6	0.4	- 0.6
5	5	11.4	0.6	- 4.4
6	11	11.3	0.7	-10.3
7	3	10.1	1.6	- 1.4
8	3	9.8	1.6	- 1.4
9	6	9.0	1.7	- 4.3
10	7	9.0	1.7	- 5.3
11	5	8.9	1.9	- 3.1
12	2	8.5	2.5	+ 0.5
13	5	8.0	3.7	- 1.3
14	18	8.0	3.7	-14.3
15	12	7.8	4.1	- 7.9
16	18	7.8	4.1	-13.9
17	9	7.8	4.1	- 4.9
18	13	7.5	4.7	- 8.3
19	11	7.4	4.7	- 6.3
20	17	6.8	5.4	-11.6
21	12	6.7	5.7	- 6.3
22	11	6.2	7.6	- 3.4
23	14	6.1	8.0	- 6.0
24	15	5.5	9.8	- 5.2
25	28	5.2	13.6	-14.4
26	27	5.2	13.6	-13.4
27	21	5.0	13.6	- 7.4
28	28	5.0	13.6	-14.4
	m. = 11.4	m. = 8.4		
	s.d. = 7.9	s.d. = 2.6		

Table 121

Bender Gestalt (error scores)

School B

Subject No.	Error Scores	Chron.Age.	Norm.	d.
1	2	14.9	0	-2
2	4	13.5	0	-4
3	7	13.4	0	-7
4	11	12.9	0	-11
5	19	11.7	0.4	-18.6
6	10	11.6	0.4	- 9.6
7	20	10.7	1.3	-18.7
8	8	10.0	1.6	- 6.4
9	23	9.9	1.6	-21.4
10	21	9.8	1.6	-19.4
11	12	9.1	1.7	-10.3
12	4	9.0	1.7	- 2.3
13	18	9.0	1.7	-16.3
14	8	8.8	2.0	- 6.0
15	9	7.9	3.9	- 5.1
16	22	7.5	4.7	-17.3
17	22	7.2	4.8	-17.2
18	23	6.9	5.1	-17.9
19	22	6.9	5.1	-16.9
20	16	6.8	5.4	-10.6
21	24	6.8	5.4	-18.6
22	28	6.0	6.8	-21.2
23	7	6.0	8.4	+ 1.4
24	22	5.8	8.9	-13.1
25	24	5.7	9.2	-14.8
26	26	5.6	9.5	-16.5
27	28	5.2	12.1	-15.9
	m = 16.3	m = 8.8		
	s.d = 8.1	s.d = 2.8		

Table 122

Bender Gestalt (error scores).

School C.

Subject No.	Error Score	Chron. Age (yrs)	B.G. norm for age	Difference
1	1	13.7	0	-1
2	8	12.7	0	-8
3	1	11.5	0.5	-0.5
4	13	11.4	0.5	-12.5
5	6	11.4	0.6	-5.4
6	2	11.2	0.8	-1.2
7	1	9.4	1.6	+0.6
8	13	8.7	2.2	-10.8
9	15	8.6	2.3	-12.7
10	13	8.4	2.8	-10.2
11	8	7.8	4.1	-3.9
12	14	7.7	4.3	-9.7
13	19	7.2	4.8	-14.2
14	8	7.0	4.8	-3.2
15	13	7.0	4.8	-8.2
16	20	6.7	5.7	-14.3
17	21	6.6	6.1	-14.9
18	17	6.6	6.1	-10.9
19	15	6.6	6.1	-8.9
20	19	5.9	8.7	-10.3
21	14	5.9	8.7	-5.3
22	14	5.5	9.8	-4.2
23	19	5.3	11.3	-7.7
24	24	5.2	12.1	-11.9
25	18	5.2	12.1	-5.9
26	16	5.1	13.6	-2.4
27	16	5.1	13.6	-2.4
28	23	5.0	13.6	-9.4
29	17	5.0	13.6	-3.4

	Mean = 13.4		Mean = 7.7	
	s.d. = 6.5		s.d. = 2.6	

Table 123

Bender Gestalt (error scores).

School D.

Subject No.	Error Score	Chron. Age (yrs)	B.G. norm for age	Difference
1	3	16.0	0	- 3
2	0	16.0	0	0
3	2	16.0	0	- 2
4	0	15.8	0	0
5	7	15.5	0	- 7
6	7	15.4	0	- 7
7	7	15.1	0	- 7
8	7	15.0	0	- 7
9	4	14.9	0	- 4
10	7	14.6	0	- 7
11	6	14.1	0	- 6
12	2	13.8	0	- 2
13	16	13.8	0	-16
14	12	13.8	0	-12
15	7	13.5	0	- 7
16	1	13.4	0	- 1
17	1	13.3	0	- 1
18	5	13.2	0	- 5
19	15	13.1	0	-15
20	2	13.1	0	- 2
21	2	12.6	0	- 2
22	1	12.5	0	- 1
23	10	12.5	0	-10
24	2	11.9	0.1	- 1.9
25	6	11.8	0.2	- 5.8
26	11	11.7	0.3	-10.7
27	5	11.3	0.7	- 4.3
28	6	11.0	1.0	- 5.0
29	3	10.9	1.1	- 1.9
30	17	10.7	1.3	-15.7
31	4	10.7	1.3	- 2.7
32	6	10.3	1.5	- 4.5
33	6	10.3	1.5	- 4.5
34	11	10.2	1.6	- 9.4
35	4	10.1	1.6	- 2.4
36	7	9.7	1.6	- 5.4
37	4	9.6	1.6	- 2.4
38	18	8.9	1.9	-16.1
39	17	8.5	2.5	-14.5
40	4	7.3	4.7	+ 0.7
41	30	6.9	5.1	-24.9
42	13	6.7	5.7	- 7.3
43	20	6.7	5.7	-14.3
44	23	6.0	8.4	-14.6
45	13	5.8	8.9	- 4.1
46	11	5.3	11.3	+ 0.3
	Mean = 7.9		Mean = 11.7	
	S.D. = 6.6		S.D. = 3.0	

Table 124

Bender Gestalt (error scores)

School A Boys

Subject No.	Error Score	Chron. Age	B. G. Norm Error Score	Difference
1	1	12.8	0	-1
2	10	12.2	0	-10
3	1	11.6	0	-1
4	5	10.4	1.4	-3.6
5	3	10.1	1.5	-1.5
6	6	9.0	1.5	-4.5
7	2	8.5	2.6	+0.6
8	9	7.8	4.3	-4.7
9	13	7.5	4.9	-8.1
10	11	7.4	5.0	-6.0
11	17	6.8	5.7	-11.3
12	12	6.7	5.8	-6.2
13	11	6.2	7.5	-3.5
14	14	6.1	7.9	-6.1
15	28	5.0	14.3	-13.7
16	28	5.0	14.3	-13.7

BENDER GESTALT (error score)

Table 125

School B

Boys

Subject No	Error Score	Chron. Age	B.G. norm Error Score	Difference
1	2	14.9	0	- 2.0
2	4	13.5	0	- 4.0
3	7	13.4	0	- 7.0
4	19	11.7	0.2	-18.8
5	19	10.7	1.2	-17.8
6	23	9.9	1.5	-21.5
7	4	9.0	1.5	- 2.5
8	8	8.8	1.9	- 6.1
9	23	7.2	5.1	-17.9
10	23	6.9	5.5	-17.5
11	15	6.8	5.7	- 9.3
12	30	6.4	6.6	-23.4
13	24	5.7	9.3	-14.7
14	26	5.6	9.7	-16.3
15	30	5.2	12.6	-17.4

TABLE 126

BENDER GESTALT (ERROR SCORE)

School C
Boys

Subject No.	Error Score	Chron. Age (years)	B.G. Norm. Error Score	Difference
1	1	11.5	0.4	-0.6
2	13	11.5	0.4	-12.6
3	6	11.4	0.5	-5.5
4	8	7.8	4.3	-3.7
5	14	7.7	4.5	-9.5
6	13	7.0	5.3	-7.7
7	20	6.7	5.8	-14.2
8	17	6.6	6.0	-11.0
9	15	6.6	6.0	-9.0
10	19	5.9	8.6	-10.4
11	18	5.2	12.6	-5.4
12	16	5.0	14.3	-1.7

School D

TABLE 127

Boys'

BENDER GESTALT (error scores)

Subject No.	ERROR SCORES	C.A.	B.G. Norm error score	Difference
1	0	16.0	0	0
2	2	16.0	0	- 2
3	0	15.8	0	0
4	7	15.5	0	- 7
5	4	14.9	0	- 4
6	2	13.9	0	- 2
7	12	13.8	0	-12
8	1	13.3	0	- 1
9	5	13.2	0	- 5
10	15	13.1	0	-15
11	2	12.6	0	- 2
12	2	11.9	0	- 2
13	5	11.3	0.6	- 4.4
14	6	10.3	1.4	- 4.6
15	6	10.3	1.4	- 4.6
16	11	10.2	1.5	- 9.5
17	18	8.9	1.7	-16.3
18	17	8.5	2.6	-14.4
19	30	6.9	5.5	-24.5
20	23	6.0	8.3	-14.7
21	11	5.3	11.7	+ 0.7

TABLE 128

BENDER GESTALT (error scores)

SCHOOL A

GIRLS

Subject No	Error Score	Chron. Age	B.G.Norm for Age	Difference
1	3	15.5	0	- 3
2	11	11.3	0	-11
3	3	9.8	1.6	- 1.4
4	7	9.0	1.8	- 5.2
5	5	8.9	1.9	- 3.1
6	5	8.0	3.6	- 1.4
7	18	8.0	3.6	-14.4
8	12	7.8	3.8	- 8.4
9	18	7.8	3.8	-14.2
10	15	5.5	9.3	- 5.7
11	27	5.2	11.5	-15.5
12	21	5.0	13.0	- 8.0

Table 129

Bender Gestalt (error scores)

School B

Girls

Subject No.	Error Score	Chron Age.	B.G. Norm for age	difference
1	11	12.9	0	-11
2	10	11.6	0	-10
3	8	10.0	1.5	-6.5
4	21	9.8	1.6	-19.4
5	11	9.1	1.8	-9.2
6	18	9.0	1.8	-16.2
7	9	7.9	3.7	-5.3
8	23	7.5	4.2	-18.8
9	23	6.9	5.3	-17.7
10	25	6.8	5.7	-19.3
11	5	6.0	8.6	+3.6
12	22	5.8	8.9	-13.1

Table 130

Bender Gestalt (error score)

School C

Girls

Subject No.	Error score	Chron. Age (yrs.)	B.G. Norm for age	Difference
1	1	13.7	0	-.1
2	8	12.7	0	-.8
3	2	11.2	0	-.2
4	1	9.4	1.7	- 0.7
5	13	8.7	2.2	-10.8
6	15	8.6	2.3	-12.7
7	13	8.4	2.7	-10.3
8	19	7.2	4.3	-14.7
9	8	7.0	4.4	- 3.6
10	21	6.6	6.6	-14.4
11	14	5.9	8.8	- 5.2
12	14	5.5	9.3	- 4.7
13	19	5.3	11.4	- 7.6
14	24	5.2	11.5	-12.5
15	16	5.0	13.0	- 3.0
16	23	5.0	13.0	-10.0
17	17	5.0	13.0	- 4.0

Table. 131

Bender Gestalt (error scores)

School D

Girls

Subject N°	Error Score	Chron. Age (years)	B.G. Norm for age	Difference
1	3	16.0	0	- 3
2	7	15.4	0	- 7
3	5	15.1	0	- 5
4	7	15.0	0	- 7
5	7	14.6	0	- 7
6	6	14.1	0	- 6
7	16	13.8	0	-16
8	7	13.5	0	- 7
9	1	13.3	0	- 1
10	2	13.1	0	- 2
11	1	12.5	0	- 1
12	10	12.5	0	-10
13	6	11.8	0	- 6
14	11	11.7	0	-11
15	6	11.0	0	- 6
16	3	10.9	0.3	- 2.7
17	17	10.7	0.7	-16.3
18	4	10.7	0.7	- 3.3
19	4	10.1	1.7	- 2.3
20	7	9.7	1.6	- 5.4
21	4	9.6	1.7	- 2.3
22	4	7.3	4.3	+ 0.3
23	13	6.7	6.2	- 6.8
24	20	6.7	6.2	-13.8
25	13	5.8	8.9	- 4.1

Table II:32

Bender Gestalt (error scores). School A.

Distortion of shape.

	Boys (n=16)		Girls (n=12)		All (n=46)	
Card	error scores	%	error scores	%	error scores	%
A Ia	6	37.5	5	41.6	11	39.2
Ib	6	37.5	3	25.0	9	32.1
1	6	37.5	4	33.3	10	35.7
3	6	37.5	3	25.0	9	32.1
5	7	43.7	3	25.0	10	35.7
6 a	4	25.0	2	16.7	6	21.4
6 b	2	12.5	2	16.7	4	14.3
7 a	4	25.0	5	41.7	9	32.1
7 b	11	68.7	12	100.0	23	82.1
8	10	62.5	8	66.7	18	64.3
	62	38.7	47	39.2	109	38.9

Rotation.

	Boys (n=16)		Girls (n=12)		All (n=46)	
Card	error scores	%	error scores	%	error scores	%
A	8	50.0	6	50.0	14	50.0
1	3	18.7	1	8.3	4	14.3
2	2	12.5	0	0	2	7.1
3	11	68.7	5	41.7	16	57.1
4	8	50.0	8	66.7	16	57.1
5	5	31.2	8	66.7	13	46.4
7	8	50.0	8	66.7	16	57.1
8	3	18.7	2	16.7	5	17.8
	48	37.5	38	39.6	86	38.4

Integration.

	Boys (n=16)		Girls (n=12)		All (n=46)	
Card	error scores	%	error scores	%	error scores	%
A	8	50.0	6	50.0	14	50.0
2	2	12.5	0	0	2	7.1
3 a	11	68.7	9	75.0	20	71.4
3 b	2	12.5	2	16.7	4	14.3
4	7	43.7	6	50.0	13	46.4
5 a	2	12.5	3	25.0	5	17.8
5 b	1	6.2	4	33.3	5	17.8
6	3	18.7	4	33.3	7	25.0
7	9	56.2	8	66.7	17	60.7
	45	31.2	42	38.9	87	34.5

Perseveration.

	Boys (n=16)		Girls (n=12)		All (n=46)	
Card	error scores	%	error scores	%	error scores	%
1	3	18.7	5	41.7	8	28.6
2	5	31.2	4	33.3	9	32.1
6	8	50.0	7	58.3	15	53.6
	16	33.3	16	44.4	32	38.1

Table 133

Bender Gestalt (error scores). School B.

Distortion of shape.

Card	Boys (n=15) error scores	%	Girls (n=12) error scores	%	All (=27) error scores	%
A a	10	66.7	6	50.0	16	59.3
" b	8	53.3	8	66.7	16	59.3
1	6	40.0	7	58.3	13	48.1
3	7	46.7	3	25.0	10	37.0
5	9	60.0	3	25.0	12	44.4
6 a	8	53.3	4	33.3	12	44.4
" b	5	33.3	6	50.0	11	40.7
7 a	10	66.7	6	50.0	16	59.3
" b	11	73.3	11	91.7	22	81.5
8	11	73.3	12	100.0	23	85.2
	85	56.7	66	55.0	151	56.0

Rotation.

Card	Boys error scores	%	Girls error scores	%	All error scores	%
A	7	46.7	6	50.0	13	48.1
1	6	40.0	2	16.7	8	29.6
2	6	40.0	4	33.3	10	37.0
3	9	60.0	7	58.3	16	59.3
4	8	53.3	4	33.3	12	44.4
5	10	66.7	6	50.0	16	59.3
7	10	66.7	9	75.0	19	70.4
8	6	40.0	6	50.0	12	44.4
	62	51.7	44	45.8	106	49.1

Integration.

Card	Boys error scores	%	Girls error scores	%	All error scores	%
A	10	66.7	6	50.0	16	59.3
2	11	73.3	8	66.7	19	70.4
3 a	11	73.3	9	75.0	20	74.1
" b	4	26.7	1	8.3	5	18.5
4	10	66.7	8	66.7	18	66.7
5 a	10	66.7	6	50.0	16	59.3
" b	10	66.7	10	83.3	20	74.1
6	11	73.3	6	50.0	17	63.0
7	13	86.7	9	75.0	22	81.5
	90	66.7	63	58.3	153	63.0

Perseveration.

Card	Boys error scores	%	Girls error scores	%	All error scores	%
1	6	40.0	6	50.0	12	44.4
2	4	26.7	3	25.0	7	26.0
6	10	66.7	4	33.3	14	51.8
	20	44.4	13	36.1	33	40.7

Table 134

Bender Gestalt (error scores). School C.

Distortion of shape.

Card	Boys (n=12) error scores	%	Girls (n=17) error scores	%	All (n=46) error scores	%
A a	7	58.3	10	58.8	17	58.6
" b	8	66.7	9	52.9	17	58.6
1	3	25.0	4	23.5	7	24.1
3	3	25.0	5	29.4	8	27.6
5	10	83.3	11	64.7	21	72.4
6 a	5	41.7	5	29.4	10	34.5
" b	2	16.7	6	35.3	8	27.6
7 a	7	58.3	8	47.1	15	51.7
" b	11	91.7	15	88.2	26	89.6
8	11	91.7	14	82.3	25	86.2
	67	55.8	87	51.2	154	53.1

Rotation.

Card	error scores	%	error scores	%	error scores	%
A	7	58.3	11	64.7	18	62.1
1	4	33.3	2	11.8	6	20.7
2	0	0	2	11.8	2	6.9
3	6	50.0	11	64.7	17	58.6
4	3	25.0	10	58.8	13	44.8
5	5	41.7	11	64.7	16	55.2
7	2	16.7	6	35.3	8	27.6
8	5	41.7	5	29.4	10	34.5
	32	33.3	58	42.6	90	38.8

Integration.

Card	error scores	%	error scores	%	error scores	%
A	9	75.0	11	64.7	20	69.0
2	5	41.7	9	52.9	14	48.3
3 a	7	58.3	11	64.7	18	62.1
" b	3	25.0	1	5.9	4	13.8
4	10	83.3	11	64.7	21	72.4
5 a	9	75.0	10	58.8	19	65.5
" b	4	33.3	6	35.3	10	34.5
6	4	33.3	5	29.4	9	31.0
7	10	83.3	11	64.7	21	72.4
	61	56.5	75	49.0	136	52.1

Perseveration.

Card	error scores	%	error scores	%	error scores	%
1	2	16.7	5	29.4	7	24.1
2	1	8.3	1	5.9	2	6.9
6	4	33.3	7	41.2	11	38.0
	7	19.4	13	25.5	20	23.0

Table 135

Bender Gestalt (Error scores). School D.

Distortion of shape.

	Boys (n=21)		Girls (n=25)		All (n=46)	
Card	error scores	%	error scores	%	error scores	%
A a	7	33.3	8	32.0	15	32.6
" b	7	33.3	11	44.0	18	39.1
1	3	14.3	5	20.0	8	17.4
3	6	28.6	10	40.0	16	34.8
5	6	28.6	5	20.0	11	24.0
6 a	7	33.3	4	16.0	11	24.0
" b	5	23.8	1	4.0	6	13.0
7 a	10	47.6	4	16.0	14	30.4
" b	15	71.4	18	72.0	33	71.7
8	10	47.6	15	60.0	25	54.3
	76	36.2	81	32.4	157	34.1

Rotation.

A	7	33.3	4	16.0	11	24.0
1	5	23.8	2	8.0	7	15.2
2	4	19.0	2	8.0	6	13.0
3	5	23.8	6	24.0	11	24.0
4	7	33.3	9	36.0	16	34.8
5	9	42.9	12	48.0	21	45.7
7	5	23.8	4	16.0	9	19.6
8	4	19.0	4	16.0	8	17.4
	46	27.4	43	21.5	89	24.2

Integration.

A	4	19.0	7	28.0	11	24.0
2	4	19.0	2	8.0	6	13.0
3 a	4	19.0	6	24.0	10	21.7
" b	1	4.8	0	0	1	2.2
4	8	38.1	8	32.0	16	34.8
5 a	7	33.3	5	20.0	12	26.1
" b	1	4.8	2	8.0	3	6.5
6	3	14.3	3	12.0	6	13.0
7	10	47.6	10	40.0	20	43.5
	42	22.2	43	19.1	85	20.5

Perseveration.

1	1	4.8	1	4.0	2	4.3
2	1	4.8	3	12.0	4	8.7
6	7	33.3	7	28.0	14	30.4
	9	14.3	11	14.7	20	14.5

Table 136

Bender Gestalt.

	Boys (n=64)		Girls (n=66)		All (n=130)	
	Total error scores.	%	Total error scores.	%	Total error scores	%
			Distortion of shape.			
Card						
Aa	30	46.9	29	44.0	59	45.0
Ab	29	45.3	31	47.0	60	46.1
1	18	28.1	20	30.3	38	29.2
3	22	34.4	21	31.8	43	33.1
5	32	50.0	22	33.3	54	41.5
6a	24	37.5	15	22.7	39	30.0
6b	14	21.9	15	22.7	29	22.3
7a	31	48.4	23	34.8	54	41.5
7b	48	75.0	56	84.8	104	80.0
8	42	65.6	49	74.2	91	70.0
Total	290	45.3	281	42.6	571	43.9
			Rotation.			
A	29	45.3	27	40.9	56	43.1
1	18	28.1	7	10.6	25	19.2
2	12	18.7	8	12.1	20	15.4
3	31	48.4	29	44.0	60	46.1
4	26	40.6	31	47.0	57	43.8
5	29	45.3	37	56.1	66	50.8
7	25	39.1	27	40.9	52	40.0
8	18	28.1	17	25.7	35	26.9
Total	188	36.7	183	34.7	371	35.7
			Integration.			
A	31	48.4	30	45.4	61	47.0
2	22	34.4	19	28.8	41	31.5
3a	33	51.6	35	53.0	68	52.3
3b	10	15.6	4	6.1	14	10.8
4	35	54.7	33	50.0	68	52.3
5a	28	43.7	24	36.4	52	40.0
5b	16	25.0	22	33.3	38	29.2
6	21	32.8	18	27.3	39	30.0
7	42	65.6	38	57.6	80	61.5
Total	238	41.3	223	37.5	461	39.4
			Perseveration.			
1	12	18.7	17	25.8	29	22.3
2	11	17.2	11	16.7	22	16.9
6	29	45.3	25	37.9	54	41.5
Total	52	27.1	53	26.8	105	26.9

Table 137

Reading.

	School A.				School B.		
No.	Raw score	Chron. age	Read. age	No.	Raw score	Chron. age	Read. age.
1	100	15.5	12.0*	1	100	14.9	12.0*
2	92	12.8	12.0*	2	7	13.5	5.5
3	79	12.2	11.0	3	41	13.4	7.4
4	84	11.6	11.5	4	25	12.9	6.4
5	102	11.4	12.0*	5	0	11.7	5.0 N.R.
6	0	11.3	5.0 N.R.	6	10	11.6	5.6
7	75	10.1	10.6	7	53	10.7	8.5
8	22	9.8	6.2	8	69	10.0	10.0
9	94	9.0	12.0*	9	0	9.9	5.0 N.R.
10	20	9.0	6.2	10	0	9.8	5.0 N.R.
11	4	8.9	5.3	11	22	9.1	6.2
12	4	8.5	5.3	12	63	9.0	9.5
13	10	8.0	5.6	13	0	9.0	5.0 N.R.
14	9	8.0	5.6	14	55	8.8	8.7
15	27	7.8	6.3	15	35	7.9	6.9
16	7	7.8	5.5	16	0	7.5	5.0 N.R.
17	42	7.8	7.5	17	0	7.2	5.0 N.R.
18	2	7.5	5.3	18	0	6.9	5.0 N.R.
19	4	7.4	5.3	19	0	6.9	5.0 N.R.
20	12	6.8	5.6	20	0	6.8	5.0 N.R.
21	10	6.7	5.6	21	0	6.8	5.0 N.R.
22	35	6.2	6.9	22	0	6.4	5.0 N.R.
23	6	6.1	5.4	23	11	6.0	5.6
24	0	5.5	5.0 N.R.	24	0	5.8	5.0 N.R.
25	0	5.2	5.0 N.R.	25	0	5.7	5.0 N.R.
26	0	5.2	5.0 N.R.	26	0	5.6	5.0 N.R.
27	0	5.0	5.0 N.R.	27	0	5.2	5.0 N.R.
28	0	5.0	5.0 N.R.				

m. = 30.0   m. = 18.2

s.d. = 36.8   s.d. = 27.7

* = Fluent

N.R. = Non - reader.

Table 138

Reading.

School C.

No.	Raw score	Chron. age	Read. age
1	71	13.7	10.2
2	41	12.7	7.4
3	30	11.5	6.6
4	74	11.5	10.5
5	83	11.4	11.3
6	42	11.2	7.5
7	7	9.4	5.5
8	3	8.7	5.3
9	0	8.6	5.0 N.R.
10	0	8.4	5.0 N.R.
11	8	7.8	5.5
12	23	7.7	6.3
13	51	7.2	8.3
14	8	7.0	5.5
15	2	7.0	5.3
16	0	6.7	5.0 N.R.
17	0	6.6	5.0 N.R.
18	0	6.6	5.0 N.R.
19	0	6.6	5.0 N.R.
20	0	5.9	5.0 N.R.
21	3	5.9	5.3
22	0	5.5	5.0 N.R.
23	0	5.3	5.0 N.R.
24	0	5.2	5.0 N.R.
25	0	5.2	5.0 N.R.
26	0	5.1	5.0 N.R.
27	0	5.1	5.0 N.R.
28	0	5.0	5.0 N.R.
29	0	5.0	5.0 N.R.

m. = 15.4
s.d. = 25.5

School D.

No.	Raw score	Chron. age	Read. age
1	105	16.0	12.0 *
2	110	16.0	12.0 *
3	18	16.0	6.1
4	100	15.8	12.0 *
5	108	15.5	12.0 *
6	85	15.4	11.6
7	104	15.1	12.0 *
8	100	15.0	12.0 *
9	91	14.9	12.0 *
10	96	14.6	12.0 *
11	105	14.1	12.0 *
12	93	13.8	12.0 *
13	15	13.8	5.9
14	17	13.8	6.0
15	73	13.5	10.5
16	100	13.5	12.0 *
17	110	13.4	12.0 *
18	95	13.2	12.0 *
19	0	13.1	5.0 N.R.
20	71	13.1	10.2
21	41	12.6	7.4
22	71	12.5	10.2
23	44	12.5	7.7
24	91	11.9	12.0 *
25	11	11.8	5.7
26	16	11.7	5.9
27	33	11.3	6.9
28	31	11.0	6.7
29	22	10.9	6.2
30	0	10.7	5.0 N.R.
31	42	10.7	7.5
32	9	10.3	5.6
33	15	10.3	5.9
34	51	10.2	8.3
35	75	10.1	10.6
36	36	9.7	7.0
37	67	9.6	9.9
38	45	8.9	7.7
39	34	8.5	6.9
40	21	7.3	6.2
41	40	6.9	7.2
42	4	6.7	5.3
43	0	6.7	5.0 N.R.
44	0	6.0	5.0 N.R.
45	3	5.8	5.3
46	2	5.3	5.2

m. = 52.2
s.d.= 39.6

* = Fluent
N.R. = Non-reader.

Table 139

Reading (whole sample).

No.	R.S.	C.A.	R.A.	No.	R.S.	C.A.	R.A.
1	105	16.0	12.0*	47	22	10.9	6.3
2	110	16.0	12.0*	48	53	10.7	8.5
3	18	16.0	6.1	49	0	10.7	5.0 N.R.
4	100	15.8	12.0*	50	42	10.7	7.6
5	108	15.5	12.0*	51	9	10.3	5.6
6	100	15.5	12.0*	52	15	10.3	5.9
7	85	15.4	11.7	53	51	10.2	8.3
8	104	15.1	12.0*	54	74	10.1	10.6
9	100	15.0	12.0*	55	75	10.1	10.7
10	91	14.9	12.0*	56	69	10.0	10.1
11	100	14.9	12.0*	57	0	9.9	5.0 N.R.
12	96	14.6	12.0*	58	22	9.8	6.3
13	105	14.1	12.0*	59	0	9.8	5.0 N.R.
14	93	13.8	12.0*	60	36	9.7	7.2
15	15	13.8	5.9	61	67	9.6	9.9
16	17	13.8	6.0	62	7	9.4	5.5
17	71	13.7	10.3	63	22	9.1	6.3
18	73	13.5	10.5	64	0	9.0	5.0 N.R.
19	6	13.5	5.4	65	94	9.0	12.0*
20	41	13.4	7.5	66	22	9.0	6.3
21	100	13.4	12.0*	67	63	9.0	9.5
22	110	13.3	12.0*	68	45	8.9	7.9
23	95	13.2	12.0*	69	4	8.9	5.3
24	0	13.1	5.0 N.R.	70	55	8.8	8.7
25	71	13.1	10.3	71	3	8.7	5.3
26	23	12.9	6.3	72	0	8.6	5.0 N.R.
27	92	12.8	12.0*	73	34	8.5	7.0
28	41	12.7	7.5	74	4	8.5	5.3
29	41	12.6	7.5	75	0	8.4	5.0 N.R.
30	71	12.5	10.3	76	10	8.0	5.6
31	44	12.5	7.7	77	10	8.0	5.6
32	79	1212	11.1	78	35	7.9	7.1
33	91	11.9	12.0*	79	41	7.9	7.5
34	11	11.8	5.7	80	8	7.8	5.5
35	16	11.7	5.9	81	27	7.8	6.6
36	0	11.7	5.0 N.R.	82	7	7.8	5.5
37	10	11.6	5.6	83	23	7.7	6.3
38	84	11.6	11.6	84	0	7.5	5.0 N.R.
39	30	11.5	6.7	85	2	7.5	5.3
40	74	11.4	10.6	86	4	7.4	5.3
41	83	11.4	11.5	87	21	7.3	6.2
42	102	11.4	12.0*	88	51	7.2	8.3
43	33	11.3	6.9	89	0	7.2	5.0 N.R.
44	0	11.3	5.0 N.R.	90	8	7.0	5.5
45	42	11.3	7.6	91	2	7.0	5.3
46	31	11.0	6.9	92	0	6.9	5.0 N.R.

Table 139 continued.

Reading (whole sample).

No.	R.S.	C.A.	R.A.	No.	R.S.	C.A.	R.A.
93	37	6.9	7.3	112	0	5.7	5.0 N.R.
94	0	6.9	5.0 N.R.	113	0	5.6	5.0 N.R.
95	13	6.8	5.7	114	0	5.6	5.0 N.R.
96	0	6.8	5.0 N.R.	115	0	5.5	5.0 N.R.
97	0	6.8	5.0 N.R.	116	0	5.5	5.0 N.R.
98	4	6.7	5.3	117	2	5.3	5.3
99	0	6.7	5.0 N.R.	118	0	5.3	5.0 N.R.
100	8	6.7	5.5	119	0	5.3	5.0 N.R.
101	0	6.6	5.0 N.R.	120	0	5.2	5.0 N.R.
102	0	6.6	5.0 N.R.	121	0	5.2	5.0 N.R.
103	0	6.6	5.0 N.R.	122	0	5.2	5.0 N.R.
104	35	6.2	7.1	123	0	5.2	5.0 N.R.
105	6	6.1	5.4	124	0	5.2	5.0 N.R.
106	0	6.0	5.0 N.R.	125	0	5.1	5.0 N.R.
107	11	6.0	5.7	126	0	5.1	5.0 N.R.
108	0	5.9	5.0 N.R.	127	0	5.0	5.0 N.R.
109	3	5.9	5.3	128	0	5.0	5.0 N.R.
110	3	5.8	5.3	129	0	5.0	5.0 N.R.
111	0	5.8	5.0 N.R.	130	0	5.0	5.0 N.R.

Table 140

Reading (all boys).

1	110	16.0	12.0*	25	53	10.7	8.5
2	18	16.0	6.1	26	9	10.3	5.6
3	100	15.8	12.0*	27	15	10.3	5.9
4	108	15.5	12.0*	28	51	10.2	8.3
5	91	14.9	12.0*	29	74	10.1	10.6
6	100	14.9	12.0*	30	0	9.9	5.0 N.R.
7	93	13.8	12.0*	31	94	9.0	12.0*
8	17	13.8	6.0	32	63	9.0	9.5
9	6	13.5	5.4	33	45	8.9	7.8
10	41	13.4	7.5	34	55	8.8	8.7
11	110	13.3	12.0*	35	34	8.5	7.0
12	95	13.2	12.0*	36	4	8.5	5.3
13	0	13.1	5.0 N.R.	37	8	7.8	5.5
14	92	12.8	12.0*	38	41	7.8	7.5
15	41	12.6	7.5	39	23	7.7	6.3
16	79	12.2	10.9	40	2	7.5	5.3
17	91	11.9	12.0*	41	4	7.4	5.3
18	0	11.7	5.0 N.R.	42	0	7.2	5.0 N.R.
19	84	11.6	11.7	43	2	7.0	5.3
20	30	11.5	6.7	44	37	6.9	7.3
21	74	11.4	10.6	45	0	6.9	5.0 N.R.
22	83	11.4	11.5	46	13	6.8	5.7
23	102	11.4	12.0*	47	0	6.8	5.0 N.R.
24	33	11.3	6.9	48	8	6.7	5.5

Table 140 continued.

Reading (all boys).

No.	R.S.	C.A.	R.A.	No.	R.S.	C.A.	R.A.
49	0	6.7	5.0 N.R.	57	0	5.6	6.0 N.R.
50	0	6.6	4.0 N.R.	58	2	5.3	5.2
51	0	6.6	5.0 N.R.	59	0	5.3	5.0 N.R.
52	35	6.2	6.9	60	0	5.2	5.0 N.R.
53	6	6.1	5.0 N.R.	61	0	5.2	5.0 N.R.
54	0	6.0	5.0 N.R.	62	0	5.2	5.0 N.R.
55	0	5.9	5.0 N.R.	63	0	5.1	5.0 N.R.
56	0	5.7	5.0 N.R.	64	0	5.0	5.0 N.R.

Table 141

Reading (all girls).

No.	R.S.	C.A.	R.A.	No.	R.S.	C.A.	R.A.
1	105	16.0	12.0*	34	0	9.0	5.0 N.R.
2	100	15.5	12.0*	35	22	9.0	6.2
3	85	15.4	11.6	36	4	8.9	5.3
4	104	15.1	12.0*	37	3	8.7	5.3
5	100	15.0	12.0*	38	0	8.6	5.0 N.R.
6	96	14.6	12.0*	39	0	8.4	5.0 N.R.
7	105	14.1	12.0*	40	10	8.0	5.6
8	15	13.8	5.9	41	10	8.0	5.6
9	71	13.7	10.2	42	35	7.9	6.9
10	73	13.5	10.4	43	27	7.8	6.3
11	100	13.4	12.0*	44	7	7.8	5.5
12	71	13.1	10.2	45	0	7.5	5.0 N.R.
13	23	12.9	6.3	46	21	7.3	6.1
14	41	12.7	7.3	47	51	7.2	8.3
15	71	12.5	10.2	48	8	7.0	5.5
16	44	12.5	7.7	49	0	6.9	5.0 N.R.
17	11	11.8	5.7	50	0	6.8	5.0 N.R.
18	16	11.7	5.9	51	4	6.7	5.2
19	10	11.6	5.6	52	0	6.7	5.0 N.R.
20	0	11.3	5.0 N.R.	53	0	6.7	5.0 N.R.
21	42	11.2	7.5	54	11	6.0	5.7
22	31	11.0	6.7	55	3	5.9	5.2
23	22	10.9	6.2	56	3	5.8	5.2
24	0	10.7	5.0 N.R.	57	0	5.8	5.0 N.R.
25	42	10.7	7.5	58	0	5.5	5.0 N.R.
26	75	10.1	10.6	59	0	5.5	5.0 N.R.
27	69	10.0	10.0	60	0	5.3	5.0 N.R.
28	22	9.8	6.2	61	0	5.2	5.0 N.R.
29	0	9.8	5.0 N.R.	62	0	5.2	5.0 N.R.
30	36	9.7	7.0	63	0	5.1	5.0 N.R.
31	67	9.6	9.8	64	0	5.0	5.0 N.R.
32	7	9.4	5.5	65	0	5.0	5.0 N.R.
33	22	9.1	6.2	66	0	5.0	5.0 N.R.

APPENDIX D.

Original working tally sheets.

Table 142

Test IA .... Provoked Correspondence (one static set)

School A ... boys.

Subject No.	Subtest i, Stage 1	i, 2	i, 3	ii, 1	ii, 2	ii, 3	iii, 1	iii, 2	iii, 3	iv, 1	iv, 2	iv, 3
1	·	✓	·	✓	·	·	✓	·	·	✓	·	·
2	·	✓	·	·	·	✓	·	·	✓	·	·	✓
3	·	·	✓	·	·	✓	·	·	✓	·	·	✓
4	·	·	✓	·	·	✓	·	·	✓	·	·	✓
5	·	✓	·	✓	·	·	✓	·	·	✓	·	·
6	·	·	✓	·	·	✓	·	·	✓	·	·	✓
7	✓	·	·	·	·	✓	·	·	✓	·	·	✓
8	·	✓	·	·	·	✓	✓	·	·	✓	·	·
9	✓	·	·	·	✓	·	·	✓	·	·	·	✓
10	·	✓	·	·	✓	·	·	·	✓	·	·	✓
11	✓	·	·	✓	·	·	·	✓	·	✓	·	·
12	·	✓	·	✓	·	·	✓	·	·	✓	·	·
13	·	✓	·	✓	·	·	✓	·	·	✓	·	·
14	·	✓	·	·	✓	·	·	✓	·	·	✓	·
15	✓	·	·	✓	·	·	✓	·	·	✓	·	·
16	✓	·	·	✓	·	·	✓	·	·	✓	·	·

School A ... girls.

Subject No.	i, Stage 1	i, 2	i, 3	ii, 1	ii, 2	ii, 3	iii, 1	iii, 2	iii, 3	iv, 1	iv, 2	iv, 3
1	·	✓	·	·	✓	·	·	·	✓	·	·	✓
2	✓	·	·	✓	·	·	✓	·	·	✓	·	·
3	✓	·	·	✓	·	·	✓	·	·	✓	·	·
4	·	✓	·	·	✓	·	·	·	✓	·	·	✓
5	·	·	✓	·	✓	·	·	✓	·	·	·	✓
6	✓	·	·	✓	·	·	✓	·	·	✓	·	·
7	✓	·	·	✓	·	·	·	·	✓	·	✓	·
8	·	✓	·	·	✓	·	·	✓	·	·	✓	·
9	·	✓	·	✓	·	·	✓	·	·	✓	·	·
10	✓	·	·	✓	·	·	✓	·	·	✓	·	·
11	✓	·	·	✓	·	·	✓	·	·	✓	·	·
12	✓	·	·	✓	·	·	✓	·	·	✓	·	·

School B ... boys

Subject No.	i, 1	i, 2	i, 3	ii, 1	ii, 2	ii, 3	iii, 1	iii, 2	iii, 3	iv, 1	iv, 2	iv, 3
1	·	·	✓	·	·	✓	·	·	✓	·	·	✓
2	·	·	✓	·	·	✓	·	·	✓	·	·	✓
3	·	✓	·	·	✓	·	·	✓	·	·	✓	·
4	✓	·	·	✓	·	·	✓	·	·	✓	·	·
5	✓	·	·	✓	·	·	✓	·	·	✓	·	·
6	✓	·	·	✓	·	·	✓	·	·	✓	·	·
7	·	·	✓	·	·	✓	·	·	✓	·	·	✓
8	·	·	✓	·	·	✓	·	·	✓	·	·	✓
9	·	✓	·	·	✓	·	·	✓	·	·	✓	·
10	✓	·	·	✓	·	·	✓	·	·	✓	·	·
11	✓	·	·	✓	·	·	✓	·	·	✓	·	·
12	✓	·	·	✓	·	·	✓	·	·	✓	·	·
13	·	·	✓	·	·	✓	·	·	✓	·	·	✓
14	✓	·	·	✓	·	·	✓	·	·	✓	·	·
15	✓	·	·	✓	·	·	✓	·	·	✓	·	·

School B ... girls.

Subject No.	i, 1	i, 2	i, 3	ii, 1	ii, 2	ii, 3	iii, 1	iii, 2	iii, 3	iv, 1	iv, 2	iv, 3
1	✓	·	·	✓	·	·	✓	·	·	✓	·	·
2	✓	·	·	✓	·	·	✓	·	·	✓	·	·
3	·	·	✓	·	·	✓	·	·	✓	·	·	✓
4	✓	·	·	✓	·	·	✓	·	·	✓	·	·
5	·	✓	·	·	✓	·	·	✓	·	·	✓	·
6	✓	·	·	✓	·	·	✓	·	·	✓	·	·
7	·	✓	·	·	✓	·	·	✓	·	·	✓	·
8	✓	·	·	✓	·	·	✓	·	·	✓	·	·
9	✓	·	·	✓	·	·	·	✓	·	·	✓	·
10	·	✓	·	·	✓	·	·	✓	·	·	✓	·
11	·	·	✓	·	·	✓	·	·	✓	·	·	✓
12	✓	·	·	✓	·	·	·	✓	·	✓	·	·

School C ... boys

Subject No.	i, 1	i, 2	i, 3	ii, 1	ii, 2	ii, 3	iii, 1	iii, 2	iii, 3	iv, 1	iv, 2	iv, 3
1	·	·	✓	·	·	✓	·	·	✓	·	·	✓
2	·	·	✓	·	·	✓	·	·	✓	·	·	✓
3	·	·	✓	·	·	✓	·	·	✓	·	·	✓
4	·	·	✓	·	·	✓	·	·	✓	·	·	✓
5	✓	·	·	✓	·	·	·	✓	·	·	✓	·
6	·	✓	·	·	✓	·	·	·	✓	·	✓	·
7	·	✓	·	·	✓	·	·	✓	·	·	✓	·
8	✓	·	·	·	✓	·	✓	·	·	✓	·	·
9	✓	·	·	✓	·	·	✓	·	·	✓	·	·
10	✓	·	·	·	✓	·	✓	·	·	✓	·	·
11	✓	·	·	✓	·	·	·	✓	·	✓	·	·
12	✓	·	·	·	✓	·	·	·	✓	·	✓	·

School C ... girls

Subject No.	i, 1	i, 2	i, 3	ii, 1	ii, 2	ii, 3	iii, 1	iii, 2	iii, 3	iv, 1	iv, 2	iv, 3
1	·	·	✓	·	·	✓	·	·	✓	·	·	✓
2	·	·	✓	·	·	✓	·	·	✓	·	·	✓
3	·	·	✓	·	·	✓	·	·	✓	·	·	✓
4	·	·	✓	·	·	✓	·	·	✓	·	·	✓
5	·	·	✓	·	·	✓	·	·	✓	·	·	✓
6	·	·	✓	·	·	✓	·	·	✓	·	·	✓
7	✓	·	·	·	✓	·	✓	·	·	✓	·	·
8	✓	·	·	✓	·	·	✓	·	·	✓	·	·
9	·	·	✓	·	✓	·	·	·	✓	·	✓	·
10	✓	·	·	✓	·	·	✓	·	·	✓	·	·
11	✓	·	·	✓	·	·	✓	·	·	✓	·	·
12	✓	·	·	✓	·	·	✓	·	·	✓	·	·
13	✓	·	·	✓	·	·	✓	·	·	·	✓	·
14	·	·	✓	✓	·	·	·	✓	·	·	·	✓
15	·	✓	·	✓	·	·	✓	·	·	·	✓	·
16	✓	·	·	✓	·	·	✓	·	·	✓	·	·
17	✓	·	·	✓	·	·	✓	·	·	✓	·	·

Table 142 continued

Test 1A . . . Provoked Correspondence (one static set.)

School D . . . boys.

Subject No.	i 1	i 2	i 3	ii 1	ii 2	ii 3	iii 1	iii 2	iii 3	iv 1	iv 2	iv 3
1	·	·	✓	·	·	✓	·	·	✓	·	·	✓
2	·	·	✓	·	·	✓	·	·	✓	·	·	✓
3	·	·	✓	·	·	✓	·	·	✓	·	·	✓
4	·	·	✓	·	·	✓	·	·	✓	·	·	✓
5	·	·	✓	·	·	✓	·	·	✓	·	·	✓
6	·	·	✓	·	·	✓	·	·	✓	·	·	✓
7	·	·	✓	·	·	✓	·	·	✓	·	·	✓
8	·	·	✓	·	·	✓	·	·	✓	·	·	✓
9	·	·	✓	·	·	✓	·	·	✓	·	·	✓
10	✓	·	·	✓	·	·	✓	·	·	✓	·	·
11	·	·	✓	·	·	✓	·	·	✓	·	·	✓
12	·	·	✓	·	·	✓	·	·	✓	·	·	✓
13	·	·	✓	·	·	✓	·	·	✓	·	·	✓
14	·	·	✓	·	✓	·	·	·	✓	·	✓	·
15	·	·	✓	·	✓	·	·	·	✓	·	✓	·
16	·	·	✓	·	·	✓	·	·	✓	·	·	✓
17	·	·	✓	·	✓	·	·	✓	·	·	·	✓
18	·	·	✓	·	✓	·	·	✓	·	·	·	✓
19	✓	·	·	✓	·	·	✓	·	·	✓	·	·
20	✓	·	·	✓	·	·	✓	·	·	✓	·	·
21	·	✓	·	·	·	✓	·	·	✓	·	·	✓

School D . . . girls

Subject No.	i 1	i 2	i 3	ii 1	ii 2	ii 3	iii 1	iii 2	iii 3	iv 1	iv 2	iv 3
1	·	·	✓	·	·	✓	·	·	✓	·	·	✓
2	·	·	✓	·	·	✓	·	·	✓	·	·	✓
3	·	·	✓	·	·	✓	·	·	✓	·	·	✓
4	·	·	✓	·	·	✓	·	·	✓	·	·	✓
5	·	·	✓	·	·	✓	·	·	✓	·	·	✓
6	·	·	✓	·	·	✓	·	·	✓	·	·	✓
7	·	·	✓	·	·	✓	·	·	✓	·	·	✓
8	·	✓	·	·	✓	·	·	✓	·	·	✓	·
9	·	·	✓	·	·	✓	·	·	✓	·	·	✓
10	·	·	✓	·	·	✓	·	·	✓	·	·	✓
11	·	·	✓	·	·	✓	·	·	✓	·	·	✓
12	✓	·	·	✓	·	·	·	✓	·	✓	·	·
13	·	✓	·	·	·	✓	·	·	✓	·	·	✓
14	·	·	✓	·	·	✓	·	·	✓	·	·	✓
15	·	·	✓	·	·	✓	·	·	✓	·	·	✓
16	·	✓	·	·	✓	·	·	·	✓	·	·	✓
17	·	✓	·	✓	·	·	✓	·	·	✓	·	·
18	✓	·	·	✓	·	·	✓	·	·	✓	·	·
19	·	✓	·	✓	·	·	·	✓	·	✓	·	·
20	·	·	✓	·	·	✓	·	·	✓	·	·	✓
21	·	·	✓	·	·	✓	·	·	✓	·	·	✓
22	·	✓	·	✓	·	·	·	✓	·	·	·	✓
23	·	✓	·	·	✓	·	·	·	✓	·	·	✓
24	✓	·	·	✓	·	·	✓	·	·	✓	·	·
25	✓	·	·	·	✓	·	✓	·	·	✓	·	·

Table 143

Test 1B . . Provoked Correspondence

School A . . . boys.

Subject No.	i 1	i 2	i 3	ii 1	ii 2	ii 3	iii 1	iii 2	iii 3	iv 1	iv 2	iv 3	v 1	v 2	v 3
1	✓	·	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·
2	·	✓	·	·	·	✓	·	·	✓	·	·	✓	·	·	✓
3	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
4	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
5	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
6	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
7	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
8	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
9	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·
10	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
11	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
12	✓	·	·	·	✓	·	✓	·	·	·	✓	·	·	✓	·
13	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
14	·	✓	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
15	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
16	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·

School A . . . girls

Subject.	i 1	i 2	i 3	ii 1	ii 2	ii 3	iii 1	iii 2	iii 3	iv 1	iv 2	iv 3	v 1	v 2	v 3
1	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
2	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
3	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
4	·	·	✓	·	·	✓	·	·	✓	·	✓	·	·	·	✓
5	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
6	✓	·	·	✓	·	·	·	✓	·	·	✓	·	·	✓	·
7	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
8	·	✓	·	·	✓	·	·	✓	·	✓	·	·	·	✓	·
9	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
10	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
11	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
12	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·

Table 144

Test I B ··· Provoked Correspondence.

School B ·· Boys

	i 1 2 3	ii 1 2 3	iii 1 2 3	iv 1 2 3	v 1 2 3
1	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
2	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
3	· ✓ ·	✓ · ·	· ✓ ·	✓ · ·	✓ · ·
4	· ✓ ·	· ✓ ·	· ✓ ·	· ✓ ·	· ✓ ·
5	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
6	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
7	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
8	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
9	· ✓ ·	· ✓ ·	· ✓ ·	· ✓ ·	· ✓ ·
10	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
11	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
12	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
13	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
14	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
15	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·

School B ··· girls

	i 1 2 3	ii 1 2 3	iii 1 2 3	iv 1 2 3	v 1 2 3
1	✓ · ·	· ✓ ·	· ✓ ·	✓ · ·	✓ · ·
2	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
3	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
4	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
5	· ✓ ·	· ✓ ·	· · ✓	· ✓ ·	· · ✓
6	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
7	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
8	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
9	· ✓ ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
10	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
11	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
12	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·

School C ·· boys.

	i 1 2 3	ii 1 2 3	iii 1 2 3	iv 1 2 3	v 1 2 3
1	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
2	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
3	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
4	· ✓ ·	· · ✓	· · ✓	· · ✓	· · ✓
5	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
6	· ✓ ·	· ✓ ·	· ✓ ·	· ✓ ·	✓ · ·
7	· ✓ ·	· ✓ ·	· · ✓	· ✓ ·	· ✓ ·
8	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
9	· · ✓	✓ · ·	✓ · ·	✓ · ·	✓ · ·
10	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
11	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
12	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·

School C ··· girls.

	i 1 2 3	ii 1 2 3	iii 1 2 3	iv 1 2 3	v 1 2 3
1	· · ✓	· · ✓	· ✓ ·	· · ✓	· · ✓
2	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
3	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
4	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
5	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
6	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
7	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
8	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
9	· ✓ ·	· ✓ ·	· ✓ ·	· ✓ ·	· ✓ ·
10	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
11	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
12	· ✓ ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
13	· ✓ ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
14	✓ · ·	✓ · ·	· ✓ ·	· ✓ ·	· · ✓
15	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
16	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
17	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·

School D ·· boys

	i 1 2 3	ii 1 2 3	iii 1 2 3	iv 1 2 3	v 1 2 3
1	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
2	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
3	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
4	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
5	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
6	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
7	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
8	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
9	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
10	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
11	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
12	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
13	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
14	· ✓ ·	· · ✓	· · ✓	· · ✓	· · ✓
15	· ✓ ·	· ✓ ·	· · ✓	· · ✓	· · ✓
16	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
17	· · ✓	· ✓ ·	✓ · ·	· ✓ ·	✓ · ·
18	· · ✓	· · ✓	· · ✓	· ✓ ·	· · ✓
19	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
20	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
21	✓ · ·	✓ · ·	· ✓ ·	✓ · ·	✓ · ·

School D ··· girls

	i 1 2 3	ii 1 2 3	iii 1 2 3	iv 1 2 3	v 1 2 3
1	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
2	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
3	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
4	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
5	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
6	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
7	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
8	· ✓ ·	· ✓ ·	· ✓ ·	· ✓ ·	· ✓ ·
9	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
10	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
11	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
12	· · ✓	✓ · ·	✓ · ·	✓ · ·	✓ · ·
13	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
14	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
15	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
16	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
17	· ✓ ·	· ✓ ·	✓ · ·	✓ · ·	✓ · ·
18	✓ · ·	✓ · ·	· ✓ ·	✓ · ·	✓ · ·
19	✓ · ·	✓ · ·	· ✓ ·	✓ · ·	✓ · ·
20	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
21	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
22	· · ✓	· · ✓	✓ · ·	✓ · ·	✓ · ·
23	· ✓ ·	· ✓ ·	· ✓ ·	✓ · ·	✓ · ·
24	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
25	✓ · ·	✓ · ·	· ✓ ·	✓ · ·	✓ · ·

TEST 2A

TABLE 145

Correspondence between several sets

School A .. boys

Test	i			ii			iii		
Stage No.	1	2	3	1	2	3	1	2	3
1	·	✓	·	·	✓	·	✓	·	·
2	·	·	✓	·	✓	·	·	·	✓
3	·	·	✓	·	·	✓	·	·	✓
4	·	·	✓	·	·	✓	·	·	✓
5	✓	·	·	·	✓	·	✓	·	·
6	·	·	✓	·	·	✓	·	·	✓
7	·	·	✓	·	·	✓	·	·	✓
8	·	✓	·	·	✓	·	·	✓	·
9	·	✓	·	·	✓	·	·	✓	·
10	·	·	✓	✓	·	·	·	·	✓
11	·	✓	·	✓	·	·	✓	·	·
12	·	✓	·	·	✓	·	·	✓	·
13	✓	·	·	·	✓	·	✓	·	·
14	✓	·	·	✓	·	·	·	✓	·
15	✓	·	·	✓	·	·	✓	·	·
16	✓	·	·	✓	·	·	✓	·	·

School A .. girls

Test	i			ii			iii		
Stage No.	1	2	3	1	2	3	1	2	3
1	·	·	✓	·	·	✓	·	·	✓
2	✓	·	·	✓	·	·	✓	·	·
3	✓	·	·	✓	·	·	✓	·	·
4	·	·	✓	·	·	✓	·	·	✓
5	·	✓	·	·	✓	·	·	✓	·
6	·	·	✓	·	✓	·	·	✓	·
7	✓	·	·	✓	·	·	·	✓	·
8	·	✓	·	·	✓	·	✓	·	·
9	✓	·	·	✓	·	·	✓	·	·
10	·	✓	·	✓	·	·	✓	·	·
11	✓	·	·	✓	·	·	✓	·	·
12	✓	·	·	✓	·	·	✓	·	·

School B .. boys

Test	i			ii			iii		
Stage No.	1	2	3	1	2	3	1	2	3
1	·	·	✓	·	·	✓	·	✓	·
2	·	·	✓	·	·	✓	·	·	✓
3	·	✓	·	·	✓	·	·	✓	·
4	✓	·	·	✓	·	·	·	✓	·
5	✓	·	·	✓	·	·	✓	·	·
6	✓	·	·	✓	·	·	·	✓	·
7	·	·	✓	·	·	✓	·	·	✓
8	·	·	✓	·	✓	·	·	·	✓
9	·	·	✓	·	✓	·	·	✓	·
10	✓	·	·	✓	·	·	✓	·	·
11	✓	·	·	✓	·	·	·	✓	·
12	✓	·	·	✓	·	·	✓	·	·
13	·	·	✓	·	·	✓	·	·	✓
14	✓	·	·	✓	·	·	✓	·	·
15	✓	·	·	✓	·	·	✓	·	·

School B .. girls

Test	i			ii			iii		
Stage No.	1	2	3	1	2	3	1	2	3
1	✓	·	·	✓	·	·	✓	·	·
2	✓	·	·	✓	·	·	✓	·	·
3	·	·	✓	·	·	✓	·	·	✓
4	✓	·	·	✓	·	·	✓	·	·
5	·	·	✓	·	·	✓	·	✓	·
6	✓	·	·	✓	·	·	✓	·	·
7	·	·	✓	·	·	✓	·	✓	·
8	✓	·	·	✓	·	·	✓	·	·
9	✓	·	·	✓	·	·	✓	·	·
10	✓	·	·	✓	·	·	✓	·	·
11	·	✓	·	·	·	✓	·	·	✓
12	✓	·	·	✓	·	·	✓	·	·

School C .. boys

Test	i			ii			iii		
Stage No.	1	2	3	1	2	3	1	2	3
1	·	·	✓	·	·	✓	·	·	✓
2	·	·	✓	·	·	✓	·	·	✓
3	·	·	✓	·	·	✓	·	✓	·
4	·	·	✓	·	·	✓	·	·	✓
5	✓	·	·	✓	·	·	✓	·	·
6	·	✓	·	·	✓	·	·	✓	·
7	·	✓	·	·	✓	·	·	✓	·
8	✓	·	·	✓	·	·	✓	·	·
9	✓	·	·	✓	·	·	·	✓	·
10	✓	·	·	✓	·	·	✓	·	·
11	✓	·	·	✓	·	·	✓	·	·
12	✓	·	✓	·	✓	·	✓	·	·

School C ... girls

Test	i			ii			iii		
Stage No.	1	2	3	1	2	3	1	2	3
1	·	✓	·	·	·	✓	·	·	✓
2	·	·	✓	·	·	✓	·	·	✓
3	·	·	✓	·	·	✓	·	·	✓
4	·	·	✓	·	·	✓	·	·	✓
5	·	·	✓	✓	·	·	·	·	✓
6	·	·	✓	·	✓	·	·	✓	·
7	✓	·	·	✓	·	·	✓	·	·
8	✓	·	·	✓	·	·	✓	·	·
9	·	·	✓	·	✓	·	·	✓	·
10	✓	·	·	✓	·	·	✓	·	·
11	✓	·	·	✓	·	·	✓	·	·
12	✓	·	·	✓	·	·	✓	·	·
13	✓	·	·	✓	·	·	·	✓	·
14	✓	·	·	✓	·	·	✓	·	·
15	·	✓	·	✓	·	·	✓	·	·
16	✓	·	·	✓	·	·	✓	·	·
17	✓	·	·	✓	·	·	✓	·	·

Table 145 continued.

Test 2A. Correspondence between several sets.

School D. Boys.

Subject	Subtest i: Stage 1 2 3	ii: 1 2 3	iii: 1 2 3
1	· · ✓	· · ✓	· · ✓
2	· · ✓	· · ✓	· · ✓
3	· · ✓	· · ✓	· · ✓
4	· · ✓	· · ✓	· · ✓
5	· · ✓	· · ✓	· · ✓
6	· · ✓	· · ✓	· · ✓
7	· · ✓	· · ✓	· · ✓
8	· · ✓	· · ✓	· · ✓
9	· · ✓	· · ✓	· · ✓
10	✓ · ·	✓ · ·	✓ · ·
11	· · ✓	· · ✓	· · ✓
12	· · ✓	· · ✓	· · ✓
13	· · ✓	· · ✓	· · ✓
14	· ✓ ·	· · ✓	· · ✓
15	· ✓ ·	· ✓ ·	· ✓ ·
16	· · ✓	· · ✓	· · ✓
17	· · ✓	· · ✓	· · ✓
18	· · ✓	· · ✓	· · ✓
19	✓ · ·	✓ · ·	✓ · ·
20	✓ · ·	✓ · ·	✓ · ·
21	✓ · ·	· · ✓	✓ · ·

School D. Girls.

Subject	Subtest i: Stage 1 2 3	ii: 1 2 3	iii: 1 2 3
1	· · ✓	· · ✓	· · ✓
2	· · ✓	· · ✓	· · ✓
3	· · ✓	· · ✓	· · ✓
4	· · ✓	· · ✓	· · ✓
5	· · ✓	· · ✓	· · ✓
6	· · ✓	· · ✓	· · ✓
7	· · ✓	· · ✓	· · ✓
8	· · ✓	· ✓ ·	· ✓ ·
9	· · ✓	· · ✓	· · ✓
10	· · ✓	· · ✓	· · ✓
11	· · ✓	· · ✓	· · ✓
12	· · ✓	✓ · ·	· · ✓
13	· · ✓	· · ✓	· · ✓
14	· · ✓	· · ✓	· · ✓
15	✓ · ·	· · ✓	· · ✓
16	· · ✓	· · ✓	· · ✓
17	· ✓ ·	✓ · ·	· ✓ ·
18	· · ✓	✓ · ·	· · ✓
19	✓ · ·	✓ · ·	✓ · ·
20	· · ✓	· · ✓	· · ·
21	· · ✓	· · ✓	· · ·
22	✓ · ·	✓ · ·	· · ·
23	· ✓ ·	✓ · ·	· ✓ ·
24	✓ · ·	✓ · ·	✓ · ·
25	· ✓ ·	✓ · ·	✓ · ·

Table 146

Test 2B Generalization of 'n' sets.

School A ... boys

	Subtest i: Stage 1 2 3	ii: 1 2 3	iii: 1 2 3
1	· · ✓	· · ✓	· ✓ ·
2	· ✓ ·	· · ✓	· ✓ ·
3	· · ✓	· · ✓	· · ✓
4	· · ✓	· · ✓	· · ✓
5	✓ · ·	✓ · ·	· ✓ ·
6	· · ✓	· · ✓	· ✓ ·
7	· · ✓	· · ✓	· ✓ ·
8	· · ✓	· · ✓	· ✓ ·
9	✓ · ·	· · ✓	· ✓ ·
10	✓ · ·	· ✓ ·	✓ · ·
11	✓ · ·	✓ · ·	· ✓ ·
12	✓ · ·	· · ✓	✓ · ·
13	· · ✓	· · ✓	· ✓ ·
14	✓ · ·	· · ✓	✓ · ·
15	✓ · ·	✓ · ·	✓ · ·
16	✓ · ·	✓ · ·	✓ · ·

School A ... girls

	Subtest i: Stage 1 2 3	ii: 1 2 3	iii: 1 2 3
1	· ✓ ·	· · ✓	· ✓ ·
2	✓ · ·	· ✓ ·	· ✓ ·
3	· · ✓	· ✓ ·	· ✓ ·
4	· · ✓	· · ✓	· ✓ ·
5	· ✓ ·	· · ✓	· ✓ ·
6	· · ✓	· · ✓	· ✓ ·
7	✓ · ·	✓ · ·	✓ · ·
8	✓ · ·	· · ✓	✓ · ·
9	· · ✓	· · ✓	✓ · ·
10	✓ · ·	· · ✓	✓ · ·
11	✓ · ·	✓ · ·	✓ · ·
12	✓ · ·	✓ · ·	✓ · ·

Table 146 Continued

Test 2B — Generalization of 'n' sets

School B ... boys

Subject No.	Subtest i: Stage 1	2	3	Subtest ii: Stage 1	2	3	Subtest iii: Stage 1	2	3
1	·	·	✓	·	·	✓	·	·	✓
2	·	·	✓	·	·	✓	·	✓	·
3	·	·	✓	✓	·	·	·	✓	·
4	✓	·	·	·	✓	·	·	✓	·
5	✓	·	·	✓	·	·	✓	·	·
6	✓	·	·	✓	·	·	✓	·	·
7	·	·	✓	·	·	✓	·	✓	·
8	·	✓	·	·	✓	·	·	✓	·
9	·	✓	·	·	✓	·	·	✓	·
10	✓	·	·	✓	·	·	✓	·	·
11	·	✓	·	✓	·	·	·	✓	·
12	✓	·	·	✓	·	·	✓	·	·
13	·	·	✓	·	✓	·	·	✓	·
14	✓	·	·	✓	·	·	✓	·	·
15	✓	·	·	✓	·	·	✓	·	·

School B ... girls

Subject No.	Subtest i: Stage 1	2	3	Subtest ii: Stage 1	2	3	Subtest iii: Stage 1	2	3
1	·	✓	·	✓	·	·	·	✓	·
2	·	✓	·	✓	·	·	·	✓	·
3	·	✓	·	·	·	✓	·	✓	·
4	✓	·	·	✓	·	·	✓	·	·
5	·	✓	·	·	✓	·	·	✓	·
6	✓	·	·	✓	·	·	✓	·	·
7	·	·	✓	·	·	✓	·	·	✓
8	✓	·	·	✓	·	·	✓	·	·
9	·	✓	·	✓	·	·	✓	·	·
10	·	·	✓	✓	·	·	✓	·	·
11	·	·	✓	·	·	✓	·	✓	·
12	✓	·	·	✓	·	·	✓	·	·

School C ... boys

Subject No.	Subtest i: Stage 1	2	3	Subtest ii: Stage 1	2	3	Subtest iii: Stage 1	2	3
1	·	·	✓	·	·	✓	·	✓	·
2	·	·	✓	·	·	✓	·	·	✓
3	·	·	✓	·	·	✓	·	·	✓
4	·	✓	·	·	·	✓	·	✓	·
5	·	·	✓	·	·	✓	✓	·	·
6	·	·	✓	✓	·	·	·	✓	·
7	·	✓	·	·	·	✓	·	✓	·
8	✓	·	·	✓	·	·	✓	·	·
9	✓	·	·	·	·	✓	·	✓	·
10	✓	·	·	·	·	✓	✓	·	·
11	✓	·	·	✓	·	·	✓	·	·
12	✓	·	·	✓	·	·	✓	·	·

School C ... girls

Subject No.	Subtest i: Stage 1	2	3	Subtest ii: Stage 1	2	3	Subtest iii: Stage 1	2	3
1	·	·	✓	·	·	✓	·	·	✓
2	·	·	✓	·	·	✓	·	·	✓
3	·	·	✓	·	·	✓	·	·	✓
4	·	·	✓	·	·	✓	·	·	✓
5	·	✓	·	·	✓	·	·	✓	·
6	·	·	✓	·	·	✓	·	✓	·
7	·	✓	·	✓	·	·	✓	·	·
8	✓	·	·	✓	·	·	✓	·	·
9	·	·	✓	·	✓	·	·	·	✓
10	·	✓	·	✓	·	·	✓	·	·
11	✓	·	·	✓	·	·	✓	·	·
12	✓	·	·	✓	·	·	✓	·	·
13	·	✓	·	·	·	✓	·	✓	·
14	✓	·	·	✓	·	·	✓	·	·
15	·	✓	·	✓	·	·	·	✓	·
16	✓	·	·	✓	·	·	✓	·	·
17	✓	·	·	✓	·	·	✓	·	·

School D .. boys

Subject No.	Subtest i: Stage 1	2	3	Subtest ii: Stage 1	2	3	Subtest iii: Stage 1	2	3
1	·	·	✓	·	·	✓	·	·	✓
2	·	·	✓	·	·	✓	·	·	✓
3	·	·	✓	·	·	✓	·	·	✓
4	·	·	✓	·	·	✓	·	·	✓
5	·	·	✓	·	·	✓	·	·	✓
6	·	·	✓	·	·	✓	·	·	✓
7	·	·	✓	·	✓	·	·	✓	·
8	·	·	✓	·	·	✓	·	·	✓
9	·	✓	·	·	✓	·	·	·	✓
10	✓	·	·	✓	·	·	✓	·	·
11	·	·	✓	·	·	✓	·	·	✓
12	·	·	✓	·	·	✓	·	·	✓
13	·	·	✓	·	·	✓	·	·	✓
14	·	·	✓	·	·	✓	·	·	✓
15	·	✓	·	·	✓	·	·	✓	·
16	✓	·	·	·	·	✓	·	·	✓
17	·	·	✓	·	✓	·	·	✓	·
18	·	✓	·	·	·	·	·	✓	·
19	✓	·	·	✓	·	·	·	·	·
20	✓	·	·	✓	·	·	·	·	·
21	✓	·	·	·	·	✓	·	✓	·

School D ... girls

Subject No.	Subtest i: Stage 1	2	3	Subtest ii: Stage 1	2	3	Subtest iii: Stage 1	2	3
1	·	·	✓	·	·	✓	·	·	✓
2	·	·	✓	·	·	✓	·	·	✓
3	·	·	✓	·	·	✓	·	·	✓
4	·	·	✓	·	·	✓	·	·	✓
5	·	·	✓	·	·	✓	·	·	✓
6	·	·	✓	·	·	✓	·	·	✓
7	·	·	✓	·	·	✓	·	·	✓
8	·	·	✓	·	✓	·	·	✓	·
9	·	·	✓	·	·	✓	·	·	✓
10	·	·	✓	·	·	✓	·	·	✓
11	·	·	✓	·	·	✓	·	·	✓
12	·	·	✓	·	✓	·	·	✓	·
13	·	·	✓	✓	·	·	·	✓	·
14	·	·	✓	·	·	✓	·	·	✓
15	·	·	✓	·	·	✓	·	✓	·
16	·	·	✓	·	·	✓	·	·	✓
17	✓	·	·	·	✓	·	·	✓	·
18	·	·	✓	✓	·	·	·	·	✓
19	·	·	✓	·	·	✓	·	·	✓
20	·	·	✓	·	·	✓	·	·	✓
21	·	·	✓	·	·	✓	·	·	✓
22	·	·	✓	✓	·	·	·	✓	·
23	·	✓	·	·	·	✓	·	✓	·
24	✓	·	·	✓	·	·	✓	·	·
25	✓	·	·	✓	·	·	✓	·	·

TABLE 147

TEST 30 .. Spontaneous Correspondence

Each cell gives the positions 1 2 3; ✓ marks the position ticked.

School A

boys

	i (1 2 3)	ii (1 2 3)	iii (1 2 3)	iv (1 2 3)	v (1 2 3)	vi (1 2 3)
1	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
2	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
3	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
4	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
5	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
6	· ✓ ·	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
7	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
8	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
9	✓ · ·	· ✓ ·	· ✓ ·	· ✓ ·	· ✓ ·	✓ · ·
10	· · ✓	· · ✓	· ✓ ·	· ✓ ·	· ✓ ·	· ✓ ·
11	· ✓ ·	· ✓ ·	· · ✓	· · ✓	· ✓ ·	✓ · ·
12	· ✓ ·	· ✓ ·	· ✓ ·	· ✓ ·	· · ✓	· ✓ ·
13	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
14	✓ · ·	· ✓ ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
15	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
16	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·

girls

	i (1 2 3)	ii (1 2 3)	iii (1 2 3)	iv (1 2 3)	v (1 2 3)	vi (1 2 3)
1	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
2	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
3	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
4	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
5	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
6	· ✓ ·	· ✓ ·	· · ✓	· · ✓	· · ✓	· ✓ ·
7	· · ✓	· · ✓	· ✓ ·	· · ✓	· ✓ ·	· ✓ ·
8	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
9	· ✓ ·	· ✓ ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
10	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
11	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
12	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·

School B

boys

	i	ii	iii	iv	v	vi
1	· · ✓	· ✓ ·	· · ✓	· · ✓	· · ✓	· ✓ ·
2	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
3	· · ✓	· · ✓	· · ✓	· ✗ ✓	· · ✓	· ✓ ·
4	· ✓ ·	· · ✓	· ✓ ·	· ✓ ·	✓ · ·	✓ · ·
5	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
6	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
7	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
8	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓	· ✓ ·
9	· · ✓	· ✓ ·	· · ✓	· · ✓	· ✓ ·	✓ · ·
10	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
11	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
12	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
13	✓ · ·	· ✓ ·	✓ · ·	✓ · ·	✓ · ·	· ✓ ·
14	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
15	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
~~16~~	~~✓ · ·~~					

girls

	i	ii	iii	iv	v	vi
1	· ✓ ·	· ✓ ·	· ✓ ·	· ✓ ·	· ✓ ·	· ✓ ·
2	· · ✓	· ✓ ·	· ✓ ·	· ✓ ·	· ✓ ·	· ✓ ·
3	· · ✓	· ✓ ·	· · ✓	· · ✓	· · ✓	· · ✓
4	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
5	· · ✓	· · ✓	· ✓ ·	· ✓ ·	· ✓ ·	✓ · ·
6	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
7	· · ✓	· · ✓	· ✓ ·	· · ✓	· · ✓	· · ✓
8	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
9	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
10	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
11	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
12	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·

School C

boys

	i	ii	iii	iv	v	vi
1	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
2	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
3	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
4	· · ✓	· · ✓	· ✓ ·	· · ✓	· · ✓	· ✓ ·
5	✓ · ·	· ✓ ·	✓ · ·	· ✓ ·	· ✓ ·	· · ✓
6	· ✓ ·	· · ✓	· ✓ ·	· · ✓	· ✓ ·	· ✓ ·
7	· ✓ ·	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
8	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
9	· · ✓	· ✓ ·	· · ✓	· · ✓	· · ✓	· ✓ ·
10	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
11	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
12	✓ · ·	✓ · ·	✓ · ·	· ✓ ·	✓ · ·	✓ · ·

girls

	i	ii	iii	iv	v	vi
1	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
2	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
3	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
4	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓	· ✓ ·
5	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
6	· ✓ ·	· ✓ ·	· ✓ ·	· ✓ ·	· ✓ ·	· ✓ ·
7	✓ · ·	✓ · ·	✓ · ·	✓ · ·	· ✓ ·	✓ · ·
8	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
9	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
10	✓ · ·	· ✓ ·	· ✓ ·	· · ✓	· · ✓	· ✓ ·
11	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
12	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
13	✓ · ·	· ✓ ·	✓ · ·	✓ · ·	· ✓ ·	✓ · ·
14	· · ✓	· ✓ ·	· ✓ ·	· · ✓	· ✓ ·	· · ✓
15	✓ · ·	· · ✓	· ✓ ·	✓ · ·	✓ · ·	✓ · ·
16	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
17	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·

Table 147 continued

Test 3A ... Spontaneous Correspondence

School D ... boys.

Subject No.	i 1	i 2	i 3	ii 1	ii 2	ii 3	iii 1	iii 2	iii 3	iv 1	iv 2	iv 3	v 1	v 2	v 3	vi 1	vi 2	vi 3
1	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
2	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
3	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
4	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
5	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
6	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
7	.	✓	.	.	✓	.	.	.	✓	.	.	✓	.	.	✓	.	.	✓
8	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
9	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	✓	.
10	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.
11	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
12	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
13	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
14	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
15	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	.	✓
16	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
17	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
18	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
19	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.
20	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.
21	✓	.	.	.	✓	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.

School D ... girls

Subject No.	i 1	i 2	i 3	ii 1	ii 2	ii 3	iii 1	iii 2	iii 3	iv 1	iv 2	iv 3	v 1	v 2	v 3	vi 1	vi 2	vi 3
1	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
2	.	.	✓	.	✓	.	.	✓	.	.	.	✓	.	.	✓	.	✓	.
3	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
4	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
5	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
6	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
7	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
8	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
9	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
10	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
11	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
12	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	✓	.	.	✓	.
13	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
14	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
15	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
16	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
17	.	.	✓	.	.	✓	.	✓	.	.	.	✓	.	✓	.	.	✓	.
18	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
19	.	✓	.	.	.	✓	.	✓	.	.	.	✓	.	.	✓	.	✓	.
20	.	.	✓	.	✓	.	✓	.	.	.	.	✓	.	✓	.	.	.	✓
21	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
22	.	✓	.	✓	.	.	.	✓	.	.	.	✓	.	.	✓	.	✓	.
23	.	.	✓	.	✓	.	.	✓	.	.	.	✓	.	.	✓	.	✓	.
24	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.
25	✓	.	.	.	✓	.	✓	.	.	.	✓	.	.	✓	.	.	✓	.

TABLE 148

Test 3b Spontaneous Correspondence

School A boys

Subject	Subtest: i			ii			iii			iv			v			vi		
Stage:	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
1	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.
2	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
3	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
4	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
5	.	✓	.	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
6	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
7	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.
8	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.
9	.	✓	.	✓	.	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.
10	.	.	✓	.	.	✓	✓	.	.	.	.	✓	.	.	✓	.	.	✓
11	✓	.	.	.	✓	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.
12	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.
13	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.
14	.	✓	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.
15	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.
16	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.

School A... girls

	i			ii			iii			iv			v			vi		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
1	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
2	✓	.	.	✓	.	.	.	✓	.	✓	.	.	✓	.	.	✓	.	.
3	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.
4	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
5	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
6	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓
7	.	✓	.	✓	.	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.
8	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.
9	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.
10	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.
11	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.
12	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.	✓	.	.

TABLE 148 continued

TEST 3b ... Spontaneous Correspondence

School B.. boys

	i 1	i 2	i 3	ii 1	ii 2	ii 3	iii 1	iii 2	iii 3	iv 1	iv 2	iv 3	v 1	v 2	v 3	vi 1	vi 2	vi 3
1	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
2	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
3	·	✓	·	✓	·	·	·	✓	·	✓	·	·	✓	·	·	·	✓	·
4	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·
5	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
6	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
7	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
8	·	✓	·	·	·	✓	·	·	✓	·	·	✓	·	✓	·	·	·	✓
9	·	✓	·	✓	·	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·
10	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
11	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
12	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
13	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	✓	·	·	✓	·
14	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
15	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·

School B.. girls

	i 1	i 2	i 3	ii 1	ii 2	ii 3	iii 1	iii 2	iii 3	iv 1	iv 2	iv 3	v 1	v 2	v 3	vi 1	vi 2	vi 3
1	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·
2	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·
3	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
4	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
5	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
6	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
7	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·
8	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
9	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
10	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
11	·	✓	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
12	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·

Table 148 continued

Test 3B ... Spontaneous Correspondence

School C ... boys

Subject No.	i 1	i 2	i 3	ii 1	ii 2	ii 3	iii 1	iii 2	iii 3	iv 1	iv 2	iv 3	v 1	v 2	v 3	vi 1	vi 2	vi 3
Sub test:- / Stage	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
1	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
2	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
3	·	✓	·	·	✓	·	·	·	✓	·	·	✓	·	·	✓	·	·	✓
4	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·
5	✓	·	·	·	✓	·	✓	·	·	·	✓	·	·	✓	·	·	✓	·
6	·	✓	·	✓	·	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·
7	·	·	✓	·	✓	·	·	·	✓	✓	·	·	✓	·	·	✓	·	·
8	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
9	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·
10	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
11	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
12	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·

School C ... girls

Subject No.	i 1	i 2	i 3	ii 1	ii 2	ii 3	iii 1	iii 2	iii 3	iv 1	iv 2	iv 3	v 1	v 2	v 3	vi 1	vi 2	vi 3
1	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
2	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·	·	✓	·	·	✓
3	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
4	✓	·	·	·	✓	·	✓	·	·	·	✓	·	·	✓	·	·	✓	·
5	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
6	·	✓	·	✓	·	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·
7	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
8	✓	·	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
9	✓	·	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·	·	✓	·
10	✓	·	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·	·	✓	·
11	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
12	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·
13	✓	·	·	·	·	✓	·	✓	·	✓	·	·	✓	·	·	✓	·	·
14	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·
15	✓	·	·	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·	✓	·

TABLE 148 continued TEST 3b Spontaneous Correspondence

School D...boys

Subject	i 1	i 2	i 3	ii 1	ii 2	ii 3	iii 1	iii 2	iii 3	iv 1	iv 2	iv 3	v 1	v 2	v 3	vi 1	vi 2	vi 3
Subtest / Stage	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
1	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
2	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
3	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
4	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
5	·	✓	·	·	·	✓	·	·	✓	·	✓	·	·	·	✓	·	·	✓
6	·	✓	·	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
7	·	✓	·	·	✓	·	·	·	✓	·	·	✓	·	·	✓	·	·	✓
8	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
9	·	✓	·	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
10	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
11	·	·	✓	·	·	✓	·	✓	·	·	·	✓	·	·	✓	·	·	✓
12	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
13	·	✓	·	·	·	✓	·	·	✓	·	✓	·	·	·	✓	·	·	✓
14	✓	·	·	·	✓	·	·	·	✓	✓	·	·	✓	·	·	✓	·	·
15	·	✓	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
16	·	✓	·	·	·	✓	·	✓	·	·	·	✓	·	·	✓	·	·	✓
17	·	·	✓	·	✓	·	·	✓	·	·	·	✓	·	·	✓	·	·	✓
18	·	·	✓	·	✓	·	·	·	✓	·	·	✓	·	·	✓	·	·	✓
19	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
20	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
21	✓	·	·	✓	·	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·

School D...girls

Subject	i 1	i 2	i 3	ii 1	ii 2	ii 3	iii 1	iii 2	iii 3	iv 1	iv 2	iv 3	v 1	v 2	v 3	vi 1	vi 2	vi 3
1	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
2	·	✓	·	·	·	✓	·	✓	·	·	·	✓	·	·	✓	·	·	✓
3	·	✓	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
4	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
5	✓	·	·	·	✓	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·
6	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
7	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	·	✓	·	·	✓
8	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
9	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
10	·	✓	·	·	✓	·	·	✓	·	·	·	✓	·	·	✓	·	·	✓
11	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
12	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
13	·	·	✓	·	✓	·	·	·	✓	·	·	✓	·	·	✓	·	·	✓
14	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
15	·	✓	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
16	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
17	·	✓	·	✓	·	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·
18	·	✓	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
19	·	✓	·	·	✓	·	·	✓	·	·	·	✓	✓	·	·	✓	·	·
20	·	✓	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
21	·	·	✓	·	✓	·	·	·	✓	·	·	✓	·	·	✓	·	·	✓
22	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·
23	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
24	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
25	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·

TABLE 149

TEST 4 Use of measures

School A boys

	i 1	i 2	i 3	ii 1	ii 2	ii 3
1	✓	·	·	·	·	✓
2	✓	·	·	✓	·	·
3	·	·	✓	·	·	✓
4	·	·	✓	·	·	✓
5	✓	·	·	✓	·	·
6	·	·	✓	·	✓	·
7	·	·	✓	·	·	✓
8	✓	·	·	✓	·	·
9	✓	·	·	✓	·	·
10	·	✓	·	·	✓	·
11	✓	·	·	✓	·	·
12	✓	·	·	✓	·	·
13	✓	·	·	·	✓	·
14	✓	·	·	✓	·	·
15	✓	·	·	✓	·	·
16	✓	·	·	✓	·	·

School A girls

	i 1	i 2	i 3	ii 1	ii 2	ii 3
1	·	·	✓	·	·	✓
2	✓	·	·	✓	·	·
3	✓	·	·	✓	·	·
4	·	·	✓	·	·	✓
5	·	·	✓	·	·	✓
6	✓	·	·	✓	·	·
7	✓	·	·	✓	·	·
8	✓	·	·	✓	·	·
9	✓	·	·	✓	·	·
10	✓	·	·	✓	·	·
11	✓	·	·	✓	·	·
12	✓	·	·	✓	·	·

School B boys

	i 1	i 2	i 3	ii 1	ii 2	ii 3
1	·	·	✓	·	·	✓
2	✓	·	·	✓	·	·
3	✓	·	·	·	✓	·
4	✓	·	·	✓	·	·
5	✓	·	·	✓	·	·
6	✓	·	·	✓	·	·
7	·	✓	·	·	·	✓
8	·	✓	·	·	✓	·
9	✓	·	·	✓	·	·
10	✓	·	·	✓	·	·
11	·	✓	·	·	✓	·
12	✓	·	·	✓	·	·
13	·	✓	·	·	✓	·
14	✓	·	·	✓	·	·
15	✓	·	·	✓	·	·

School B girls

	i 1	i 2	i 3	ii 1	ii 2	ii 3
1	✓	·	·	✓	·	·
2	✓	·	·	✓	·	·
3	·	·	✓	·	·	✓
4	✓	·	·	✓	·	·
5	·	✓	·	·	✓	·
6	·	✓	·	·	✓	·
7	✓	·	·	✓	·	·
8	✓	·	·	✓	·	·
9	✓	·	·	✓	·	·
10	✓	·	·	✓	·	·
11	·	·	✓	·	✓	·
12	✓	·	·	✓	·	·

School C Boys

	1	2	3	1	2	3
1	·	·	✓	·	·	✓
2	·	✓	·	·	✓	·
3	·	✓	·	·	✓	·
4	·	✓	·	·	✓	·
5	✓	·	·	✓	·	·
6	·	✓	·	·	✓	·
7	✓	·	·	✓	·	·
8	✓	·	·	✓	·	·
9	·	✓	·	·	✓	·
10	✓	·	·	✓	·	·
11	✓	·	·	✓	·	·
12	✓	·	·	✓	·	·

School C Girls

	1	2	3	1	2	3
1	·	·	✓	·	·	✓
2	·	✓	·	·	✓	·
3	·	·	✓	·	·	✓
4	·	·	✓	·	·	✓
5	✓	·	·	✓	·	·
6	✓	·	·	✓	·	·
7	✓	·	·	✓	·	·
8	✓	·	·	✓	·	·
9	✓	·	·	✓	·	·
10	✓	·	·	✓	·	·
11	·	✓	·	·	✓	·
12	✓	·	·	✓	·	·
13	✓	·	·	✓	·	·
14	✓	·	·	✓	·	·
15	✓	·	·	✓	·	·
16	✓	·	·	✓	·	·
17	✓	·	·	✓	·	·

School D Boys

	1	2	3	1	2	3
1	·	·	✓	·	·	✓
2	·	·	✓	·	·	✓
3	·	·	✓	·	·	✓
4	·	·	✓	·	·	✓
5	·	·	✓	·	·	✓
6	·	·	✓	·	·	✓
7	·	✓	·	·	✓	·
8	·	·	✓	·	·	✓
9	·	·	✓	·	·	✓
10	✓	·	·	✓	·	·
11	·	✓	·	·	✓	·
12	·	·	✓	·	·	✓
13	·	✓	·	·	✓	·
14	·	·	✓	·	·	✓
15	✓	·	·	✓	·	·
16	✓	·	·	✓	·	·
17	✓	·	·	✓	·	·
18	✓	·	·	✓	·	·
19	✓	·	·	✓	·	·
20	✓	·	·	✓	·	·
21	✓	·	·	✓	·	·

School D Girls

	1	2	3	1	2	3
1	·	·	✓	·	·	✓
2	·	✓	·	·	✓	·
3	·	·	✓	·	✓	·
4	·	·	✓	·	·	✓
5	✓	·	·	✓	·	·
6	·	·	✓	·	·	✓
7	✓	·	·	✓	·	·
8	·	✓	·	·	✓	·
9	·	·	✓	·	·	✓
10	✓	·	·	✓	·	·
11	✓	·	·	✓	·	·
12	·	✓	·	·	✓	·
13	·	·	✓	·	·	✓
14	·	·	✓	·	·	✓
15	✓	·	·	✓	·	·
16	·	✓	·	·	✓	·
17	✓	·	·	✓	·	·
18	·	·	✓	·	·	✓
19	✓	·	·	✓	·	·
20	·	·	✓	·	·	✓
21	·	✓	·	·	✓	·
22	✓	·	·	✓	·	·
23	✓	·	·	✓	·	·
24	✓	·	·	✓	·	·
25	✓	·	·	✓	·	·

Table 150. Test 5A. Equating of quantities. Unequal sets.

School A. Boys.

	i			ii			iii			iv		
	1	2	3	1	2	3	1	2	3	1	2	3
1	.	.	✓	.	.	✓	.	.	✓	.	.	✓
2	.	✓	.	.	✓	.	.	✓	.	.	✓	.
3	.	✓	.	.	✓	.	.	✓	.	.	✓	.
4	.	.	✓	.	.	✓	.	.	✓	.	.	✓
5	.	.	✓	.	✓	.	.	✓	.	.	✓	.
6	.	.	✓	.	.	✓	.	.	✓	.	.	✓
7	.	.	✓	.	.	✓	.	.	✓	.	.	✓
8	.	✓	.	.	✓	.	.	✓	.	.	.	✓
9	.	✓	.	✓	.	.	✓	.	.	✓	.	.
10	.	✓	.	.	✓	.	✓	.	.	.	✓	.
11	.	✓	.	.	✓	.	✓	.	.	✓	.	.
12	.	✓	.	.	✓	.	.	✓	.	.	✓	.
13	.	✓	.	.	✓	.	.	✓	.	.	.	✓
14	.	✓	.	✓	.	.	✓	.	.	✓	.	.
15	✓	.	.	✓	.	.	✓	.	.	✓	.	.
16	✓	.	.	✓	.	.	✓	.	.	✓	.	.

School A. Girls.

	i			ii			iii			iv		
	1	2	3	1	2	3	1	2	3	1	2	3
1	.	✓	.	.	✓	.	.	✓	.	.	✓	.
2	.	✓	.	✓	.	.	✓	.	.	✓	.	.
3	.	.	✓	✓	.	.	✓	.	.	✓	.	.
4	.	✓	.	.	✓	.	.	✓	.	.	✓	.
5	.	.	✓	✓	.	.	.	✓	.	.	.	✓
6	.	✓	.	.	✓	.	.	✓	.	.	.	✓
7	.	✓	.	✓	.	.	.	✓	.	.	✓	.
8	.	✓	.	.	✓	.	✓	.	.	✓	.	.
9	.	✓	.	✓	.	.	✓	.	.	✓	.	.
10	✓	.	.	✓	.	.	✓	.	.	✓	.	.
11	✓	.	.	✓	.	.	✓	.	.	✓	.	.
12	✓	.	.	✓	.	.	✓	.	.	✓	.	.

School B ... boys.

1	.	.	✓	.	✓	.	.	✓	.	.	✓	.
2	.	✓	.	.	✓	.	.	✓	.	.	✓	.
3	.	✓	.	✓	.	.	✓	.	.	✓	.	.
4	✓	.	.	✓	.	.	✓	.	.	✓	.	.
5	✓	.	.	✓	.	.	✓	.	.	✓	.	.
6	✓	.	.	✓	.	.	✓	.	.	✓	.	.
7	.	.	✓	.	✓	.	.	✓	.	.	✓	.
8	.	.	✓	.	.	✓	.	✓	.	.	.	✓
9	.	✓	.	✓	.	.	.	✓	.	.	✓	.
10	✓	.	.	✓	.	.	✓	.	.	✓	.	.
11	.	✓	.	✓	.	.	✓	.	.	✓	.	.
12	✓	.	.	✓	.	.	✓	.	.	✓	.	.
13	.	✓	.	✓	.	.	✓	.	.	.	✓	.
14	✓	.	.	✓	.	.	✓	.	.	✓	.	.
15	✓	.	.	✓	.	.	✓	.	.	✓	.	.

School B ... girls

1	.	✓	.	.	✓	.	✓	.	.	✓	.	.
2	.	✓	.	✓	.	.	✓	.	.	.	✓	.
3	.	✓	.	.	✓	.	.	✓	.	.	✓	.
4	✓	.	.	✓	.	.	✓	.	.	✓	.	.
5	.	✓	.	.	✓	.	.	✓	.	.	✓	.
6	✓	.	.	✓	.	.	✓	.	.	✓	.	.
7	.	✓	.	.	.	✓	.	.	✓	.	.	✓
8	✓	.	.	✓	.	.	✓	.	.	✓	.	.
9	✓	.	.	✓	.	.	✓	.	.	✓	.	.
10	✓	.	.	✓	.	.	✓	.	.	✓	.	.
11	.	✓	.	.	✓	.	.	✓	.	.	✓	.
12	.	✓	.	.	✓	.	.	✓	.	✓	.	.

TABLE 150 continued

TEST 5A .. EQUATING OF QUANTITIES .. UNEQUAL SETS

School C boys

	i 1	i 2	i 3	ii 1	ii 2	ii 3	iii 1	iii 2	iii 3	iv 1	iv 2	iv 3
1			✓			✓			✓			✓
2			✓			✓			✓		✓	
3			✓			✓		✓	x		✓	
4		✓		✓			✓			✓		
5		✓		✓			✓			✓		
6			✓			✓	✓				✓	
7		✓			✓			✓			✓	
8	✓			✓			✓			✓		
9		✓			✓			✓			✓	
10			✓	✓				✓			✓	
11	✓			✓			✓			✓		
12		✓		✓				✓			✓	

School C girls

	i 1	i 2	i 3	ii 1	ii 2	ii 3	iii 1	iii 2	iii 3	iv 1	iv 2	iv 3
1			✓			✓			✓		✓	
2		✓			✓			✓		✓		
3			✓			✓			✓			✓
4			✓			✓			✓			✓
5		✓		✓			✓			✓		
6	✓			✓				✓		✓		
7		✓		✓			✓				✓	
8			✓			✓			✓			✓
9		✓			✓			✓			✓	
10	✓			✓			✓			✓		
11	✓			✓			✓				✓	
12	✓			✓			✓			✓		
13	✓			✓			✓			✓		
14		✓			✓			✓			✓	
15		✓			✓		✓			✓		
16	✓			✓			✓			✓		
17	✓			✓			✓				✓	

School D boys

	1	2	3	1	2	3	1	2	3	1	2	3
1			✓			✓			✓			✓
2			✓			✓			✓			✓
3			✓			✓			✓			✓
4			✓			✓			✓			✓
5			✓			✓			✓			✓
6			✓			✓			✓			✓
7			✓		✓			✓			✓	
8			✓			✓			✓			✓
9			✓			✓		✓			✓	
10	✓			✓			✓			✓		
11			✓			✓			✓			✓
12			✓			✓			✓			✓
13		✓				✓			✓			✓
14			✓			✓			✓			✓
15		✓		✓				✓			✓	
16		✓			✓			✓			✓	
17		✓				✓		✓			✓	
18		✓			✓			✓			✓	
19	✓			✓			✓			✓		
20	✓			✓			✓			✓		
21		✓			✓			✓			✓	

D..... girls

	1	2	3	1	2	3	1	2	3	1	2	3
1			✓			✓			✓			✓
2		✓			✓			✓			✓	
3			✓			✓			✓			✓
4			✓			✓			✓		✓	
5		✓			✓			✓			✓	
6			✓			✓			✓			✓
7		✓			✓			✓			✓	
8		✓			✓			✓			✓	
9			✓			✓			✓			✓
10		✓			✓			✓			✓	
11			✓			✓			✓			✓
12			✓			✓		✓			✓	
13		✓			✓			✓			✓	
14			✓		✓			✓			✓	
15		✓			✓			✓		✓		
16			✓			✓			✓			✓
17			✓			✓		✓			✓	
18			✓			✓			✓			✓
19		✓			✓			✓			✓	
20			✓			✓			✓			✓
21			✓			✓			✓			✓
22		✓		✓			✓				✓	
23		✓			✓			✓			✓	
24	✓			✓			✓			✓		
25		✓		✓			✓				✓	

Equating of quantities equal sets

TEST 5b TABLE 151

School A boys

	i			ii			iii			iv			v		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
1	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
2	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
3	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
4	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
5	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
6	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
7	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
8	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·
9	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
10	·	·	✓	·	·	✓	·	✓	·	·	✓	·	·	✓	·
11	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·
12	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·
13	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·
14	✓	·	·	✓	·	·	·	✓	·	✓	·	·	✓	·	·
15	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
16	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·

School A.. girls

	i			ii			iii			iv			v		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
1	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
2	✓	·	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·
3	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·
4	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
5	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
6	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
7	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·
8	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·
9	·	✓	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
10	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
11	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
12	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·

School B.. boys

1	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
2	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
3	·	✓	·	·	✓	·	·	·	✓	·	✓	·	·	✓	·
4	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·
5	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
6	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
7	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
8	·	✓	·	·	✓	·	·	✓	·	·	·	✓	·	·	✓
9	✓	·	·	✓	·	·	·	✓	·	·	✓	·	·	✓	·
10	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
11	·	✓	·	·	✓	·	·	✓	·	·	✓	·	✓	·	·
12	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
13	·	·	✓	·	✓	·	·	·	✓	·	·	✓	·	·	✓
14	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
15	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·

School B... girls

1	✓	·	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·
2	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·
3	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
4	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
5	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓
6	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·
7	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·
8	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
9	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
10	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·
11	·	✓	·	✓	·	·	✓	·	·	✓	·	·	·	✓	·
12	✓	·	·	✓	·	·	✓	·	·	✓	·	·	✓	·	·

Table 151 continued

Test 58 .. Equating of quantities (equal sets)

School C .. boys.

	i (1 2 3)	ii (1 2 3)	iii (1 2 3)	iv (1 2 3)	v (1 2 3)
1	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
2	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
3	· ✓ ·	· ✓ ·	· · ✓	· · ✓	· · ✓
4	· ✓ ·	· · ✓	✓ · ·	· · ✓	· · ✓
5	· ✓ ·	· ✓ ·	✓ · ·	· ✓ ·	· ✓ ·
6	· ✓ ·	· · ✓	✓ · ·	· ✓ ·	· ✓ ·
7	· ✓ ·	✓ · ·	· ✓ ·	✓ · ·	✓ · ·
8	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
9	· ✓ ·	· ✓ ·	· ✓ ·	· ✓ ·	· · ✓ ·
10	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
11	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
12	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·

School C ... girls

	i (1 2 3)	ii (1 2 3)	iii (1 2 3)	iv (1 2 3)	v (1 2 3)
1	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
2	· · ✓	· ✓ ·	· · ✓	· · ✓	· · ✓
3	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
4	✓ · ·	· ✓ ·	✓ · ·	· ✓ ·	· ✓ ·
5	· · ✓	· ✓ ·	· · ✓	· · ✓	· · ✓
6	· ✓ ·	· · ✓	✓ · ·	· · ✓	· ✓ ·
7	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
8	✓ · ·	✓ · ·	✓ · ·	· ✓ ·	· ✓ ·
9	· ✓ ·	· ✓ ·	✓ · ·	✓ · ·	✓ · ·
10	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
11	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
12	✓ · ·	· ✓ ·	✓ · ·	· ✓ ·	✓ · ·
13	✓ · ·	· · ✓	✓ · ·	✓ · ·	✓ · ·
14	· ✓ ·	· ✓ ·	· ✓ ·	✓ · ·	✓ · ·
15	✓ · ·	· · ✓	· ✓ ·	· ✓ ·	· ✓ ·
16	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
17	✓ · ·	· ✓ ·	✓ · ·	✓ · ·	✓ · ·

School D ... boys.

	i	ii	iii	iv	v
1	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
2	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
3	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
4	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
5	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
6	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
7	· · ✓	· ✓ ·	· · ✓	· · ✓	· · ✓
8	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
9	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
10	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
11	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
12	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
13	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
14	· ✓ ·	✓ · ·	· ✓ ·	✓ · ·	✓ · ·
15	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
16	· · ✓	· · ✓	· ✓ ·	· · ✓	· · ✓
17	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
18	· · ✓	· ✓ ·	· · ✓	· · ✓	· ✓ ·
19	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
20	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
21	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·

School D ... girls

	i	ii	iii	iv	v
1	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
2	· ✓ ·	· · ✓	· ✓ ·	· · ✓	· ✓ ·
3	· ✓ ·	· ✓ ·	✓ · ·	✓ · ·	✓ · ·
4	· · ✓	· · ✓	· · ✓	· · ✓	· ✓ ·
5	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
6	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
7	· · ✓	· · ✓	· · ✓	· ✓ ·	· · ✓
8	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
9	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
10	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
11	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
12	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
13	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
14	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
15	· ✓ ·	· ✓ ·	· ✓ ·	✓ · ·	✓ · ·
16	· · ✓	· · ✓	· · ✓	· · ✓	· · ✓
17	· · ✓	· · ✓	· · ✓	· · ✓	· ✓ ·
18	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
19	· ✓ ·	· ✓ ·	· ✓ ·	· · ✓	✓ · ·
20	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
21	· · ✓	· ✓ ·	· ✓ ·	· · ✓	· · ✓
22					
23	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
24	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·
25	✓ · ·	✓ · ·	✓ · ·	✓ · ·	✓ · ·

TABLE 152

TEST 6 Conservation of continuous quantity

	School A boys												School A girls										
	i					ii			iii				i					ii			iii		
	1	2	3	T.	O.	1	2	3	1	2	3		1	2	3	T.	O.	1	2	3	1	2	3
1	✓			✓			✓			✓		1			✓					✓			✓
2	✓				✓	✓			✓			2	✓				✓	✓			✓		
3			✓					✓			✓	3	✓				✓	✓			✓		
4			✓					✓			✓	4			✓					✓			✓
5	✓			✓		✓			✓			5	✓				✓			✓			✓
6			✓					✓			✓	6	✓			✓		✓			✓		
7			✓					✓			✓	7	✓				✓	✓			✓		
8	✓			✓		✓			✓			8		✓		✓		✓			✓		
9		✓		✓		✓			✓			9	✓				✓	✓			✓		
10			✓					✓			✓	10	✓				✓	✓			✓		
11	✓			✓		✓			✓			11	✓			✓		✓			✓		
12	✓				✓	✓			✓			12	✓				✓	✓			✓		
13	✓				✓	✓			✓														
14	✓			✓		✓			✓														
15	✓			✓		✓			✓														
16	✓			✓		✓			✓														

	School B boys												School B girls										
1			✓					✓			✓	1	✓			✓		✓			✓		
2			✓					✓			✓	2	✓				✓	✓			✓		
3	✓			✓		✓			✓			3			✓				✓		✓		
4	✓				✓	✓			✓			4	✓				✓	✓			✓		
5	✓				✓	✓			✓			5			✓				✓			✓	
6	✓			✓		✓			✓			6	✓				✓	✓			✓		
7	✓				✓	✓			✓			7	✓				✓	✓			✓		
8		✓			✓	✓			✓			8	✓			✓		✓			✓		
9	✓			✓		✓			✓			9	✓			✓		✓			✓		
10	✓				✓	✓			✓			10	✓				✓	✓			✓		
11	✓			✓		✓			✓			11	✓				✓	✓			✓		
12	✓			✓		✓			✓			12	✓				✓	✓			✓		
13			✓					✓			✓												
14	✓				✓	✓			✓														
15	✓			✓		✓			✓														

Table 152 continued.

Test 6. Conservation of continuous quantity.

School C ... boys

Boys	I 1 2 3	T.O.	II 1 2 3	III 1 2 3
1	. . ✓	. .	. . ✓	. . ✓
2	. . ✓	. .	. . ✓	. . ✓
3	. . ✓	. .	✓ . .	. . ✓
4	. . ✓	. .	. ✓ .	✓ . .
5	✓ . .	. ✓	✓ . .	✓ . .
6	. ✓ .	✓ .	✓ . .	✓ . .
7	✓ . .	✓ .	✓ . .	✓ . .
8	✓ . .	✓ .	✓ . .	✓ . .
9	✓ . .	✓ .	✓ . .	✓ . .
10	✓ . .	✓ .	✓ . .	✓ . .
11	✓ . .	✓ .	✓ . .	✓ . .
12	✓ . .	✓ .	✓ . .	✓ . .

School C ... girls

	i 1 2 3	T.O.	ii 1 2 3	iii 1 2 3
1	. . ✓	. .	. . ✓	. . ✓
2	. . ✓	. .	. ✓ .	. . ✓
3	. . ✓	. .	. . ✓	. . ✓
4	. . ✓	. .	. . ✓	. . ✓
5	. ✓ .	✓ .	. ✓ .	. . ✓
6	. ✓ .	✓ .	✓ . .	. ✓ .
7	✓ . .	✓ .	✓ . .	✓ . .
8	✓ . .	✓ .	✓ . .	✓ . .
9	✓ . .	. ✓	✓ . .	✓ . .
10	✓ . .	✓ .	✓ . .	✓ . .
11	✓ . .	✓ .	✓ . .	✓ . .
12	✓ . .	✓ .	✓ . .	✓ . .
13	✓ . .	✓ .	✓ . .	✓ . .
14	✓ . .	✓ .	✓ . .	✓ . .
15	✓ . .	. ✓	✓ . .	✓ . .
16	✓ . .	✓ .	✓ . .	✓ . .
17	✓ . .	✓ .	✓ . .	✓ . .

School D ... boys

	I 1 2 3	T.O.	II 1 2 3	III 1 2 3
1	. . ✓	. .	. . ✓	. . ✓
2	. . ✓	. .	. . ✓	. . ✓
3	. . ✓	. .	✓ . .	. . ✓
4	. . ✓	. .	. . ✓	. . ✓
5	. . ✓	. .	. . ✓	. . ✓
6	. . ✓	. .	. . ✓	. . ✓
7	✓ . .	. ✓	✓ . .	✓ . .
8	. . ✓	. .	. ✓ .	. . ✓
9	. . ✓	. .	✓ . .	. . ✓
10	✓ . .	✓ .	✓ . .	✓ . .
11	. . ✓	. .	✓ . .	. . ✓
12	. . ✓	. .	. . ✓	. . ✓
13	. . ✓		✓ . .	. . ✓
14	✓ . .	✓ .	✓ . .	✓ . .
15	✓ . .	. ✓	✓ . .	✓ . .
16	✓ . .	. ✓	✓ . .	✓ . .
17	. . ✓	. .	✓ . .	. ✓ .
18	✓ . .	✓ .	✓ . .	✓ . .
19	✓ . .	. ✓	✓ . .	✓ . .
20	✓ . .	. ✓	✓ . .	✓ . .
21	✓ . .	✓ .	✓ . .	✓ . .

School D ... girls

	i 1 2 3	T.O.	ii 1 2 3	iii 1 2 3
1	. . ✓	. .	✓ . .	. . ✓
2	. ✓ .	. .	✓ . .	. . ✓
3	. . ✓	. .	✓ . .	. ✓ .
4	. . ✓	. .	. . ✓	. . ✓
5	✓ . .	. ✓	✓ . .	✓ . .
6	. . ✓	. .	. ✓ .	. . ✓
7	✓ . .	✓ .	✓ . .	✓ . .
8	✓ . .	✓ .	✓ . .	✓ . .
9	. . ✓	. .	. . ✓	. . ✓
10	. . ✓	. .	✓ . .	. . ✓
11	. . ✓	. .	✓ . .	. ✓ .
12	✓ . .	✓ .	✓ . .	✓ . .
13	. . ✓	. .	✓ . .	. . ✓
14	. . ✓	. .	✓ . .	. . ✓
15	✓ . .	✓ .	✓ . .	✓ . .
16	✓ . .	✓ .	✓ . .	. ✓ .
17	✓ . .	✓ .	✓ . .	✓ . .
18	✓ . .	. ✓	✓ . .	✓ . .
19	✓ . .	✓ .	✓ . .	✓ . .
20	. . ✓	. .	. . ✓	. . ✓
21	. . ✓	. .	✓ . .	. ✓
22	✓ . .	✓ .	✓ . .	✓ . .
23	✓ . .	. ✓	✓ . .	✓ . .
24	✓ . .	✓ .	✓ . .	✓ . .
25	✓ . .	✓ .	✓ . .	✓ . .

Table 153
Test 7 ... Conservation of Discontinuous Quantities

School A ... boys

	i					ii			iii			iv		
	1	2	3	T	O	1	2	3	1	2	3	1	2	3
1	·	·	✓	·	·	✓	·	·	·	·	✓	✓	·	·
2	·	·	✓	·	·	·	·	✓	·	✓	·	·	·	✓
3	·	·	✓	·	·	·	·	✓	·	·	✓	·	·	✓
4	·	·	✓	·	·	·	·	✓	·	·	✓	·	·	✓
5	✓	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·
6	·	·	✓	·	·	·	·	✓	·	·	✓	·	·	✓
7	·	·	✓	·	·	·	·	✓	·	·	✓	·	·	✓
8	✓	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·
9	·	·	✓	·	·	·	·	✓	·	·	✓	·	·	✓
10	·	·	✓	·	·	·	·	✓	·	·	✓	·	·	✓
11	✓	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·
12	✓	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·
13	✓	·	·	✓	·	✓	·	·	✓	·	·	·	✓	·
14	✓	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·
15	✓	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·
16	✓	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·

School A .. girls

	i					ii			iii			iv		
	1	2	3	T	O	1	2	3	1	2	3	1	2	3
1	·	·	✓	·	·	·	·	✓	·	·	✓	·	·	✓
2	✓	·	·	·	✓	✓	·	·	✓	·	·	✓	·	·
3	✓	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·
4	·	·	✓	·	·	·	·	✓	·	·	✓	·	·	✓
5	·	·	✓	·	·	·	·	✓	·	·	✓	·	·	✓
6	·	✓	·	·	·	·	✓	·	·	·	✓	✓	·	·
7	·	·	✓	·	·	·	·	✓	✓	·	·	✓	·	·
8	✓	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·
9	✓	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·
10	✓	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·
11	✓	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·
12	✓	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·

School B ... boys

	i					ii			iii			iv		
	1	2	3	T	O	1	2	3	1	2	3	1	2	3
1	·	·	✓	·	·	·	·	✓	·	·	✓	·	·	✓
2	·	·	✓	·	·	·	·	✓	·	·	✓	·	·	✓
3	✓	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·
4	✓	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·
5	✓	·	·	·	✓	✓	·	·	✓	·	·	✓	·	·
6	✓	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·
7	·	·	✓	·	·	·	·	✓	·	·	✓	·	·	✓
8	·	·	✓	·	·	·	·	✓	·	·	✓	·	·	✓
9	✓	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·
10	✓	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·
11	·	✓	·	·	·	✓	·	·	✓	·	·	✓	·	·
12	✓	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·
13	·	·	✓	·	·	·	·	✓	·	·	✓	·	·	✓
14	✓	·	·	✓	·	·	✓	·	✓	·	·	✓	·	·
15	✓	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·

School B .. girls

	i					ii			iii			iv		
	1	2	3	T	O	1	2	3	1	2	3	1	2	3
1	✓	·	·	·	✓	✓	·	·	✓	·	·	✓	·	·
2	✓	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·
3	·	·	✓	·	·	·	·	✓	·	·	✓	·	·	✓
4	✓	·	·	·	✓	✓	·	·	✓	·	·	✓	·	·
5	✓	·	·	·	✓	·	✓	·	·	✓	·	·	✓	·
6	✓	·	·	·	✓	✓	·	·	✓	·	·	✓	·	·
7	✓	·	·	✓	·	✓	·	·	✓	·	·	·	✓	·
8	✓	·	·	·	✓	✓	·	·	✓	·	·	✓	·	·
9	✓	·	·	✓	·	✓	·	·	✓	·	·	✓	·	·
10	✓	·	·	·	✓	✓	·	·	✓	·	·	✓	·	·
11	✓	·	·	·	✓	✓	·	·	✓	·	·	✓	·	·
12	✓	·	·	·	✓	✓	·	·	✓	·	·	✓	·	·

Table 153 continued

Test 7...... Conservation of Discontinuous Quantities

School C Boys

No.	i			ii			iii			iv		
1	·	·	✓	·	·	✓	·	·	✓	·	·	✓
2	·	·	✓	·	·	✓	·	·	✓	·	·	✓
3	·	·	✓	·	·	✓	·	·	✓	·	·	✓
4	·	·	✓	·	·	✓	·	·	✓	·	·	✓
5	✓			✓	·	·	✓	·	·	✓	✓	·
6	·	✓	·	✓	·	·	✓	·	·	✓	·	·
7	✓	·	·	✓	·	·	✓	·	·	✓	·	·
8	✓	·	·	✓	·	·	✓	·	·	✓	·	·
9	✓	·	·	✓	·	·	✓	·	·	✓	·	·
10	✓	·	·	✓	·	·	✓	·	·	✓	·	·
11	✓	·	·	✓	·	·	✓	·	·	✓	·	·
12	✓	·	·	✓	·	·	✓	·	·	✓	·	·

School C Girls

No.	i			ii			iii			iv		
1	·	·	✓	·	·	✓	·	·	✓	·	·	✓
2	·	·	✓	·	·	✓	·	·	✓	·	·	✓
3	·	·	✓	·	·	✓	·	·	✓	·	·	✓
4	·	·	✓	·	·	✓	·	·	✓	·	·	✓
5	·	·	✓	·	·	✓	·	✓	·	·	✓	·
6	✓	·	·	✓	·	·	✓	·	·	✓	·	·
7	✓	·	·	✓	·	·	✓	·	·	✓	·	·
8	✓	·	·	✓	·	·	✓	·	·	✓	·	·
9	✓	·	·	✓	·	·	✓	·	·	✓	·	·
10	✓	·	·	✓	·	·	✓	·	·	✓	·	·
11	✓	·	·	✓	·	·	✓	·	·	✓	·	·
12	✓	·	·	✓	·	·	✓	·	·	·	✓	·
13	✓	·	·	✓	·	·	✓	·	·	✓	·	·
14	·	✓	·	✓	·	·	✓	·	·	✓	·	·
15	✓	·	·	✓	·	·	✓	·	·	✓	·	·
16	✓	·	·	✓	·	·	✓	·	·	✓	·	·
17	✓	·	·	✓	·	·	✓	·	·	✓	·	·

School D Boys

No.	i			ii			iii			iv		
1	·	·	✓	·	·	✓	·	·	✓	·	·	✓
2	·	·	✓	·	·	✓	·	·	✓	·	·	✓
3	·	·	✓	·	·	✓	·	·	✓	·	·	✓
4	·	·	✓	·	·	✓	·	·	✓	·	·	✓
5	·	·	✓	·	·	✓	·	·	✓	·	·	✓
6	·	·	✓	·	·	✓	·	·	✓	·	·	✓
7	·	·	✓	·	·	✓	·	·	✓	·	·	✓
8	·	·	✓	·	·	✓	·	·	✓	·	·	✓
9	·	·	✓	·	·	✓	·	·	✓	·	·	✓
10	✓	·	·	✓	·	·	✓	·	·	✓	·	·
11	·	·	✓	·	·	✓	·	·	✓	·	·	✓
12	·	·	✓	·	·	✓	·	·	✓	·	·	✓
13	·	·	✓	·	·	✓	·	·	✓	·	·	✓
14	·	✓	·	·	✓	·	·	✓	·	·	✓	·
15	✓	·	✓	✓	·	✗	✓	·	✗	✓	·	✗
16	·	·	✓	·	·	✓	·	·	✓	·	·	✓
17	·	·	✓	·	·	✓	·	·	✓	·	·	✓
18	✓	·	·	✓	·	·	✓	·	·	✓	·	·
19	✓	·	·	✓	·	·	✓	·	·	✓	·	·
20	✓	·	·	✓	·	·	✓	·	·	✓	·	·
21	·	✓	·	✓	·	·	✓	·	·	✓	·	·

School D Girls

No.	i			ii			iii			iv		
1	·	·	✓	·	·	✓	·	·	✓	·	·	✓
2	·	·	✓	·	·	✓	·	·	✓	·	·	✓
3	·	·	✓	·	·	✓	·	·	✓	·	·	✓
4	·	·	✓	·	·	✓	·	·	✓	·	·	✓
5	·	·	✓	·	·	✓	·	·	✓	·	·	✓
6	·	·	✓	·	·	✓	·	·	✓	·	·	✓
7	·	✓	·	·	·	✓	·	·	✓	·	·	✓
8	·	✓	·	·	✓	·	·	✓	·	·	✓	·
9	·	·	✓	·	·	✓	·	·	✓	·	·	✓
10	·	✓	·	·	·	✓	·	·	✓	·	·	✓
11	·	·	✓	·	·	✓	·	·	✓	·	·	✓
12	✓	·	·	✓	·	·	✓	·	·	✓	·	·
13	·	✓	·	·	·	✓	·	·	✓	·	·	✓
14	·	·	✓	·	·	✓	·	·	✓	·	·	✓
15	·	·	✓	·	·	✓	·	·	✓	·	·	✓
16	·	·	✓	·	·	✓	·	·	✓	·	·	✓
17	✓	·	·	✓	·	·	✓	·	·	✓	·	·
18	·	·	✓	·	·	✓	·	·	✓	·	·	✓
19	✓	·	·	✓	·	·	✓	·	·	✓	·	·
20	·	·	✓	·	·	✓	·	·	✓	·	·	✓
21	·	·	✓	·	·	✓	·	·	✓	·	·	✓
22	✓	·	·	✓	·	·	✓	·	·	✓	·	·
23	✓	·	·	✓	·	·	✓	·	·	✓	·	·
24	✓	·	·	✓	·	·	✓	·	·	✓	·	·
25	✓	·	·	✓	·	·	✓	·	·	✓	·	·
26												

Table 154. Test 8. Relations between parts and wholes.

School A boys

	1	2	3
1	·	✓	·
2	·	✓	·
3	·	·	✓
4	·	·	✓
5	·	✓	·
6	·	·	✓
7	·	✓	·
8	·	✓	·
9	·	✓	·
10	·	✓	·
11	·	✓	·
12	·	✓	·
13	·	✓	·
14	✓	·	·
15	✓	·	·
16	✓	·	·

School A girls

	1	2	3
1	·	·	✓
2	✓	·	·
3	·	✓	·
4	·	·	✓
5	·	✓	·
6	·	✓	·
7	·	✓	·
8	·	✓	·
9	·	✓	·
10	·	✓	·
11	✓	·	·
12	✓	·	·

School B boys

	1	2	3
1	·	·	✓
2	·	·	✓
3	✓	·	·
4	✓	·	·
5	✓	·	·
6	✓	·	·
7	·	✓	·
8	·	✓	·
9	·	✓	·
10	✓	·	·
11	✓	·	·
12	✓	·	·
13	·	✓	·
14	✓	·	·
15	✓	·	·

School B girls

	1	2	3
1	✓	·	·
2	✓	·	·
3	·	✓	·
4	✓	·	·
5	·	·	✓
6	·	✓	·
7	✓	·	·
8	✓	·	·
9	✓	·	·
10	✓	·	·
11	✓	·	·
12	✓	·	·

School C..boys

	1	2	3
1	·	·	✓
2	·	·	✓
3	·	✓	·
4	✓	·	·
5	✓	·	·
6	✓	·	·
7	✓	·	·
8	✓	·	·
9	✓	·	·
10	✓	·	·
11	✓	·	·
12	✓	·	·

School C..girls

	1	2	3
1	·	·	✓
2	·	·	✓
3	·	·	✓
4	·	✓	·
5	✓	·	·
6	✓	·	·
7	✓	·	·
8	·	✓	·
9	✓	·	·
10	✓	·	·
11	✓	·	·
12	✓	·	·
13	✓	·	·
14	·	✓	·
15	✓	·	·
16	✓	·	·
17	✓	·	·

School D..boys

	1	2	3
1	·	·	✓
2	·	·	✓
3	✓	·	·
4	·	·	✓
5	·	·	✓
6	·	·	✓
7	·	✓	·
8	·	·	✓
9	·	·	✓
10	✓	·	·
11	·	·	✓
12	·	·	✓
13	·	·	✓
14	✓	·	·
15	✓	·	·
16	·	·	✓
17	·	✓	·
18	·	✓	·
19	✓	·	·
20	✓	·	·
21	✓	·	·

School D..girls

	1	2	3
1	·	·	✓
2	·	✓	·
3	✓	·	·
4	·	·	✓
5	·	·	✓
6	·	·	✓
7	✓	·	·
8	✓	·	·
9	·	·	✓
10	✓	·	·
11	·	✓	·
12	✓	·	·
13	·	✓	·
14	·	·	✓
15	✓	·	·
16	·	✓	·
17	✓	·	·
18	✓	·	·
19	✓	·	·
20	✓	·	·
21	✓	·	·
22	✓	·	·
23	✓	·	·
24	✓	·	·
25	✓	·	·

Table 155. Test 9. Seriation.

School A ... boys

	i (1 2 3)	ii (1 2 3)	iii (1 2 3)	iv (1 2 3)	v (1 2 3)	vi (1 2 3)
1	3	3	3	3	3	3
2	3	3	3	2	2	2
3	3	3	3	2	2	2
4	3	3	3	3	3	3
5	3	3	3	2	2	3
6	3	3	3	2	2	2
7	3	3	3	2	2	2
8	3	3	3	2	2	2
9	2	2	2	2	2	2
10	2	3	2	2	2	2
11	3	3	2	2	2	2
12	3	3	3	2	2	2
13	3	3	2	2	2	1
14	3	3	2	2	2	1
15	2	1	1	1	1	1
16	1	1	1	1	1	1

School A ... girls

	i (1 2 3)	ii (1 2 3)	iii (1 2 3)	iv (1 2 3)	v (1 2 3)	vi (1 2 3)
1	3	3	3	2	2	2
2	3	3	2	2		1
3	3		2	2		2
4	3		2	3		2
5	3	3	3	2	2	2
6	3	3	2	2	2	2
7	3	2	2	1	1	1
8	3	2	2	1	2	1
9	2	2	2	1	1	1
10	2	2	1	1	1	1
11	2	1	1	1	1	1
12	1	1	1	1	1	1

School B ... boys

	i	ii	iii	iv	v	vi
1	3	3	3	2	2	2
2	3	3	3	2	2	3
3	1	2	2	2	3	2
4	2	3	2	2	2	2
5	1	1	1	1	1	1
6	1	1	1	1	1	1
7	3	3	3	3	3	2
8	3	3	3	2	2	1
9	2	2	2	2	2	2
10	1	1	1	1	1	1
11	2	2	1	1	1	1
12	1	1	1	1	1	1
13	2	3	2	1	2	2
14	1	1	1	1	1	1
15	1	1	1	1	1	1

School B... girls

	i	ii	iii	iv	v	vi
1	2	2	2	1	1	1
2	2	2	3	1	1	2
3	3	3	2	2	2	2
4	1	1	1	2	1	1
5	3	3	2	3	2	2
6	3	2	2	1	1	1
7	3	3	2	2	2	3
8	1	1	2	2	2	2
9	2	3	2	2	2	2
10	1	1	1	2	1	1
11	2	3	3	2	2	2
12	2	2	1	2	1	1

School C ... boys

	i	ii	iii	iv	v	vi
1	3	3	3	3	3	3
2	3	3	3	3	3	3
3	3	3	3	3	3	3
4	3	2	3	2	2	2
5	2	3	2	2	2	1
6	2	3	2	2	2	2
7	3	2	2	1	2	2
8	2	2	2	2	2	2
9	2	2	1	1	2	1
10	2	2	2	2	1	1
11	2	1	1	2	1	1
12	3	2	2	1	1	1

School C.. girls

	i	ii	iii	iv	v	vi
1	3	2	3	3	3	3
2	3	3	3	3	3	2
3	3	3	3	3	3	3
4	3	2		2	2	3
5	2	1	2	1	1	1
6	2	2	2	1	1	1
7	2	3	2	1	2	1
8	3	3	2	3	2	3
9	3	2	3	3	2	3
10	2	2	2	2	1	2
11	2	3	2	2	2	2
12	1	3	2	2	2	2
13	3	3	2	2	2	2
14	2	3	2	2	1	2
15	2	2	2	1	1	2
16	2	1	2	1	1	1
17	2	2	2	3	1	2

School D ... boys

	i	ii	iii	iv	v	vi
1	3	3	3	3	3	3
2	3	3	3	3	3	3
3	3	3	3	3	3	3
4	3	3	3	3	3	3
5	3	3	3	3	3	3
6	3	3	2	3	3	3
7	3	3	2	3	2	3
8	3	3	3	3	3	2
9	3	3	3	3	3	3
10	1	1	1	1	1	1
11	3	3	3	3	3	3
12	3	3	3	3	3	3
13	3	3	3	2	3	3
14	3	3	3	3	3	3
15	3	3	3	2	2	2
16	3	3	3	2	2	2
17	3	3	2	2	2	2
18	3	2	2	2	1	2
19	1	1	2	1	1	1
20	1	1	2	1	1	1
21	2	2	1	1	1	2

School D ... girls

	i	ii	iii	iv	v	vi
1	3	3	3	3	3	3
2	3	3	3	3	3	3
3	3	3	3	3	3	3
4	3	3	3	3	3	3
5	3	3	3	3	3	3
6	2	3	3	3	3	3
7	3	3	2	3	3	3
8	3	3	2	3	2	2
9	3	3	3	3	3	3
10	3	3	2	2	2	2
11	3	3	3	3	3	2
12	3	3	1	1	1	2
13	3	3	2	2	2	2
14	3	2	2	2	2	2
15	3	3	3	2	2	2
16	3	3	3	2	2	2
17	3	3	2	2	2	2
18	3	3	3	2	2	2
19	2	2	2	1	1	1
20	3	3	3	2	3	3
21	3	3	2	2	3	3
22	2	2	2	2	2	1
23	3	3	2	1	2	2
24	1	1	1	1	1	1
25	1	1	1	1	1	1

TABLE 156 TEST 10 ORDINATION AND CARDINATION

School A Boys

Test / Step	i 1	i 2	i 3	ii 1	ii 2	ii 3
1	·	·	✓	·	·	✓
2	·	·	✓	·	·	✓
3	·	·	✓	·	·	✓
4	·	·	✓	·	·	✓
5	·	·	✓	·	·	✓
6	·	·	✓	·	·	✓
7	·	·	✓	·	·	✓
8	✓	·	·	·	·	✓
9	✓	·	·	·	✓	·
10	·	·	✓	·	·	✓
11	·	·	✓	·	·	✓
12	·	·	✓	·	·	✓
13	·	·	✓	·	·	✓
14	·	✓	·	·	✓	·
15	·	✓	·	✓	·	·
16	·	✓	·	·	·	✓

School A Girls

Test / Step	i 1	i 2	i 3	ii 1	ii 2	ii 3
1	·	·	✓	·	·	✓
2	·	✓	·	·	✓	·
3	·	·	✓	·	·	✓
4	·	·	✓	·	·	✓
5	·	·	✓	·	·	✓
6	·	·	✓	·	·	✓
7	·	✓	·	·	·	✓
8	✓	·	·	·	✓	·
9	✓	·	·	·	✓	·
10	✓	·	·	✓	·	·
11	·	✓	·	✓	·	·
12	✓	·	·	✓	·	·

School B Boys

Test / Step	i 1	i 2	i 3	ii 1	ii 2	ii 3
1	·	·	✓	·	·	✓
2	·	✓	·	·	·	✓
3	✓	·	·	·	✓	·
4	✓	·	·	·	✓	·
5	✓	·	·	✓	·	·
6	✓	·	·	✓	·	·
7	·	·	✓	·	·	✓
8	·	✓	·	·	·	✓
9	✓	·	·	·	✓	·
10	·	·	✓	✓	·	·
11	·	✓	·	·	✓	·
12	✓	·	·	✓	·	·
13	✓	·	·	·	·	✓
14	✓	·	·	✓	·	·
15	✓	·	·	✓	·	·

School B Girls

Test / Step	i 1	i 2	i 3	ii 1	ii 2	ii 3
1	✓	·	·	·	✓	·
2	✓	·	·	·	✓	·
3	✓	·	·	·	·	✓
4	✓	·	·	✓	·	·
5	·	·	✓	·	·	✓
6	·	✓	·	·	✓	·
7	·	·	✓	·	·	✓
8	·	·	✓	·	·	✓
9	✓	·	·	✓	·	·
10	✓	·	·	·	✓	·
11	·	✓	·	·	✓	·
12	✓	·	·	·	✓	·

C boys

Step	i 1	i 2	i 3	ii 1	ii 2	ii 3
1	·	·	✓	·	·	✓
2	·	·	✓	·	·	✓
3	·	·	✓	·	·	✓
4	·	✓	·	·	✓	·
5	✓	·	·	·	·	✓
6	✓	·	·	·	✓	·
7	·	✓	·	·	·	✓
8	✓	·	·	·	✓	·
9	✓	·	·	·	·	✓
10	✓	·	·	·	✓	·
11	✓	·	·	·	✓	·
12	·	·	✓	·	✓	·

C girls

Step	i 1	i 2	i 3	ii 1	ii 2	ii 3
1	·	·	✓	·	·	✓
2	✓	·	·	·	·	✓
3	·	·	✓	·	·	✓
4	·	·	✓	·	·	✓
5	·	✓	·	·	✓	·
6	·	✓	·	·	·	✓
7	✓	·	·	✓	·	·
8	✓	·	·	·	·	✓
9	·	·	✓	·	·	✓
10	✓	·	·	·	✓	·
11	·	·	✓	·	·	✓
12	·	✓	·	✓	·	·
13	·	✓	·	·	·	✓
14	✓	·	·	·	✓	·
15	·	✓	·	·	✓	·
16	✓	·	·	✓	·	·
17	✓	·	·	·	✓	·

D boys

Step	i 1	i 2	i 3	ii 1	ii 2	ii 3
1	·	·	✓	·	·	✓
2	·	·	✓	·	·	✓
3	·	·	✓	·	·	✓
4	·	·	✓	·	·	✓
5	·	·	✓	·	·	✓
6	·	·	✓	·	·	✓
7	·	·	✓	·	·	✓
8	·	·	✓	·	·	✓
9	·	·	✓	·	·	✓
10	✓	·	·	·	✓	·
11	·	·	✓	·	·	✓
12	·	·	✓	·	·	✓
13	·	·	✓	·	·	✓
14	·	·	✓	·	·	✓
15	·	·	✓	·	·	✓
16	·	✓	·	·	·	✓
17	·	✓	·	·	·	✓
18	·	✓	·	·	·	✓
19	✓	·	·	·	✓	·
20	✓	·	·	✓	·	·
21	·	✓	·	·	✓	·

D girls

Step	i 1	i 2	i 3	ii 1	ii 2	ii 3
1	·	·	✓	·	·	✓
2	·	✓	·	·	✓	·
3	·	·	✓	·	·	✓
4	·	·	✓	·	·	✓
5	·	·	✓	·	·	✓
6	·	·	✓	·	·	✓
7	·	✓	·	·	·	✓
8	·	·	✓	·	·	✓
9	·	·	✓	·	·	✓
10	·	✓	·	·	·	✓
11	·	·	✓	·	·	✓
12	✓	·	·	·	·	✓
13	·	·	✓	·	·	✓
14	·	✓	·	·	·	✓
15	·	·	✓	·	✓	·
16	·	·	✓	·	·	✓
17	·	✓	·	·	✓	·
18	·	·	✓	·	·	✓
19	·	✓	·	·	·	✓
20	·	·	✓	·	·	✓
21	·	·	✓	·	·	✓
22	·	✓	·	·	✓	·
23	·	✓	·	·	✓	·
24	✓	·	·	✓	·	·
25	✓	·	·	✓	·	·

TABLE 157

TEST 11 Class Inclusion

School A boys

	1			2			3		4		5		6		7		8		9		10		11		12		13			
	a	b	c	a	b	c	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	c	
1	✓	✓	×	✓	✓	✓	✓	✓	×	✓	✓	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	×	✓	✓	×	18
2	✓	✓	×	✓	✓	✓	✓	✓	×	✓	×	✓	✓	✓	×	✓	×	✓	×	✓	×	×	×	✓	×	×	✓	✓	✓	18
3	✓	✓	×	✓	×	✓	✓	✓	×	×	×	×	×	✓	×	✓	×	✓	×	✓	×	✓	✓	✓	×	✓	×	×	×	13
4	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	23
5	✓	×	×	✓	×	×	✓	×	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	×	×	✓	×	×	✓	✓	×	12
6	✓	✓	×	✓	✓	✓	✓	✓	×	✓	✓	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	×	×	✓	×	17
7	✓	✓	×	✓	×	×	✓	✓	×	✓	×	✓	×	✓	×	×	×	✓	×	✓	×	✓	×	✓	×	×	✓	✓	×	14
8	✓	✓	×	✓	×	✓	✓	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	×	✓	✓	✓	17
9	×	✓	×	×	×	×	×	×	×	×	×	×	×	×	×	✓	×	✓	×	×	×	×	×	✓	×	×	×	×	×	4
10	✓	✓	×	✓	×	×	×	×	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	×	×	✓	✓	13
11	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	✓	✓	✓	20
12	✓	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	15
13	✓	✓	×	✓	×	✓	×	×	×	×	×	×	×	×	×	×	×	✓	×	✓	×	✓	×	✓	×	×	✓	✓	×	10
14	✓	✓	×	✓	✓	×	✓	×	×	✓	✓	✓	✓	✓	×	✓	✓	✓	×	✓	✓	✓	✓	✓	×	✓	×	×	×	19
15	×	×	×	×	×	×	×	×	×	×	×	×	×	×	✓	×	×	×	×	×	×	×	×	×	×	×	×	×	×	1
16	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	0
	13	13	2	13	6	9	10	9	0	11	3	11	2	12	0	13	1	14	0	13	2	11	2	14	1	5	8	11	5	

Girls

	1			2			3		4		5		6		7		8		9		10		11		12		13			
	a	b	c	a	b	c	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	c	
1	✓	✓	×	✓	×	✓	×	×	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	×	✓	✓	✓	15
2	×	✓	×	×	✓	×	✓	✓	×	✓	✓	✓	×	✓	×	×	×	✓	×	✓	×	✓	×	✓	×	×	×	×	×	12
3	✓	✓	✓	✓	×	×	✓	×	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	×	×	✓	×	×	✓	✓	×	14
4	✓	✓	✓	✓	×	✓	✓	✓	×	✓	✓	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	×	✓	✓	×	18
5	✓	✓	✓	✓	✓	✓	✓	×	×	✓	✓	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	×	×	×	×	16
6	✓	✓	×	✓	✓	×	✓	×	✓	✓	✓	✓	×	✓	×	✓	×	✓	✓	✓	×	✓	×	✓	×	✓	×	✓	✓	19
7	✓	×	×	✓	×	✓	✓	×	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓	×	×	×	×	×	12
8	✓	×	×	✓	×	✓	×	×	×	×	×	✓	×	✓	×	✓	×	×	×	✓	×	×	×	✓	×	×	×	✓	×	9
9	×	×	✓	✓	✓	✓	✓	×	✓	✓	×	✓	×	✓	×	×	✓	✓	×	✓	×	✓	×	✓	×	✓	×	×	×	16
10	✓	✓	×	×	×	×	×	×	×	×	×	×	×	✓	×	×	×	×	×	✓	×	✓	×	×	×	✓	×	×	×	6
11	×	×	×	✓	×	✓	×	×	×	✓	×	✓	×	✓	×	✓	×	✓	×	×	×	×	×	✓	×	×	×	×	×	8
12	✓	×	✓	✓	×	×	×	×	×	✓	×	✓	×	✓	×	✓	✓	✓	×	✓	×	×	×	✓	✓	×	✓	×	×	13
13	9	7	5	10	4	7	7	2	2	10	4	11	0	12	0	9	2	10	1	11	0	8	0	11	2	3	4	5	2	

TABLE 158

TEST II Class Inclusion

School B boys

	1a	1b	1c	2a	2b	2c	3a	3b	4a	4b	5a	5b	6a	6b	7a	7b	8a	8b	9a	9b	10a	10b	11a	11b	12a	12b	13a	13b	13c	
1	✓	✓	x	✓	✓	✓	✓	x	x	✓	x	✓	x	✓	x	✓	x	✓	x	✓	x	✓	x	✓	x	x	x	✓	✓	16
2	✓	✓	x	✓	✓	✓	✓	✓	x	✓	x	✓	x	✓	x	✓	x	✓	x	✓	x	x	x	✓	x	x	x	✓	✓	16
3	✓	✓	x	✓	x	x	✓	x	x	✓	x	✓	x	✓	x	✓	x	x	x	✓	x	✓	x	✓	x	✓	✓	✓	✓	15
4	✓	✓	x	✓	✓	✓	x	✓	x	✓	✓	✓	x	✓	x	✓	✓	✓	x	✓	x	✓	x	✓	x	✓	✓	✓	✓	20
5	✓	x	✓	x	x	x	x	x	x	✓	x	✓	x	✓	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	5
6	x	[illegible]	x	x	x	x	x	x	x	x	x	x	x	x	✓	✓	x	x	x	x	✓	x	x	x	x	✓	x	x	x	4
7	✓	✓	✓	✓	✓	x	x	✓	x	✓	✓	✓	x	✓	x	✓	x	✓	x	✓	x	✓	x	✓	✓	x	x	✓	✓	18
8	✓	✓	✓	x	✓	x	✓	x	x	✓	x	✓	x	✓	x	✓	x	x	x	x	x	✓	x	✓	x	✓	x	x	x	12
9	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	x	x	x	✓	✓	x	✓	✓	✓	✓	✓	x	✓	x	✓	x	✓	✓	✓	20
10	x	x	x	x	x	✓	x	x	x	✓	x	✓	x	x	x	✓	x	✓	x	✓	x	✓	x	✓	✓	x	x	x	x	9
11	✓	✓	x	✓	x	✓	x	✓	x	x	x	x	✓	✓	x	✓	✓	x	x	✓	x	✓	x	✓	x	x	x	✓	x	13
12	x	x	x	✓	✓	x	x	x	x	x	x	x	✓	✓	x	x	✓	✓	✓	x	✓	x	✓	✓	x	✓	✓	x	x	12
13	✓	✓	x	✓	x	✓	x	✓	x	x	✓	✓	x	✓	x	✓	x	✓	x	✓	x	✓	x	✓	x	x	x	✓	✓	15
14	✓	✓	✓	✓	✓	✓	x	x	✓	x	✓	x	✓	x	✓	✓	✓	x	✓	x	x	x	✓	x	x	x	x	x	x	14
15	x	✓	x	x	✓	✓	✓	x	x	x	x	x	x	✓	✓	x	✓	✓	x	x	x	x	x	x	✓	x	x	✓	x	10

School B girls

	1a	1b	1c	2a	2b	2c	3a	3b	4a	4b	5a	5b	6a	6b	7a	7b	8a	8b	9a	9b	10a	10b	11a	11b	12a	12b	13a	13b	13c	
1	✓	✓	x	✓	✓	x	✓	x	x	x	x	x	x	x	x	✓	x	✓	x	x	x	✓	x	✓	✓	✓	x	✓	✓	13
2	✓	✓	x	✓	x	✓	✓	x	x	x	x	✓	✓	x	x	x	✓	✓	x	x	x	x	x	✓	x	x	x	✓	✓	12
3	✓	✓	✓	✓	✓	✓	✓	x	x	x	x	✓	x	✓	✓	x	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	23
4	x	✓	x	x	✓	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	2
5	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	x	✓	x	✓	x	✓	✓	✓	✓	✓	✓	✓	x	✓	✓	✓	x	✓	✓	23
6	✓	x	x	✓	x	x	✓	x	✓	x	x	✓	x	✓	✓	✓	x	✓	✓	x	x	x	x	✓	✓	✓	x	x	x	13
7	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	✓	✓	✓	✓	✓	x	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	27
8	x	x	✓	x	✓	x	x	x	✓	✓	x	x	x	x	x	✓	x	x	x	x	x	x	x	✓	x	x	x	x	x	6
9	x	x	x	x	x	x	x	x	✓	x	x	x	x	✓	x	✓	✓	x	x	x	x	✓	✓	✓	x	✓	x	x	x	8
10	✓	✓	✓	✓	x	✓	✓	x	✓	x	✓	x	✓	x	x	✓	✓	✓	x	x	✓	✓	✓	x	✓	✓	✓	✓	✓	20
11	✓	✓	x	✓	x	x	x	x	x	✓	x	✓	x	✓	x	✓	x	✓	✓	x	x	✓	x	✓	✓	✓	x	x	x	13
12	✓	✓	x	✓	x	x	✓	x	✓	x	✓	x	x	✓	✓	✓	x	✓	✓	✓	✓	x	✓	✓	✓	x	✓	✓	✓	19
	9	9	5	9	6	5	8	2	5	4	3	6	3	7	4	8	6	9	6	4	5	7	5	10	8	8	4	7	7	

TABLE 159

TEST 11 Class Inclusion. School C ... boys

	1a	1b	1c	2a	2b	2c	3a	3b	4a	4b	5a	5b	6a	6b	7a	7b	8a	8b	9a	9b	10a	10b	11a	11b	12a	12b	13a	13b	13c	
1	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✗	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	26
2	✓	✓	✗	✓	✓	✓	✓	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✗	✓	✓	✓	18
3	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✗	✗	✗	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	24
4	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	28
5	✓	✓	✓	✓	✓	✓	✗	✗	✗	✓	✓	✓	✓	✗	✗	✓	✗	✗	✗	✓	✓	✓	✓	✗	✓	✓	✓	✗	✓	19
6	✓	✓	✗	✓	✗	✗	✗	✗	✗	✓	✗	✓	✓	✓	✗	✓	✗	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	17
7	✓	✓	✗	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗	✓	✗	✓	✗	✓	✗	✗	✗	✗	✗	✗	✓	✗	✓	✓	✓	14
8	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✓	✓	✓	✗	✓	✗	✓	✓	✗	✗	✓	✗	✗	✓	10
9	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	29
10	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✓	✓	✓	✗	✓	✗	✓	✓	✗	✗	✓	✗	✗	✗	8
11	✗	✗	✗	✗	✗	✓	✗	✗	✓	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✓	✗	✓	✗	✓	✓	✗	7
12	✗	✗	✓	✓	✓	✓	✗	✓	✗	✗	✗	✗	✗	✓	✗	✗	✗	✓	✓	✗	✗	✗	✗	✓	✓	✗	✓	✗	✗	11
	8	9	6	9	8	9	6	7	2	7	7	7	5	8	3	9	5	10	4	9	6	9	9	7	9	8	10	7	8	

girls

	1a	1b	1c	2a	2b	2c	3a	3b	4a	4b	5a	5b	6a	6b	7a	7b	8a	8b	9a	9b	10a	10b	11a	11b	12a	12b	13a	13b	13c	
1	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✓	✓	✓	✓	✓	22
2	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✓	✗	✓	✓	✓	22
3	✓	✓	✓	✓	✗	✓	✗	✓	✗	✓	✓	✓	✓	✓	✗	✗	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✓	18
4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	27
5	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓	✗	✗	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	6
6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓	✓	✓	27
7	✓	✗	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✓	✓	✓	✓	✗	✓	✓	✓	✓	✗	✗	✓	✗	✗	✗	✗	✓	13
8	✓	✓	✓	✓	✗	✗	✗	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	24
9	✓	✓	✓	✓	✗	✗	✗	✗	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✗	✗	✓	✗	✓	✓	✗	✓	✓	✓	15
10	✓	✓	✓	✓	✗	✗	✓	✓	✗	✓	✓	✓	✓	✓	✗	✗	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	17
11	✓	✓	✗	✓	✓	✗	✗	✗	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✗	✓	✓	✓	15
12	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	0
13	✓	✓	✓	✗	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	26
14	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✓	✗	✓	✗	✗	✗	✓	✗	✗	✗	4
15	✓	✗	✗	✗	✓	✗	✓	✗	✓	✓	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✓	✗	✗	✓	9
16	✓	✗	✗	✓	✓	✗	✓	✗	✗	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✓	✓	✗	✓	✗	✗	✗	✗	13
17	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✓	✓	✗	✗	✗	✓	✓	✓	✗	✓	✗	✗	✗	7
	13	10	9	11	9	5	8	7	4	11	8	10	9	14	7	9	6	12	7	12	7	14	6	13	7	9	8	10	10	

School D Class Inclusion Test II — TABLE 160

Boys	1a	1b	1c	2a	2b	2c	3a	3b	4a	4b	5a	5b	6a	6b	7a	7b	8a	8b	9a	9b	10a	10b	11a	11b	12a	12b	13a	13b	13c	
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	29
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	29
3	✓	✓	✓	✓	✗	✓	✓	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✓	✓	✓	✓	✗	✓	✗	✓	✓	✓	✓	21
4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	29
5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	29
6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	29
7	✓	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✓	10
8	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	29
9	✓	✓	✗	✓	✗	✓	✓	✓	✗	✓	✓	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✗	✓	✗	✓	17
10	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	28
11	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	29
12	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	29
13	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	29
14	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	27
15	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✓	✓	✓	✓	✓	12
16	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	29
17	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	29
18	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	29
19	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	0
20	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓	✗	✗	✗	2
21	✓	✗	✗	✓	✗	✗	✓	✓	✓	✓	✓	✗	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	22
Girls	18	18	15	18	14	17	17	18	15	18	16	18	16	17	15	17	15	18	16	18	16	18	15	18	16	19	16	17	19	487
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	29
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	28
3	✓	✓	✗	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	26
4	✓	✓	✗	✓	✗	✓	✓	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✗	✗	✓	✗	✓	✓	✗	✓	✓	✓	17
5	✓	✓	✗	✓	✗	✗	✓	✓	✗	✓	✗	✓	✗	✓	✗	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	21
6	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	28
7	✓	✓	✗	✓	✗	✓	✓	✗	✗	✗	✗	✓	✗	✓	✗	✓	✓	✓	✗	✓	✗	✓	✗	✓	✓	✓	✗	✓	✓	17
8	✓	✓	✗	✓	✗	✗	✓	✗	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✗	✗	✓	✓	✗	✗	✓	✓	14
9	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	29
10	✓	✓	✗	✓	✗	✓	✓	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✓	✗	✗	✓	✓	17
11	✓	✗	✗	✓	✗	✓	✓	✓	✗	✓	✓	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✗	✗	✓	✓	16
12	✓	✓	✗	✗	✗	✓	✓	✓	✗	✓	✗	✓	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓	✗	19
13	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	29
14	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	29
15	✓	✓	✗	✓	✓	✓	✓	✓	✗	✓	✗	✓	✓	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✓	✓	✗	✗	✓	✓	19
16	✓	✓	✗	✓	✓	✓	✓	✓	✗	✓	✓	✓	✗	✓	✗	✓	✓	✓	✗	✓	✗	✓	✓	✓	✓	✓	✗	✓	✓	22
17	✓	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✓	✓	✗	✗	✓	✗	✗	✗	✗	✗	✓	✓	✓	✓	✗	✗	✓	✓	11
18	✗	✓	✓	✓	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	24
19	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	26
20	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	✗	✗	✓	✓	24
21	✗	✗	✗	✓	✗	✗	✗	✓	✗	✗	✗	✓	✗	✓	✗	✓	✓	✓	✗	✓	✓	✗	✓	✓	✓	✓	✗	✓	✗	14
22	✓	✓	✓	✓	✗	✓	✓	✗	✓	✓	✓	✓	✗	✓	✗	✓	✓	✓	✗	✓	✗	✓	✗	✓	✓	✗	✓	✓	✗	20
23	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓	✓	✓	26
24	✓	✓	✓	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	4
25	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✓	✓	✗	✓	✗	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓	✗	9
	22	21	10	22	12	18	21	20	10	20	15	24	13	22	12	24	17	23	12	21	14	21	15	23	20	13	11	23	19	

APPENDIX E.

Summary of all scores.

Table 161

Boys.

Number of times each child was at a particular stage in each test. (Based upon the results in the subtests)

Age group	Subject No.	1A (1 2 3)	1B (1 2 3)	2A (1 2 3)	2B (1 2 3)	3A (1 2 3)	3B (1 2 3)	4 (1 2 3)	5A (1 2 3)	5B (1 2 3)	6 (1 2 3)	7 (1 2 3)	8 (1 2 3)	9 (1 2 3)	10 (1 2 3)
16 years	1	4	5	3	3	6	6	2	4	5	3	4	1	6	2
	2	4	5	3	3	6	6	2	4	5	3	4	1	6	2
15 "	3	4	5	3	3	6	6	2	4	5	1 2	4	1	6	2
	4	4	5	3	3	6	6	2	4	5	3	4	1	6	2
14 "	5	4	5	3	3	6	2 4	2	4	5	3	4	1	6	2
	6	4	5	1 2	3	2 4	6	2	3 1	5	3	4	1	3 3	2
13 "	7	4	5	3	3	6	1 5	2	4	5	3	4	1	6	2
	8	4	5	3	2 1	2 4	2 4	2	3 1	1 4	3	4	1	1 2 3	2
	9	4	5	3	1 2	6	6	2	4	5	3	4	1	2 4	1 1
	10	4	3 2	3	1 1 1	1 5	3 3	1 1	3 1	5	3	4	1	1 4 1	1 1
	11	4	5	3	3	6	6	2	4	5	1 2	4	1	1 5	2
	12	4	5	3	2 1	1 5	1 5	2	2 2	5	1 2	4	1	6	2
	13	4	5	3	3	6	6	2	4	5	3	4	1	6	1 1
12 "	14	3 1	4 1	1 2	1 2	6	6	1 1	4	5	1 2	2 2	1	2 4	2
	15	4	5	3	3	6	1 5	2	4	5	1 2	4	1	6	2
	16	1 3	1 4	1 2	2 1	6	6	2	4	5	3	1 3	1	4 2	1 1
11 "	17	4	5	3	3	6	6	2	4	5	3	4	1	6	2
	18	4	5	2 1	1 2	2 3 1	6	2	4	5	3	4	1	5 1	1 1
	19	4	5	3	3	6	6	2	4	5	3	4	1	3 5	2
	20	4	5	3	3	6	6	2	4	5	3	4	1	6	2
	21	4	5	3	3	6	6	2	1 3	5	3	4	1	6	2
	22	4	5	1 2	3	6	2 4	2	2 2	2 3	1 2	4	1	6	2
	23	4	5	3	3	6	6	2	4	5	3	4	1	6	2
	24	4	5	3	5	6	2 4	2	1 3	5	1 2	4	1	2 4	2
10 "	25	4	5	3	3	6	6	2	4	5	3	4	1	6	2
	26	2 2	1 4	1 2	3	6	4 1 1	2	1 3	3 2	3	4	1	6	2
	27	2 2	2 3	3	3	5 1	5 1	2	2 2	5	3	4	1	2 4	2
	28	4	5	3	1 2	6	2 4	2	4	1 4	3	4	1	4 2	1 1
	29	3 1	5	2 1	2 1	6	1 5	2	3 1	5	3	4	1	2 4	2
9 "	30	4	5	2 1	3	6	6	2	4	5	3	4	1	6	2
	31	4	5	3	1 2	1 5	6	1 1	4	5	3	4	1	3 3	2
	32	4	5	3	1 2	6	6	1 1	3 1	5	3	4	1	1 5	2
8 "	33	2 2	3 1 1	3	2 1	6	2 4	2	3 1	5	1 1 1	4	1	4 2	1 1
	34	4	5	1 2	3	1 5	2 4	2	1 3	3 2	2 1	4	1	1 2 3	1 1
	35	2 2	1 4	3	2 1	6	1 5	2	4	2 3	3	4	1	1 4 1	1 1
	36	1 3	5	3	1 2	6	6	2	4	5	3	4	1	3 3	2
7 "	37	4	1 4	3	2 1	2 4	6	2	3 1	1 1 3	1 1 1	4	1	4 2	2
	38	2 1 1	5	3	1 2	6	6	2	3 1	5	3	4	1	3 3	1 1
	39	2 2	5	3	1 2	2 3 1	2 4	2	3 1	1 4	3	4	1	2 4	1 1
	40	1 2 1	5	3	1 1 1	3 3	1 5	2	3 1	5	2 1	4	1	5 1	1 1
	41	2 2	5	1 2	2 1	3 3	1 5	2	1 3	3 2	3	4	1	5 1	2
	42	4	5	2 1	3	1 2 3	1 5	2	1 3	2 3	3	4	1	6	1 1
	43	3 1	1 4	3	1 1 1	4 2	4 2	2	3 1	1 4	3	4	1	2 4	1 1
6 "	44	4	5	3	3	6	6	2	4	5	3	4	1	6	1 1
	45	4	5	3	3	6	6	2	4	5	3	4	1	6	1 1
	46	3 1	5	2 1	2 1	1 4 1	5 1	2	2 2	5	3	4	1	4 2	2
	47	4	5	2 1	1 2	6	6	2	3 1	1 4	3	3 1	1	4 2	2
	48	3 1	2 3	3	2 1	4 2	6	2	4	5	3	4	1	3 3	2
	49	4	4 1	3	2 1	1 5	3 1 2	2	4	3 2	3	4	1	1 4 1	1 1
	50	4	4 1	2 1	1 1 1	2 4	6	2	4	5	3	4	1	3 3	1 1
	51	3 1	5	3	3	6	6	2	4	5	3	4	1	6	1 1
	52	3 1	5	2 1	1 2	6	6	1 1	3 1	5	3	4	1	4 2	2
	53	4	4 1	2 1	2 1	4 2	5 1	2	3 1	4 1	3	4	1	1 3 2	2
	54	4	5	3	3	6	6	2	4	5	3	4	1	6	2
5 "	55	3 1	5	3	2 1	6	6	2	1 2 1	5	3	4	1	1 5	1 1
	56	4	5	3	2 1	2 4	2 4	2	2 2	1 4	3	4	1	1 4 1	1 1
	57	4	5	3	3	6	6	2	4	5	3	3 1	1	6	2
	58	1 3	4 1	2 1	1 1 1	5 1	5 1	2	4	5	3	3 1	1	3 3	2
	59	4	5	3	3	6	6	2	4	5	3	4	1	6	2
	60	4	5	3	3	6	6	2	4	5	3	4	1	5 1	1 1
	61	4	5	3	3	6	6	2	4	5	3	4	1	6	2
	62	3 1	5	3	3	6	6	2	4	5	3	4	1	5 1	1 1
	63	1 2 1	5	3	3	5 1	6	2	1 3	5	3	4	1	3 2 1	1
	64	4	5	3	3	6	6	2	4	5	3	4	1	6	1

Table 162

Girls — Number of times each child was at a particular stage in each test. (Based upon the results in the sub tests)

Subject	1a			1b			2a			2b			3a			3b			4			5a			5b			6			7			8			9			10		
15-16 Stage:	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
1			4			6			3			3			6			6			2			4			5		1	2			4			1			6			2
2		2	2			5			3		2	1			6			6			2		4				5			3			4		1			3	3			2
3			4			5			3			3		3	3		2	4		2			4			3	2	1	1	1			4		1				6			2
4			4			5			3			3			6	4	2			1	1			4	3	2		1	1	1			4	1					6			2
5			4			5			3			3			6			6			2		1	3		1	4			3			4			1			6			2
																							4																			
13-14 years																																										
6			4			5			3			3			6	4	2		2				4		5			3					4			1			6			2
7			4			5			3			3			6			6			2			4			5		1	2			4			1			6			2
8			4			5			3			3			6		4	2	2				4			1	4	3				1	3	1				1	5		1	1
9			4		1	4		1	2			3			6			6			2		1	3			5			3			4			1			6			2
10		4			5			2	1		2	1			6	6				2			4		5			3				4		1				3	3			2
11			4			5			3			3			6			6			2			4			5			3			4			1			6			2
12	3	1		4		1	1		2		2	1		2	4	6				2			4				5	1		2		1	3	1				4	2		1	1
11-12 years																																										
13	4			3	2		3			1	2			6			6		2			2	2	4	1	4		3			4			1			4	2		1	1	
14			4			5			3			3			6		3	3		2		1	3			1	4		1	2			4			1		1	5	1		1
15			4			5			3			3			6			6	2					4			5	1	1	1			4		1			1	5			2
16	3	1		4	1		1		2		2	1		2	4	6				2			2	2	5			3			4			1			3	1	2	1		1
17		1	3			5			3	1	1	1			6		1	5			2		4				5	1		2		1	3		1			4	2			2
18			4			5			3			3			6			6			2		3	1			5	1		2			4			1		5	1		1	1
19	4			5			3			1	2			5	1		6		2			2	2			5		3			4			1			2	4		1	1	
20	4			5			3			1	2		6			5	1		2			3	1		4	1		3			4			1			1	3	2		2	
21			4			5			3			3			6			6			2			4			5			3			4			1			6			2
22			4			5		1	2		1	2			6	5	1		2			1	3		2	3		3					4	1				3	3		1	1
9-10 years																																										
23		2	2			5			3			3			6			6		2				4			5	2	1				4		1			3	3			2
24	3	1		3	2		1	2		1	2			3	3	1	5		2				2	2		1	4	3			4			1				4	2		2	
25	4			4	1		1		2	1		2			6	5	1				2			4	5			3					4	1				3	3			2
26	2	2		4	1		3					3		3	3	2	3	1	2				4		1	3	1	3			4			1			3	3			1	1
27			4			5			3		2	1		1	5		6				2		4				5	1	1	1			4		1			4	2	1		1
28	4			5			3				2	1		6			6		2			3		1		5		3			4				1			5	1			2
29	4			5			3			3			6			6			2			4			5			3			4			1			6			2		
30			4			5			3			3	1	2	3	5	1				2			4		2	3			3			4	1				1	5			2
31			4			5			3			3			6		1	5		2				4		5		1		2			4	1				3	3			2
32			4			5			3			3		1	5	2	4				2			4	2	3				3			4		1			2	4			2
33		4			2	3		1	2		3		1	3	2			6		2			4				5		3		1	3				1		2	4			2
34	4			5			3			3			6			6				2				4			5		1	2		2	2	1			[illegible]				1	1
35	2	2			1	4			3		1	2			6			6			2		4				5			3			4			1		2	4			2
7-8 years																																										
36	3	1				5		3			2	1			6			6			2	1	1	2			5		1	2			4		1			3	3			2
37			4			5	1		2	3					6			6	2			3	1			1	4		2	1		2	2	1			5	1			2	
38			4			5		2	1		1	2		6		1	5		2			3	1		1	2	2	1	2			2	2	1			4	2			1	1
39	3	1		5			3			2	1		5	1		6			2			2	2		5			3			4			1			4	1	1	2		
40	4			2	3			2	1		1	2		4	2			6	2				3	1			5	3			1	2	1		1			4	2			2
41	2	1	1	5			2	1		3				3	3	1	5		2			1	3			5		3			2	2			1		4	1	1		1	1
42		4		5				1	2			3		1	5		6		2				3	1		5		3			3	1		1				3	3			2
43		4		1	4		3			2		1	6				6		2			2	2			5		2	1		4				1		2	3	1	1	1	
44	3	1		5			3			1		2	4	2			6		2			3	1		4	1		3			4				1		3	3		1	1	
45	4			5			3			3			6			6			2			4			5			3			4			1			6					2
46	1	2	1	3	2		2	1		1	1	1	1	3	2		6		2			2	2			5		3			4			1			1	5			2	
47	4			5			3			3					6	5	1		2					4	3	2		3			4				1		2	3	1	1		1
48		2	2		5			2	1		1	2			6	4	2		2				4		3	2		3			4			1				3	3			2
5-6 years																																										
49	2	2		4	1		3			2	1		6			6			2			4			5			3			4			1			4	1	1	2		
50		4		5			3			2		1	6			6			2			4			5			3			4			1			6			1	1	
51		2	2	1	3		2	1			2	1		3	3	6			2				4		5			3			4			1			1	3	2		2	
52	4			5			3			3			6			6			2			4			5			3			4			1			6			2		
53	4			5			3			2	1		1	3	2	4	2		2			4			5			3			4			1			1	5			1	1
54			4			5		1	2		1	2			6	4	2			1	1		4		3	2		3			4			1				5	1		2	
55	4			5			3			3			6			6				2		3	1		5			3			4			1			6			1	1	
56	3	1		4	1		2	1		3			2	4		6			2			2	2		5			3			4			1			4	2		1	1	
57	3	1		5			3			3			6			6			2			1	3		5			3			4			1			4	2		1	1	
58	4			5			2	1		2		1	6			6			2			4			4	1		3			4				1		4	2		2		
59	4			4	1		3			3			6				6		2			4			3	2		3			3	1		1			2	3	1	1	1	
60	3	1		4	1		2	1			2	1	4	2		4	1	1	2			4			4	1		3			4			1				4	2		1	1
61	4			5			3			3			6			6			2			4			5			3			4			1			5	1		1	1	
62	1	1	2	2	2	1	3			3				3	3		6		2				4		2	3		3			3	1			1		1	4	1	1	1	
63	2	2		5			2	1		1	2		4	1	1	1	4	1	2			2	2		1	3	1	3			4			1			2	4			2	
64	4			5			3			3			6			6			2			4			5			3			4			1			5	1		2		
65	4			5			3			3			6			6			2			4			5			3			4			1			6			2		
66	4			5			3			3			6			6			2			4			5			3			4			1			2	4		1	1	

Table 163

Summary of Weighted Scores on Piagetian Tests Standardised Test Scores and Pultibec Ratings

School A.

SSubject No.	Raven's CPM	E.P.V.T.	C.V.S.	Reading	Bender Gestalt	Piagetian Overall	1A (PIAGETIAN TESTS)	2B	2A	2B	3A	3B	4	5A	5B	6	7	8	9	10	11	IQ	Pultibec	Overall Subject No.
1	18	96	56	100	3	97	6	10	6	4	12	12	4	4	10	6	8	2	9	4	15	74	37	6
2	34	84	43	92	1	63	1	1	2	5	12	6	2	8	5	2	4	1	10	4	15	96	29	27
3	32	85	48	79	10	82	7	9	5	4	12	12	0	4	10	0	7	1	8	3	18	71	45	32
4	26	99	59	84	1	101	8	10	6	6	12	12	4	4	10	6	8	2	9	4	13	80	28	38
5	27	83	56	102	5	108	8	10	6	6	12	12	4	8	10	6	8	2	12	4	23	97	26	42
6	21	40	9	0	12	14	0	0	0	2	0	1	0	1	1	0	0	0	7	2	12	51	42	44
7	20	57	31	75	3	51	1	0	1	1	12	11	0	5	5	0	0	1	10	4	12	82	34	54
8	19	60	30	22	2	41	0	0	0	4	12	6	0	2	5	0	0	1	7	4	14	75	27	58
9	23	65	35	94	6	102	8	10	6	5	11	12	3	8	10	6	8	2	9	4	17	88	37	65
10	24	61	36	20	7	98	6	9	6	5	12	12	4	4	10	6	8	2	10	4	18	88	23	66
11	15	50	33	4	5	91	5	10	3	4	12	12	4	5	10	4	8	1	9	4	16	80	25	69
12	19	63	45	4	2	95	6	10	6	5	12	6	4	8	10	6	8	1	9	4	14	93	25	74
13	20	57	28	10	5	64	0	3	4	5	8	12	0	5	10	0	4	1	8	4	19	87	26	76
14	11	49	31	9	20	37	3	0	1	0	9	5	0	3	5	0	4	1	3	3	12	64	36	77
15	11	59	32	27	12	33	4	4	2	2	0	6	0	2	5	1	0	1	5	1	9	79	34	79
16	9	54	27	7	19	20	1	0	0	4	2	6	0	1	1	0	0	1	3	1	16	71	36	81
17	21	43	26	42	10	51	3	0	3	5	12	6	0	5	5	0	0	1	9	2	17	75	22	82
18	16	49	29	2	13	51	4	5	3	3	3	5	0	1	10	1	8	1	6	1	4	70	21	85
19	14	56	31	4	11	78	6	10	4	1	9	10	2	2	7	6	8	1	8	4	13	90	25	86
20	11	54	17	12	18	31	1	0	1	1	6	1	0	3	5	0	0	1	8	4	20	99	48	95
21	10	54	20	10	12	46	1	3	3	2	8	6	0	4	5	0	0	1	9	4	15	92	29	100
22	21	50	22	35	11	50	1	0	1	5	12	6	1	5	5	0	1	1	8	4	11	110	22	105
23	15	52	29	6	14	22	4	1	1	2	2	1	0	1	1	0	0	0	7	2	19	110	33	106
24	14	42	18	0	15	7	0	0	1	2	0	0	0	0	1	0	0	1	2	0	6	90	39	115
25	10	17	17	0	27	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	69	35	120
26	9	18	15	0	26	2	0	0	0	0	0	0	0	0	0	0	0	0	1	1	8	92	40	121
27	11	21	11	0	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	78	36	128
28	6	8	0	0	27	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75	43	129

Table 164

Summary of weighted scores on Piagetian Tests, Standardised Test scores and Pultibec ratings

School A boys

Subject No.	Ravens C.P.M.	E.P.V.T.	C.V.S.	Reading	Bender Gestalt	Piagetian (overall)	PIAGETIAN TESTS 1A	1B	2A	2B	3A	3B	4	5A	5B	6	7	8	9	10	11	10	Pultibec	Overall Subect No.
1	34	84	43	92	1	63	1	1	2	5	12	6	2	8	5	2	4	1	10	4	18	96	29	27
2	32	85	48	79	10	82	7	9	5	4	12	12	0	4	10	0	7	1	8	3	18	71	45	32
3	26	99	59	84	1	101	8	10	6	6	12	12	4	4	10	6	8	2	9	4	13	80	28	38
4	27	83	56	102	5	108	8	10	6	6	12	12	4	8	10	6	8	2	12	4	23	97	28	42
5	20	57	31	75	3	51	1	0	1	1	12	11	0	5	5	0	0	1	10	4	12	82	34	54
6	23	65	35	94	6	102	8	10	6	5	11	12	3	8	10	6	8	2	9	4	17	88	37	65
7	19	63	45	4	2	95	6	10	6	5	12	6	4	8	10	6	8	1	9	4	14	93	25	74
8	21	43	26	42	10	51	3	0	3	5	12	6	0	5	5	0	0	1	9	2	17	75	22	82
9	16	49	29	2	13	51	4	5	3	3	3	5	0	1	10	1	8	1	6	1	4	70	21	85
10	14	56	31	4	11	78	6	10	4	1	9	10	2	2	7	6	8	1	8	4	13	90	25	86
11	11	54	17	12	18	31	1	0	1	1	6	1	0	3	5	0	0	1	8	4	20	99	48	95
12	10	54	20	10	12	46	1	3	3	2	8	6	0	4	5	0	0	1	9	4	15	92	29	100
13	21	50	22	35	11	50	1	0	1	5	12	6	1	5	5	0	1	1	8	4	11	110	22	105
14	15	52	29	6	14	22	4	1	1	2	2	1	0	1	1	0	0	0	7	2	19	110	33	106
15	10	17	17	0	27	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	69	35	120
16	6	8	0	0	27	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	75	43	129

Table 165

Summary of weighted scores on Piagetian Tests
Standardised test scores and Pultibec ratings

School A ... girls

Subject No.	Ravens C.P.M.	E.P.V.T.	C.V.S.	Reading	Bender Gestalt	Piagetian tests overall	1A	1B	2A	2B	3A	3B	4	5A	5B	6	7	8	9	10	11 Inclusion	IQ	Pultibec	Overall subject No.
							← PIAGETIAN TESTS													→				
1	18	96	56	100	3	97	6	10	6	4	12	12	4	4	10	6	8	2	9	4	15	74	37	6
2	21	40	9	0	12	14	0	0	0	2	0	1	0	1	1	0	0	0	7	2	12	51	42	44
3	19	60	30	22	2	41	0	0	0	4	12	6	0	2	5	0	0	1	7	4	14	75	27	58
4	24	61	36	20	7	98	6	9	6	5	12	12	4	4	10	6	8	2	10	4	18	88	23	66
5	15	50	33	4	5	91	5	10	3	4	12	12	4	5	10	4	8	1	9	4	16	80	25	69
6	20	57	28	10	5	64	0	3	4	5	8	12	0	5	10	0	4	1	8	4	19	87	26	76
7	11	49	31	9	20	37	3	0	1	0	9	5	0	3	5	0	4	1	3	3	12	64	36	77
8	11	59	32	27	12	33	4	4	2	2	0	6	0	2	5	1	0	1	5	1	9	79	34	79
9	9	54	27	7	19	20	1	0	0	4	2	6	0	1	1	0	0	1	3	1	16	71	36	81
10	14	42	18	0	15	7	0	0	1	2	0	0	0	0	1	0	0	1	2	0	6	90	39	115
11	9	18	15	0	26	2	0	0	0	0	0	0	0	0	0	0	0	0	1	1	8	92	40	121
12	11	21	11	0	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	78	36	128

TABLE 166

Summary of Weighted Scores on Piagetian Tests, Standardised Test Scores and Pultibec ratings

School B

Subject No.	Ravens CPM	E.P.V.T.	C.V.S.	Reading	Bender Gestalt	Piagetian (Overall)	1A	1B	2A	2B	3A	3B	4	5A	5B	6	7	8	9	10	11	IQ	Pultibec	Subject No. (Overall)
							← PIAGETIAN TESTS →																	
1	28	102	54	100	2	99	8	10	5	6	10	12	4	5	10	6	8	2	9	4	14	78		11
2	20	61	33	7	4	102	8	10	6	5	12	12	0	4	10	6	8	2	9	10	11	63		19
3	18	56	34	41	7	40	4	2	3	3	11	3	1	1	5	0	0	0	6	1	14	73		20
4	13	59	25	25	11	25	0	2	0	2	6	6	0	2	4	0	0	0	2	1	11	63		26
5	21	61	26	0	19	36	4	5	1	2	5	6	0	0	5	0	0	0	7	1	18	53		36
6	14	31	18	10	10	27	0	0	0	2	7	6	0	2	5	0	0	0	4	1	10	58		37
7	8	52	11	53	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	53		48
8	16	67	32	69	8	91	8	10	6	4	11	12	4	4	10	3	8	1	8	2	21	93		56
9	11	36	9	0	23	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	4	53		57
10	8	26	3	0	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	48		59
11	16	63	33	22	12	78	4	8	5	3	7	12	2	4	10	4	3	2	10	4	21	78		63
12	17	68	34	63	4	95	8	10	6	5	12	12	3	5	10	0	8	1	11	4	16	78		64
13	7	43	17	0	18	14	0	0	0	0	0	0	2	0	5	0	0	1	4	2	13	80		67
14	16	37	17	55	8	84	8	10	5	3	11	10	2	7	7	1	8	1	8	3	11	80		70
15	30	61	22	35	9	56	4	0	5	6	11	6	0	5	5	0	1	0	9	4	25	78		78
16	7	38	3	0	22	4	0	0	0	0	0	0	0	0	0	0	0	0	0	4	6	48		84
17	11	34	7	0	22	43	4	5	4	3	8	5	0	3	3	0	0	1	6	1	18	53		89
18	13	42	16	0	23	7	2	1	0	1	0	0	0	0	0	0	0	0	3	0	8	53		92
19	13	20	13	0	22	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	9	80		94
20	14	44	18	0	16	15	0	0	1	2	0	0	2	1	4	0	1	0	2	2	11	78		96
21	0	36	10	0	24	7	4	0	0	2	0	0	0	0	0	0	0	0	0	1	18	70		97
22	5	6	18	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	53		108
23	13	38	15	11	7	60	8	10	5	5	12	2	3	4	2	0	0	0	7	2	12	94		112
24	8	44	18	0	22	7	1	0	0	0	0	0	0	3	0	0	0	0	2	1	18	95		113
25	13	57	35	0	24	78	8	10	6	4	2	10	2	2	9	8	8	1	6	2	13	105		114
26	9	20	12	0	26	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	12	72		119
27	8	20	6	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	70		122

Summary of weighted scores on Piagetian tests standardised tests and Pultibec ratings

SCHOOL B Boys

Individual Piagetian tests (columns 1a–10)

Subject No.	Raven's C.P.M	E.P.V.T	C.V.S	Reading	Bender Gestalt	Piagetian (overall)	1a	1b	2a	2b	3a	3b	4	5a	5b	6	7	8	9	10	Class Inclusion 11	IQ	PULTIBEC	Overall sample No.
1	28	102	54	100	22	99	8	10	5	6	10	12	4	5	10	6	8	2	9	4	14	78	34	11
2	20	61	33	7	4	96	8	10	6	5	12	12	0	4	10	6	8	2	10	3	14	63	30	19
3	18	56	34	41	7	40	4	2	3	3	11	3	1	1	5	0	0	0	6	1	14	73	31	20
4	21	61	26	0	19	36	4	5	1	2	5	6	6	0	5	0	0	0	7	1	18	53	36	36
5	8	52	11	53	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	53	40	48
6	11	36	9	6	23	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	4	53	39	57
7	17	68	34	63	18	95	8	10	6	5	12	12	3	5	10	0	8	1	11	4	16	78	30	67
8	16	37	17	55	8	84	8	10	5	3	11	10	2	7	7	1	8	1	8	3	11	80	27	70
9	11	34	7	0	22	43	4	5	4	3	8	5	0	3	3	0	0	1	6	1	18	53	36	89
10	13	20	13	0	22	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	9	80	33	94
11	14	44	18	0	16	15	0	0	1	2	0	0	2	1	4	0	1	0	2	2	11	78	32	96
12	5	6	18	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	53	47	113
13	13	57	35	0	24	78	8	10	6	4	2	10	2	2	9	6	8	1	6	2	13	105	31	114
14	9	20	12	0	24	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	12	72	34	119
15	8	20	6	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	70	28	122

Table 168

Summary of weighted scores on Piagetian Tests, standardized Test scores and Pultibec Ratings

School B Girls

Subject No.	Raven's C.P.M.	E.P.V.T.	C.V.S.	Reading	Bender Gestalt	Piagetian (overall)	1A	1B	2A	2B	3A	3B	4	5A	5B	6	7	8	9	10	11	IQ	Pultibec	Overall subject No.
							← PIAGETIAN TESTS →																	
1	13	59	25	25	11	25	0	2	0	2	6	6	0	2	4	0	0	0	2	1	11	63		26
2	14	31	18	10	10	27	0	0	0	2	7	6	0	2	5	0	0	0	4	1	10	58		37
3	16	67	32	69	8	91	8	10	6	4	11	12	4	4	10	3	8	1	8	2	21	93		56
4	8	26	3	0	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	48		59
5	16	63	33	22	12	78	4	8	5	3	7	12	2	4	10	4	3	2	10	4	21	78		63
6	7	43	17	0	184	7	0	0	0	0	0	0	0	0	0	0	0	1	4	2	13	80		64
7	20	61	22	35	9	56	4	0	5	6	11	6	0	5	5	0	1	0	9	4	25	78		78
8	7	38	3	0	22	4	0	0	0	0	0	0	0	0	0	0	0	0	0	4	6	48		84
9	13	42	16	0	23	7	2	1	0	1	0	0	0	0	0	0	0	0	3	0	8	53		92
10	0	36	10	0	24	7	4	0	0	2	0	0	0	0	0	0	0	0	0	1	18	70		97
11	13	38	15	11	7	60	8	10	5	5	12	2	3	4	2	0	0	0	7	2	12	94		108
12	8	44	18	0	22	7	1	0	0	0	0	0	0	3	0	0	0	0	2	1	18	95		112

Table 169

Summary of weighted scores on Piagetian tests, Standardised Test Scores and Pultibec ratings.

School C

							←					PIAGETIAN TESTS								→			
Subject No.	Raven's C.P.M.	E.P.V.T.	C.V.S.	Reading	Bender Gestalt	Piagetian overall	1A	1B	2A	2B	3A	3B	4	5A	5B	6	7	8	9	10	11	1Q	Pultibec	Overall subject No.
1	32	99	66	71	1	105	8	9	5	6	12	12	4	7	10	6	8	2	12	4	22	110	20	17
2	17	77	35	41	8	93	8	10	6	6	12	9	2	3	9	5	8	2	11	2	22	85	36	28
3	20	87	55	30	1	105	8	10	6	5	12	12	4	8	10	6	6	2	12	4	26	83	27	39
4	18	78	55	74	13	103	8	10	6	6	12	12	2	7	10	6	6	2	12	4	18	89	27	40
5	20	73	65	83	6	94	8	10	5	6	12	10	2	6	8	4	6	1	12	4	24	90	23	41
6	28	81	51	42	2	108	8	10	6	6	12	12	4	8	10	6	8	2	12	4	18	71	36	45
7	17	57	37	7	1	89	8	10	6	6	11	4	4	8	3	6	8	1	10	4	27	92	26	62
8	13	30	21	3	13	72	8	10	4	3	12	12	0	1	9	4	6	0	1	2	6	70	34	71
9	16	40	30	0	15	52	8	10	4	5	6	5	0	1	6	2	0	0	2	3	27	74	35	72
10	13	27	21	0	13	8	1	0	0	1	1	0	0	2	0	0	0	0	3	0	13	63	25	75
11	14	44	25	8	8	72	8	9	6	4	10	6	2	1	7	3	6	0	8	2	28	81	32	80
12	13	41	31	23	14	26	2	0	0	4	5	4	0	1	4	0	0	0	4	2	19	78	24	83
13	14	50	21	51	19	31	0	0	0	0	12	1	0	8	2	0	0	1	5	2	24	93	20	88
14	16	22	22	8	8	53	6	5	4	5	12	2	0	4	2	0	0	0	9	4	15	112	26	90
15	17	63	31	2	13	47	5	4	3	3	8	2	2	5	5	1	1	0	7	1	17	88	39	91
16	17	55	30	0	20	48	4	6	3	4	11	5	0	4	2	0	0	0	6	3	14	80	24	101
17	20	27	21	0	21	16	0	0	0	1	5	2	2	0	0	0	0	0	5	1	17	78	35	102
18	15	24	21	0	15	8	1	0	0	0	0	0	0	0	0	0	0	0	6	1	10	56	45	103
19	17	34	18	0	17	36	0	2	1	3	10	6	0	4	5	0	0	0	3	2	29	89	34	104
20	10	30	17	0	19	13	1	0	0	2	0	0	0	4	0	0	0	0	5	1	8	80	39	109
21	9	50	40	3	14	12	0	0	0	0	0	0	2	1	0	0	0	0	5	4	15	99	34	110
22	12	20	19	0	14	16	0	1	0	0	0	6	0	0	2	0	1	0	5	1	0	85	30	116
23	15	30	15	0	19	25	1	1	1	4	2	3	0	0	2	0	0	0	8	3	26	100	24	118
24	15	25	18	0	24	40	5	4	0	0	9	6	0	4	3	0	1	1	6	1	4	84	33	123
25	14	9	19	0	18	3	1	0	0	0	0	0	0	0	0	0	0	0	1	1	7	100	33	124
26	14	30	21	0	16	18	4	0	3	0	1	0	0	3	0	0	0	0	4	3	11	101	29	125
27	14	32	21	0	16	27	2	0	1	2	3	6	0	2	5	0	0	0	4	2	9	96	23	126
28	14	15	14	0	23	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	13	80	43	127
29	13	56	22	0	17	6	0	0	0	0	0	0	0	1	1	0	0	0	4	0	7	115	23	130

Table 170

Summary of weighted scores on Piagetian Tests, Standardised Test scores and Pullibec ratings

School C ... boys

							PIAGETIAN TESTS.																
Subject No.	Ravens C.P.M.	E.P.V.T.	C.V.S.	READING	BENDER GESTALT	PIAGETIAN (Overall)	1A	1B	2A	2B	3A	3B	4	5A	5B	6	7	8	9	10	11	1Q	PULTIBEC	Overall Subject No.
1	20	87	55	30	1	105	8	10	6	5	12	12	4	8	10	6	6	2	12	4	26	83	27	39
2	18	78	55	74	13	103	8	10	6	6	12	12	2	7	10	6	6	2	12	4	18	89	27	40
3	20	73	65	83	6	94	8	10	5	6	12	10	2	6	8	4	6	1	12	4	24	90	23	41
4	14	44	25	8	8	72	8	9	6	4	10	6	2	1	7	3	6	0	8	2	28	81	32	80
5	13	41	31	23	14	26	2	0	0	4	5	4	0	1	4	0	0	0	4	2	19	78	24	83
6	17	63	31	2	13	47	5	4	3	3	8	2	2	5	5	1	1	0	7	1	17	88	39	91
7	17	55	30	0	20	48	4	6	3	4	11	5	0	4	2	0	0	0	6	3	14	80	24	101
8	15	24	21	0	15	10	1	0	0	0	0	0	2	0	0	0	0	0	6	1	10	56	45	102
9	17	34	18	0	17	36	0	2	1	3	10	6	0	4	5	0	0	0	3	2	29	89	34	104
10	10	30	17	0	19	13	1	0	0	2	0	0	0	4	0	0	0	0	5	1	8	80	39	109
11	14	9	19	0	18	3	1	0	0	0	0	0	0	0	0	0	0	0	1	1	7	100	33	124
12	14	30	21	0	16	18	4	0	3	0	1	0	0	3	0	0	0	0	4	3	11	101	29	125

TABLE 171

Summary of weighted scores on Piagetian Tests,
Standardised Test Scores and Pultibec ratings.

School C... Girls

Subject No.	Raven's C.P.M.	E.P.V.T.	C.V.S.	Reading	Bender Gestalt	Piagetian Overall	Piagetian tests															IQ	Pultibec	Overall Subject No.
							1A	1B	2A	2B	3A	3B	4	5A	5B	6	7	8	9	10	11			
1	32	99	66	71	1	105	8	9	5	6	12	12	4	7	10	6	8	2	12	4	22	110	20	17
2	17	77	35	41	8	93	8	10	6	6	12	9	2	3	9	5	8	2	11	2	22	85	36	28
3	28	81	51	42	2	108	8	10	6	6	12	12	4	8	10	6	8	2	12	4	18	71	36	45
4	17	57	37	7	1	89	8	10	6	6	11	4	4	8	3	6	8	1	10	4	27	92	26	62
5	13	30	21	3	13	72	8	10	4	3	12	12	0	1	9	4	6	0	1	2	6	70	34	71
6	16	40	30	0	15	52	8	10	4	5	6	5	0	1	6	2	0	0	2	3	27	74	35	72
7	13	27	21	0	13	8	1	0	0	1	1	0	0	2	0	0	0	0	3	0	13	63	25	75
8	14	50	21	51	19	31	0	0	0	0	12	1	0	8	2	0	0	1	5	2	24	93	20	88
9	16	22	22	8	8	53	6	5	4	5	12	2	0	4	2	0	0	0	9	4	15	112	26	90
10	20	27	21	0	21	14	0	0	0	1	5	2	0	0	0	0	0	0	5	1	17	78	35	103
11	9	50	40	3	14	12	0	0	0	0	0	0	2	1	0	0	0	0	5	4	15	99	34	110
12	12	20	19	0	14	16	0	1	0	0	0	6	0	0	2	0	1	0	5	1	0	85	30	116
13	15	30	15	0	19	25	1	1	1	4	2	3	0	0	2	0	0	0	8	3	26	100	24	118
14	15	25	18	0	24	40	5	4	0	0	9	6	0	4	3	0	1	1	6	1	4	84	33	123
15	14	32	21	0	16	27	2	0	1	2	3	6	0	2	5	0	0	0	4	2	9	96	23	126
16	14	15	14	0	23	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	13	80	43	127
17	13	56	22	0	17	6	0	0	0	0	0	0	0	1	1	0	0	0	4	0	7	115	22	130

School D

TABLE 172

SUMMARY OF WEIGHTED SCORES IN PIAGETIAN TESTS, STANDARDISED TESTS AND PULTIBEC RATINGS

SCHOOL D

Subject No. (in C.A.)	R.P.M.	E.P.V.T.	C.V.S.	Reading	B.G.	Piagetian Overall	← PIAGETIAN TESTS → 1A	1B	2A	2B	3A	3B	4	5A	5B	6	7	8	9	10	11	IQ	Pultibec	Overall Sample No.
1	28	93	47	105	3	106	8	10	6	6	12	12	4	8	10	4	8	2	12	4	29	79	35	1
2	35	121	79	110	0	108	8	10	6	6	12	12	4	8	10	6	8	2	12	4	29	132	24	2
3	23	116	73	18	2	108	8	10	6	6	12	12	4	8	10	6	8	2	12	4	29	84	41	3
4	34	98	72	100	0	94	8	10	6	6	12	12	4	8	0	4	8	0	12	4	21	79	25	4
5	33	116	77	108	7	108	8	10	6	6	12	12	4	8	10	6	8	2	12	4	29	110	24	5
6	21	54	46	85	7	88	8	10	6	6	*9	10	2	4	7	3	8	1	12	2	28	56	42	7
7	20	95	62	104	5	84	8	10	6	6	12	2	3	8	2	3	8	0	12	4	26	90	34	8
8	21	103	69	100	7	106	8	10	6	6	12	12	4	7	9	6	8	2	12	4	17	83	39	9
9	32	111	73	91	4	106	8	10	6	6	12	10	4	8	10	6	8	2	12	4	29	83	42	10
10	20	113	71	96	7	74	8	10	6	6	12	2	0	4	0	0	8	2	12	4	21	82	45	12
11	28	52	50	105	6	107	8	10	6	6	12	12	4	8	10	5	8	2	12	4	28	86	43	13
12	32	91	66	93	2	107	8	10	6	6	12	11	4	8	10	6	8	2	12	4	29	83	36	14
13	22	73	46	15	16	84	8	10	6	6	12	8	0	4	9	0	7	0	11	3	17	64	34	15
14	21	40	32	17	12	85	8	10	6	4	10	10	2	5	9	0	8	1	8	4	10	67	33	16
15	12	53	49	73	7	52	8	10	6	4	12	0	2	4	0	0	4	0	9	4	14	61	41	18
16	29	104	74	100	1	108	8	10	6	6	12	12	4	8	10	6	8	2	12	4	29	100	33	21
17	36	117	78	110	1	106	8	10	6	6	12	12	4	8	10	5	8	2	11	4	29	109	31	22
18	23	77	58	95	5	100	8	10	6	4	11	11	4	6	10	4	8	2	12	4	17	88	40	23
19	17	21	26	0	15	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	28	47	42	24
20	23	78	49	71	2	87	8	10	6	6	12	9	0	4	10	4	7	0	8	3	17	86	40	25
21	30	76	38	41	2	103	8	10	6	6	12	11	2	8	10	4	8	2	12	4	29	83	29	29
22	28	75	55	71	1	99	8	10	6	6	12	12	0	8	10	3	8	1	11	4	16	80	27	30
23	16	62	47	44	10	36	1	2	4	4	10	0	2	6	0	0	0	0	5	2	19	62	41	31
24	19	102	73	91	2	108	8	10	6	6	12	12	4	8	10	6	8	2	12	4	29	93	33	33
25	25	45	28	11	6	91	7	10	6	3	12	11	4	4	10	4	7	1	8	4	29	98	37	34

TABLE 172 (cont'd)

SCHOOL D (CONTINUED)

No.	R.RM.	E.P.V.T.	C.V.S.	Reading	B.G.	Piagetian Overall	← PIAGETIAN TESTS →															IQ	Pultibec	Overall sample No.
26	21	59	50	16	11	97	8	10	6	6	12	12	4	5	10	4	8	2	7	3	29	87	35	35
27	19	59	45	33	5	99	8	10	6	6	12	10	2	7	10	4	8	2	10	4	29	77	37	43
28	24	61	30	31	6	66	8	10	4	5	12	1	0	3	3	0	8	0	9	3	19	77	31	46
29	21	52	40	22	3	95	6	10	6	6	12	12	2	8	10	1	8	1	9	4	22	80	34	47
30	19	33	24	0	17	46	1	2	2	2	9	5	0	6	9	0	0	0	8	2	11	59	42	49
31	14	52	32	42	4	55	0	1	4	4	12	1	4	8	0	0	8	0	9	4	24	86	29	50
32	23	74	35	9	6	74	6	9	5	6	12	3	4	7	2	0	4	0	12	4	27	70	27	51
33	18	54	34	15	6	42	6	8	3	3	7	1	0	2	0	0	0	0	8	4	12	58	39	52
34	16	66	42	51	11	84	8	10	6	4	12	10	0	4	9	0	8	2	8	3	29	82	38	53
35	16	50	44	75	4	38	2	1	0	6	9	5	0	4	5	0	0	0	3	3	26	91	37	55
36	23	48	35	36	7	88	8	10	6	6	8	1	4	8	8	6	8	0	11	4	24	85	31	60
37	21	70	51	67	4	93	8	10	6	6	12	11	2	8	5	4	8	0	9	4	14	102	30	61
38	19	64	39	45	18	79	6	3	6	4	12	10	0	5	10	3	8	1	8	3	29	79	31	68
39	24	41	33	34	17	70	6	9	6	4	12	11	0	4	8	0	0	1	6	3	29	80	27	73
40	19	44	33	21	4	39	4	4	1	3	7	6	0	2	5	0	0	0	5	2	20	69	29	87
41	6	12	13	40	30	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	85	31	93
42	20	46	28	4	13	37	6	3	2	4	9	0	0	4	0	0	0	0	7	2	26	100	28	98
43	17	10	19	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	66	31	99
44	8	9	15	0	23	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	64	42	107
45	15	28	15	3	13	10	1	1	1	0	4	0	0	2	0	0	0	0	0	1	9	87	41	111
46	14	72	37	2	11	25	7	1	2	3	1	1	0	4	0	0	1	0	3	2	22	115	27	117

Table 173
Weighted scores on Piagetian tests, Standardized Test scores and Pultibec ratings.

School D ... boys

Subject No.	Ravens' C.P.M.	E.P.V.T.	C.V.S.	Reading.	Bender Gestalt	Piagetian/Overall	1A	1B	2A	2B	3A	3B	4	5A	5B	6	7	8	9	10	11	IQ	Pultibec
							PIAGETIAN TESTS																
1	35	121	79	110	0	108	8	10	6	6	12	12	4	8	10	6	8	2	12	4	29	132	24
2	23	116	73	18	2	108	8	10	6	6	12	12	4	8	10	6	8	2	12	4	29	84	41
3	34	98	72	100	0	94	8	10	6	6	12	12	4	8	0	4	8	0	12	4	21	79	25
4	33	116	77	108	7	108	8	10	6	6	12	12	4	8	10	6	8	2	12	4	29	110	24
5	32	111	73	91	4	106	8	10	6	6	12	10	4	8	10	6	8	2	12	4	29	83	42
6	32	91	66	93	2	107	8	10	6	6	12	11	4	8	10	6	8	2	12	4	29	83	36
7	21	40	32	17	12	85	8	10	6	4	10	10	2	5	9	0	8	1	8	4	10	67	33
8	36	117	78	110	1	106	8	10	6	6	12	12	4	8	10	5	8	2	11	4	29	109	31
9	23	77	58	95	5	100	8	10	6	4	11	11	4	6	10	4	8	2	12	4	17	88	40
10	17	19	26	0	15	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	28	47	42
11	30	76	38	41	2	103	8	10	6	6	12	11	2	8	10	4	8	2	12	4	29	83	29
12	19	102	73	91	2	108	8	10	6	6	12	12	4	8	10	6	8	2	12	4	29	93	33
13	19	59	45	33	5	99	8	10	6	6	12	10	2	7	10	4	8	2	10	4	29	77	37
14	23	74	35	9	6	74	6	9	5	6	12	3	4	7	2	0	4	0	12	4	27	70	27
15	18	54	34	15	6	42	6	8	3	3	7	1	0	2	0	0	0	0	8	4	12	58	39
16	16	66	42	51	11	84	8	10	6	4	12	10	0	4	9	0	8	2	8	3	29	82	38
17	19	64	39	45	18	79	6	3	6	4	12	10	0	5	10	3	8	1	8	3	29	79	31
18	24	41	33	34	17	70	6	9	6	4	12	11	0	4	8	0	0	1	6	3	29	80	27
19	6	12	13	40	30	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	85	31.
20	8	9	15	0	23	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	64	42.
21	14	72	37	2	11	25	7	1	2	3	1	1	0	4	0	0	1	0	3	2	22	115	27

School D
Girls

TABLE 174

SUMMARY OF WEIGHTED SCORES IN PIAGETION TESTS

STANDARDISED TEST SCORES AND PULTIBEC SCORE

School D Girls

Chron. Age	RAVENS C.P.M	E.P.V.T.	C.V.S.	READING	BENDER GESTALT	PIAGETIAN OVERALL 1-10	1A	1B	2A	2B	3A	3B	4	5A	5B	6	7	8	9	10	11	1Q	PULTIBEC	C.A. OVERALL
							← PIAGETIAN TESTS →																	
1	28	93	47	105	3	106	8	10	6	6	12	12	4	8	10	4	8	2	12	4	29	79	35	1
2	21	54	46	85	7	88	8	10	6	6	9	10	2	4	7	3	8	1	12	2	28	56	42	7
3	20	95	62	104	5	84	8	10	6	6	12	2	3	8	2	3	8	0	12	4	26	90	34	8
4	21	103	69	100	7	106	8	10	6	6	12	12	4	7	9	6	8	2	12	4	17	83	39	9
5	20	113	71	96	7	74	8	10	6	6	12	2	0	4	0	0	8	2	12	4	21	82	45	12
6	28	52	50	105	6	107	8	10	6	6	12	12	4	8	10	5	8	2	12	4	28	86	43	13
7	22	73	46	15	16	84	8	10	6	6	12	8	0	4	9	0	7	0	11	3	17	64	34	15
8	12	53	49	73	7	52	4	5	4	4	12	0	2	4	0	0	4	0	9	4	14	61	41	18
9	29	104	74	100	1	108	8	10	6	6	12	12	4	8	10	6	8	2	12	4	29	100	33	21
10	23	78	49	71	2	87	8	10	6	6	12	9	0	4	10	4	7	0	8	3	17	86	40	25
11	28	75	55	71	1	99	8	10	6	6	12	12	0	8	10	3	8	1	11	4	16	80	27	30
12	16	62	47	44	10	36	1	2	4	4	10	0	2	6	0	0	0	0	5	2	19	62	41	31
13	25	45	28	11	6	91	7	10	6	3	12	11	4	4	10	4	7	1	8	4	29	78	37	34
14	21	59	50	16	11	97	8	10	6	6	12	12	4	5	10	4	8	2	7	3	29	87	35	35
15	24	61	30	31	6	66	8	10	4	5	12	1	0	3	3	0	8	0	9	3	19	77	31	45
16	21	52	40	22	3	95	6	10	6	6	12	12	2	8	10	1	8	1	9	4	22	80	34	46
17	19	33	24	0	17	46	1	2	2	2	9	5	0	6	9	0	0	0	8	2	11	59	42	48
18	14	52	32	42	4	55	0	1	4	4	12	1	4	8	0	0	8	0	9	4	24	86	29	49
19	16	50	44	75	4	38	2	1	0	6	9	5	0	4	5	0	0	0	3	3	26	91	37	55
20	23	48	35	36	7	88	8	10	6	6	8	1	4	8	8	6	8	0	11	4	24	85	31	60
21	21	70	51	67	4	93	8	10	6	6	12	11	2	8	5	4	8	0	9	4	14	102	30	61
22	19	44	33	21	4	39	4	4	1	3	7	6	0	2	5	0	0	0	5	2	20	69	29	87
23	20	46	28	4	13	37	6	3	2	4	9	0	0	4	0	0	0	0	7	2	26	100	28	98
24	17	10	19	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	66	31	99
25	15	28	15	3	13	10	1	1	1	0	4	0	0	2	0	0	0	0	0	1	9	87	41	111

APPENDIX F.

Details of results in Piagetian Tests.

Contents:

Table 175

Summary of individuals weighted scores on all subtests of Piagetian number tests. (Whole sample).

SECONDARY.

Yrs.	No.	1A	1B	2A	2B	3A	3B
		1 2 3 4	1 2 3 4 5	1 2 3	1 2 3	1 2 3 4 5 6	1 2 3 4 5 6
16.0+	1	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
	2	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
	3	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
15.0+	4	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
	5	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
	6	1 1 2 2	2 2 2 2 2	2 2 2	1 2 1	2 2 2 2 2 2	2 2 2 2 2 2
	7	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 1 1 2 2 1	1 2 1 2 2 2
	8	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	1 1 0 0 0 0
	9	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
14.0+	10	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	1 2 2 1 2 2
	11	2 2 2 2	2 2 2 2 2	2 2 1	2 2 2	2 1 2 2 2 1	2 2 2 2 2 2
	12	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	0 1 1 0 0 0
	13	1 2 2 2	2 2 2 2 2	2 2 2	2 0 1	2 2 2 2 2 2	2 1 2 2 2 2
13.0+	14	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	1 2 2 2 2 2
	15	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	1 1 1 1 2 2
	16	2 2 2 2	2 2 2 2 2	2 2 2	2 1 1	1 1 2 2 2 2	1 1 2 2 2 2
	17	2 2 2 2	2 2 1 2 2	1 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
	18	1 1 1 1	1 1 1 1 1	2 1 1	2 1 1	2 2 2 2 2 2	0 0 0 0 0 0
	19	2 2 2 2	2 2 2 2 2	2 2 2	2 2 1	2 2 2 2 2 2	2 2 2 2 2 2
	20	1 1 1 1	1 0 1 0 0	1 1 1	2 0 1	2 2 2 2 2 1	1 0 1 0 0 1
	21	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
	22	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
	23	2 2 2 2	2 2 2 2 2	2 2 2	1 1 2	2 2 2 2 2 1	1 2 2 2 2 2
	24	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	0 0 0 0 0 0
	25	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	1 1 1 2 2 2
12.0+	26	0 0 0 0	0 1 1 0 0	0 0 0	1 0 1	1 1 1 1 1 1	1 1 1 1 1 1
	27	1 0 0 0	0 1 0 0 0	1 1 0	2 2 1	2 2 2 2 2 2	1 1 1 1 1 1
	28	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 1 1 1 2 2
	29	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 1 2 2 2
	30	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
	31	0 0 1 0	2 0 0 0 0	2 0 2	2 1 1	2 2 2 2 1 1	0 0 0 0 0 0
	32	1 2 2 2	1 2 2 2 2	2 1 2	1 2 1	2 2 2 2 2 2	2 2 2 2 2 2
JUNIOR.							
11.0+	33	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
	34	1 2 2 2	2 2 2 2 2	2 2 2	2 0 1	2 2 2 2 2 2	2 1 2 2 2 2
	35	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
	36	1 1 1 1	1 1 1 1 1	0 0 1	0 1 1	1 2 1 1 0 0	1 1 1 1 1 1
	37	0 0 0 0	0 0 0 0 0	0 0 0	1 0 1	2 1 1 1 1 1	1 1 1 1 1 1
	38	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
	39	2 2 2 2	2 2 2 2 2	2 2 2	2 2 1	2 2 2 2 2 2	2 2 2 2 2 2
	40	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
	41	2 2 2 2	2 2 2 2 2	2 2 1	2 2 2	2 2 2 2 2 2	1 1 2 2 2 2
	42	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
	43	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	1 2 2 1 2 2
	44	0 0 0 0	0 0 0 0 0	0 0 0	0 1 1	0 0 0 0 0 0	0 0 1 0 0 0
	45	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
	46	2 2 2 2	2 2 2 2 2	0 2 2	2 2 1	2 2 2 2 2 2	0 0 0 0 0 1

Table 175 continued

Summary of weighted score on each subtest of main Piagetian Tests. (Whole sample in chronological age order.)

Test.		4		5A				5B					6			7				8	9						10	
Subtest.		1	2	1	2	3	4	1	2	3	4	5	1	2	3	1	2	3	4	1	1	2	3	4	5	6	1	2
Yrs.	No.																											
16.0+	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
15.0+	4	2	2	2	2	2	2	0	0	0	0	0	2	0	2	2	2	2	2	0	2	2	2	2	2	2	2	2
	5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	6	2	2	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	2	2
	7	1	1	1	1	1	1	1	2	1	2	1	1	0	2	2	2	2	2	1	2	2	2	2	2	2	2	2
	8	2	1	2	2	2	2	1	1	0	0	0	2	0	1	2	2	2	2	0	2	2	2	2	2	2	2	2
	9	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
14.0+	10	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	11	2	2	2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	2	2
	12	0	0	1	1	1	1	0	0	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2
	13	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
13.0+	14	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	15	0	0	1	1	1	1	2	2	2	1	2	0	0	0	1	2	2	2	0	2	2	1	2	2	2	1	2
	16	1	1	2	1	1	1	2	1	2	2	2	0	0	0	2	2	2	2	1	2	2	1	0	1	2	2	2
	17	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	18	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	0	2	2	1	2	1	1	2	2
	19	0	0	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	2	1	2
	20	0	1	1	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	2	1	0	1
	21	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	22	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	1	2	2
	23	2	2	2	2	1	1	2	2	2	2	2	2	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	25	0	0	1	1	1	1	2	2	2	2	2	2	0	2	1	2	2	2	0	2	2	1	1	1	1	1	2
12.0+	26	0	0	1	1	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1
	27	0	2	2	2	2	2	2	2	2	2	2	0	1	1	2	0	2	0	1	2	2	2	1	1	2	2	2
	28	1	1	1	1	1	0	2	1	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	1	1	2
	29	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	30	0	0	2	2	2	2	2	2	2	2	2	2	0	1	2	2	2	2	1	2	2	2	2	2	1	2	2
	31	1	1	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	1	0	2
	32	0	0	1	1	1	1	2	2	2	2	2	0	0	0	2	2	1	2	1	2	2	1	1	1	1	1	2
11.0+	33	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	34	2	2	1	1	1	1	2	2	2	2	2	2	0	2	1	2	2	2	1	2	2	1	1	1	1	2	2
	35	2	2	2	1	1	1	2	2	2	2	2	2	0	2	2	2	2	2	2	2	1	1	1	1	1	1	2
	36	0	1	1	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	2	1	0	1
	37	0	0	1	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	0	0	1	0	1
	38	2	2	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	2	2
	39	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	40	1	1	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	41	1	1	2	2	1	1	1	1	2	2	2	2	0	2	2	2	2	2	1	2	2	2	2	2	2	2	2
	42	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	43	1	1	1	2	2	2	2	2	2	2	2	2	0	2	2	2	2	2	2	2	2	2	1	1	2	2	2
	44	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	2	1	1	1	0	1	1
	45	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	46	0	0	1	1	1	0	1	1	1	0	0	0	0	0	2	2	2	2	0	2	2	2	1	1	1	2	2

Table 175continued.

JUNIORS.

Yrs.	No.	1A 1 2 3 4	1B 1 2 3 4 5	2A 1 2 3	2B 1 2 3	3A 1 2 3 4 5 6	3B 1 2 3 4 5 6
10.0+	47	1 1 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
	48	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	0 0 0 0 0 0
	49	1 0 0 0	1 1 0 0 0	1 0 1	0 1 1	2 2 1 2 1 1	1 0 1 1 1 1
	50	0 0 0 0	0 0 1 0 0	2 0 2	2 0 2	2 2 2 2 2 2	1 0 0 0 0 0
	51	2 1 2 1	1 2 2 2 2	1 2 2	2 2 2	2 2 2 2 2 2	0 1 2 0 0 0
	52	2 1 2 1	1 1 2 2 2	1 1 1	1 1 1	1 1 1 1 1 2	1 0 0 0 0 0
	53	2 2 2 2	2 2 2 2 2	2 2 2	0 2 2	2 2 2 2 2 2	1 2 1 2 2 2
	54	1 0 0 0	0 0 0 0 0	0 1 0	0 0 1	2 2 2 2 2 2	1 2 2 2 2 2
	55	1 0 1 0	0 0 1 0 0	0 0 0	2 2 2	1 2 1 2 2 1	1 1 1 2 0 0
	56	2 2 2 2	2 2 2 2 2	2 2 2	1 2 1	2 1 2 2 2 2	2 2 2 2 2 2
9.0+	57	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	0 0 0 0 0 0
	58	0 0 0 0	0 0 0 0 0	0 0 0	2 1 1	2 2 2 2 2 2	1 1 1 1 1 1
	59	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	0 0 0 0 0 0
	60	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 1 0 2 1 2	1 0 0 0 0 0
	61	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 1 2 2 2 2
	62	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 1	0 1 0 1 1 1
	63	1 1 1 1	1 1 2 2 2	2 2 1	1 1 1	2 2 1 1 1 0	2 2 2 2 2 2
	64	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	0 0 0 0 0 0
	65	2 2 2 2	2 2 2 2 2	2 2 2	2 2 1	1 2 2 2 2 2	2 2 2 2 2
	66	1 1 2 2	2 2 2 1 2	2 2 2	2 2 1	2 2 2 2 2 2	2 2 2 2 2 2
	67	2 2 2 2	2 2 2 2 2	2 2 2	2 2 1	2 2 2 2 2 2	2 2 2 2 2 2
8.0+	68	2 1 1 2	2 1 0 0 0	2 2 2	2 1 1	2 2 2 2 2 2	2 1 1 2 2 2
	69	2 1 1 2	2 2 2 2 2	1 1 1	1 2 1	2 2 2 2 2 2	2 2 2 2 2 2
	70	2 2 2 2	2 2 2 2 2	2 1 2	1 1 1	2 2 2 2 2 1	1 2 2 2 1 2
	71	2 2 2 2	2 2 2 2 2	2 0 2	1 1 1	2 2 2 2 2 2	2 2 2 2 2 2
	72	2 2 2 2	2 2 2 2 2	2 1 1	2 2 1	1 1 1 1 1 1	1 0 1 1 1 1
	73	2 1 1 2	2 2 2 1 2	2 2 2	1 2 1	2 2 2 2 2 2	2 1 2 2 2 2
	74	0 2 2 2	2 2 2 2 2	2 2 2	2 2 1	2 2 2 2 2 2	1 1 1 1 1 1
	75	0 1 0 0	0 0 0 0 0	0 0 0	1 0 0	0 0 0 0 1 0	0 0 0 0 0 0
	76	0 0 0 0	0 0 1 1 1	2 1 1	2 2 1	1 1 1 2 2 1	2 2 2 2 2 2
	77	0 0 2 1	0 0 0 0 0	0 0 1	0 0 0	2 2 1 2 1 1	1 0 1 1 1 1

INFANTS.

Yrs.	No.	1A 1 2 3 4	1B 1 2 3 4 5	2A 1 2 3	2B 1 2 3	3A 1 2 3 4 5 6	3B 1 2 3 4 5 6
7.0+	78	1 1 1 1	0 0 0 0 0	2 2 1	2 2 2	2 2 1 2 2 2	1 1 1 1 1 1
	79	1 1 1 1	1 1 1 0 1	1 1 0	0 2 0	0 0 0 0 0 0	1 1 1 1 1 1
	80	2 2 2 2	1 2 2 2 2	2 2 2	1 2 1	2 2 1 2 2 1	1 1 1 1 1 1
	81	1 0 0 0	0 0 0 0 0	0 0 0	2 2 0	1 1 0 0 0 0	1 1 1 1 1 1
	82	1 2 0 0	0 0 0 0 0	1 1 1	2 2 1	2 2 2 2 2 2	1 1 1 1 1 1
	83	0 0 1 1	0 0 0 0 0	0 0 0	2 2 0	0 1 0 1 1 2	0 1 0 1 1 1
	84	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	0 0 0 0 0 0
	85	0 1 1 2	1 1 1 1 1	1 1 1	0 2 1	0 1 0 1 1 0	1 0 1 1 1 1
	86	1 1 2 2	2 2 2 2 2	2 0 2	0 1 0	2 2 2 1 1 1	2 2 0 2 2 2
	87	1 0 1 2	2 2 0 0 0	0 0 1	2 0 1	1 0 1 2 2 1	1 1 1 1 1 1
	88	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0	2 2 2 2 2 2	0 1 0 0 0 0
	89	1 1 1 1	1 1 1 1 1	2 1 1	1 1 1	2 1 2 2 1 0	1 0 1 1 1 1
	90	2 1 2 1	1 1 1 1 1	2 1 1	2 1 2	2 2 2 2 2 2	0 1 0 0 0 1
	91	1 1 2 1	1 1 1 1 0	1 1 1	2 0 1	1 2 1 2 1 1	1 0 1 0 0 0

Table 175 continued.

Test.		4	5A	5B	6	7	8	9	10
Subtest.		1 2	1 2 3 4	1 2 3 4 5	1 2 3	1 2 3 4	1	1 2 3 4 5 6	1 2
Yrs.	No.								
10.0+	47	1 1	2 2 2 2	2 2 2 2 2	0 0 1	2 2 2 2	1	2 2 2 1 1 1	2 2
	48	0 0	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0 0	0	0 0 0 0 0 0	0 0
	49	0 0	2 2 1 1	2 2 2 2 1	0 0 0	0 0 0 0	0	2 2 1 1 1 1	1 1
	50	2 2	2 2 2 2	0 0 0 0 0	0 0 0	2 2 2 2	0	2 2 2 1 1 1	2 2
	51	2 2	2 2 1 2	1 0 1 0 0	0 0 0	1 1 1 1	0	2 2 2 2 2 2	1 1
	52	0 0	1 0 0 1	0 0 0 0 0	0 0 0	0 0 0 0	0	2 2 2 2 1 1	2 2
	53	0 0	1 1 1 1	2 2 1 2 2	0 0 0	2 2 2 2	2	2 2 1 1 1 1	1 0
	54	0 0	2 1 1 1	0 0 0 0 0	0 0 0	0 0 0 0	1	2 2 2 1 1 2	2 2
	55	0 0	1 1 1 1	1 1 1 2 0	0 0 0	0 0 0 0	0	1 1 1 0 0 0	1 2
	56	2 2	1 1 1 1	2 2 2 2 2	1 1 1	2 2 2 2	1	2 2 1 1 1 1	0 2
9.0+	57	0 0	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0 0	0	0 0 0 0 0 0	0 0
	58	0 0	2 0 0 0	1 1 1 1 1	0 0 0	0 0 0 0	1	2 1 1 1 1 1	2 2
	59	0 0	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0 0	0	0 0 0 0 0 0	0 0
	60	2 2	2 2 2 2	0 0 0 0 0	2 2 2	2 2 2 2	0	2 2 2 1 2 2	2 2
	61	1 1	2 2 2 2	2 1 1 2 2	2 0 2	2 2 2 2	0	2 2 1 1 2 2	2 2
	62	2 2	2 2 2 2	0 1 0 1 1	2 2 2	2 2 2 2	1	2 2 2 1 1 2	2 2
	63	1 1	1 1 1 1	2 2 2 2 2	2 1 1	0 1 1 1	2	2 2 2 2 1 1	2 2
	64	1 1	0 0 0 0	1 1 1 1 1	0 0 0	0.0 0 0	1	2 1 1 0 0 0	1 1
	65	2 1	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2 2	2	2 2 2 1 1 1	2 2
	66	2 2	1 1 1 1	2 2 2 2 2	2 2 2	2 2 2 2	2	2 2 1 2 2 1	2 2
	67	1 2	2 1 1 1	2 2 2 2 2	0 0 0	2 2 2 2	1	2 2 2 2 2 1	2 2
8.0+	68	0 0	1 2 1 1	2 2 2 2 2	2 0 1	2 2 2 2	1	2 2 1 1 1 1	1 2
	69	2 2	2 0 1 2	2 2 2 2 2	0 2 2	2 2 2 2	1	2 2 2 1 1 1	2 2
	70	1 1	2 2 1 2	1 1 1 2 2	1 0 0	2 2 2 2	1	2 2 2 1 1 0	1 2
	71	0 0	1 0 0 0	2 1 2 2 2	1 1 2	2 2 1 1	0	1 0 0 0 0 0	1 1
	72	0 0	0 0 1 0	1 2 0 2 1	1 0 1	2 2 1 1	0	1 1 0 0 0 0	1 2
	73	0 0	1 1 1 1	2 1 2 2 1	0 0 0	0 0 0 0	1	2 1 1 1 0 1	1 2
	74	2 2	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2 2	1	2 2 2 1 1 1	2 2
	75	0 0	1 0 0 1	0 0 0 0 0	0 0 0	0 0 0 0	0	1 2 0 0 0 0	0 0
	76	0 0	1 1 1 2	2 2 2 2 2	0 0 0	1 1 2 0	1	2 2 1 1 1 1	2 2
	77	0 0	1 0 1 1	1 1 1 1 1	0 0 0	2 2 0 0	1	2 1 0 0 0 0	1 2
7.0+	78	0 0	1 2 1 1	1 1 1 1 1	0 0 0	0 0 0 1	0	2 2 1 1 1 2	2 2
	79	0 0	1 1 0 0	1 1 1 1 1	1 0 0	0 0 0 0	1	2 1 1 0 1 0	0 1
	80	1 1	1 0 0 0	1 2 0 2 2	2 1 0	2 2 2 2	0	2 1 2 1 1 1	1 1
	81	0 0	1 0 0 0	1 0 0 0 0	0 0 0	0 0 0 0	1	1 1 1 0 0 0	0 1
	82	0 0	1 1 1 2	1 1 1 1 1	0 0 0	0 0 0 0	1	2 2 2 1 1 1	0 2
	83	0 0	1 0 0 0	1 1 0 1 1	0 0 0	0 0 0 0	0	1 1 1 0 1 0	0 2
	84	0 0	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0 0	0	0 0 0 0 0 0	2 2
	85	0 0	1 0 0 0	2 2 2 2 2	1 0 0	2 2 2 2	1	2 1 1 1 1 1	2 2
	86	1 1	1 1 0 1	2 2 1 1 1	2 2 2	2 2 2 2	1	1 2 1 1 1 1	2 2
	87	0 0	1 0 0 1	0 0 0 0 0	0 0 0	0 0 0 0	0	1 1 1 1 1 0	1 1
	88	0 0	1 0 0 1	0 0 0 1 1	0 0 0	0 0 0 0	1	1 2 0 1 1 0	0 2
	89	0 0	1 0 1 1	0 0 1 1 1	0 0 0	0 0 0 0	1	1 1 1 1 1 1	0 1
	90	0 0	2 2 2 2	1 1 0 0 0	0 0 0	0 0 0 0	0	2 1 1 2 1 2	2 2
	91	1 1	2 2 0 1	1 2 0 1 1	1 0 0	1 0 0 0	0	1 2 1 1 1 1	0 1

Table 175 continued.

INFANTS.

Yrs.	No.	1A 1 2 3 4	1B 1 2 3 4 5	2A 1 2 3	2B 1 2 3	3A 1 2 3 4 5 6	3B 1 2 3 4 5 6
6.0+	92	0 0 1 1	1 0 0 0 0	0 0 0	2 1 0	0 0 0 0 0 0	0 0 0 0 0 0
	93	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	0 0 0 0 0 0
	94	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	0 0 0 0 0 0
	95	0 0 1 0	0 0 0 0 0	1 0 0	0 0 1	1 1 1 2 1 0	0 1 0 0 0 0
	96	0 0 0 0	0 0 0 0 0	0 0 1	1 0 1	0 0 0 0 0 0	0 0 0 0 0 0
	97	1 1 1 1	0 0 0 0 0	0 0 0	2 0 0	0 0 0 0 0 0	0 0 0 0 0 0
	98	1 1 2 2	1 1 1 0 0	1 0 1	1 2 1	2 1 1 2 2 1	0 0 0 0 0 0
	99	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	0 0 0 0 0 0
	100	1 0 0 0	0 1 0 1 1	1 1 1	0 2 0	1 1 2 1 2 1	1 1 1 1 1 1
	101	1 1 1 1	1 1 2 1 1	1 1 1	1 2 1	1 2 2 2 2 2	2 1 2 0 0 0
	102	0 0 0 0	0 0 0 0 0	0 0 0	1 0 0	0 1 1 2 2 1	0 1 0 0 0 1
	103	0 1 0 0	0 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	0 0 0 0 0 0
	104	0 0 0 0	2 0 0 0 0	0 0 1	0 2 1	2 1 2 2 2 1	1 1 1 1 1 1
	105	1 0 0 0	0 0 0 0 0	0 1 0	2 2 0	2 2 2 2 2 2	1 1 1 1 1 1
	106	1 1 1 1	1 0 0 0 0	0 0 1	0 2 0	0 1 1 0 0 0	1 0 0 0 0 0
	107	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	0 0 0 0 0 0
	108	2 2 2 2	2 2 2 2 2	1 2 2	2 2 1	2 2 2 2 2 2	1 1 0 0 0 0
5.0+	109	0 1 0 0	0 0 0 0 0	0 0 0	0 2 0	0 0 0 0 0 0	0 0 0 0 0 0
	110	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	0 0 0 0 0 0
	111	0 1 0 0	0 0 1 0 0	1 0 0	0 0 0	0 1 0 1 1 1	0 0 0 0 0 0
	112	0 0 0 0	1 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	1 1 1 1 1 1
	113	2 2 2 2	2 2 2 2 2	2 2 2	2 1 1	0 1 0 0 0 1	2 2 2 2 1 1
	114	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	0 0 0 0 0 0
	115	0 0 0 0	0 0 0 0 0	1 0 0	0 2 0	0 0 0 0 0 0	0 0 0 0 0 0
	116	0 0 0 0	1 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	1 1 1 1 1 1
	117	1 2 2 2	0 0 1 0 0	0 2 0	0 2 1	0 1 0 0 0 0	0 0 1 0 0 0
	118	0 0 0 1	1 0 0 0 0	0 0 1	1 2 1	0 1 0 0 1 0	0 2 1 0 0 0
	119	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	0 0 0 0 0 0
	120	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	0 0 0 0 0 0
	121	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	0 0 0 0 0 0
	122	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	0 0 0 0 0 0
	123	2 0 1 2	0 0 1 1 2	0 0 0	0 0 0	2 1 1 2 1 2	1 1 1 1 1 1
	124	0 0 1 0	0 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	0 0 0 0 0 0
	125	0 1 2 1	0 0 0 0 0	1 1 1	0 0 0	0 0 0 1 0 0	0 0 0 0 0 0
	126	1 0 0 1	0 0 0 0 0	1 0 0	1 0 1	0 2 1 0 0 0	0 2 1 1 1 1
	127	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	0 0 0 0 0 0
	128	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	0 0 0 0 0 0
	129	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	0 0 0 0 0 0
	130	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	0 0 0 0 0 0

Table 175 continued.

Test.		4	5A	5B	6	7	8	9	10
Subtest.		1 2	1 2 3 4	1 2 3 4 5	1 2 3	1 2 3 4	1	1 2 3 4 5 6	1 2
Yrs.	No.								
6.0+	92	0 0	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0 0	0	1 2 0 0 0 0	0 0
	93	0 0	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0 0	0	0 0 0 0 0 0	0 0
	94	0 0	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0 0	0	0 0 0 0 0 0	2 0
	95	0 0	1 1 0 0	1 1 1 1 1	0 0 0	0 0 0 0	1	2 2 1 1 1 1	2 2
	96	1 1	1 0 0 0	1 1 1 1 0	0 0 0	1 0 0 0	0	1 1 0 0 0 0	1 1
	97	0 0	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0 0	0	0 0 0 0 0 0	0 1
	98	0 0	1 1 1 1	0 0 0 0 0	0 0 0	0 0 0 0	0	2 2 1 0 1 1	1 1
	99	0 0	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0 0	0	0 0 0 0 0 0	0 0
	100	0 0	1 1 1 1	1 1 1 1 1	0 0 0	0 0 0 0	1	2 2 2 1 1 1	2 2
	101	0 0	1 1 1 1	1 0 1 0 0	0 0 0	0 0 0 0	0	2 1 1 0 1 1	1 2
	102	0 0	2 0 1 1	0 0 0 0 0	0 0 0	0 0 0 0	0	1 1 1 1 1 0	0 1
	103	0 0	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0 0	0	1 1 1 1 1 1	0 1
	104	1 1	1 1 1 1	1 1 1 1 1	0 0 0	0 0 0 0	0	1 1 0 0 1 0	0 2
	105	0 1	1 1 1 2	1 1 1 1 1	0 0 0	0 0 0 1	1	2 2 1 1 1 1	2 2
	106	0 0	1 0 0 0	0 0 1 0 0	0 0 0	0 0 0 0	0	2 2 1 1 1 0	1 1
	107	0 0	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0 0	0	0 0 0 0 0 0	0 0
	108	2 1	1 1 1 1	1 0 0 0 1	0 0 0	0 0 0 0	0	1 2 1 1 1 1	1 1
5.0+	109	0 0	2 0 1 1	0 0 0 0 0	0 0 0	0 0 0 0	0	1 1 1 1 1 0	0 1
	110	0 0	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0 0	0	1 2 1 1 0 0	2 2
	111	0 0	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0 0	0	0 0 0 0 0 0	0 0
	112	0 0	1 1 1 0	0 0 0 0 0	0 0 0	0 0 0 0	0	1 1 0 0 0 0	0 1
	113	1 1	1 0 0 1	2 1 2 2 2	2 2 2	2 2 2 2	1	1 2 1 0 1 1	0 2
	114	0 0	0 0 0 0	0 0 0 0 0	0 0 0	0 1 0 0	0	0 0 0 0 0 0	0 0
	115	0 0	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0 0	1	1 1 0 0 0 0	0 0
	116	0 0	0 0 0 1	0 1 0 1 0	0 0 0	1 0 0 0	0	0 2 1 1 1 0	1 0
	117	0 0	1 1 1 1	0 0 0 0 0	0 0 0	1 0 0 0	0	1 1 0 0 0 1	1 1
	118	0 0	0 0 0 0	0 2 0 0 0	0 0 0	0 0 0 0	0	2 2 1 1 1 1	1 2
	119	0 0	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0 0	0	0 0 0 0 0 0	0 0
	120	0 0	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0 0	0	1 0 0 0 0 0	1 0
	121	0 0	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0 0	0	1 0 0 0 0 0	1 0
	122	0 0	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0 0	0	0 0 0 0 0 0	0 0
	123	0 0	0 0 0 0	1 1 1 0 0	0 0 0	1 0 0 0	1	1 2 1 1 0 1	0 1
	124	0 0	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0 0	0	0 0 0 0 0 0	0 1
	125	0 0	1 0 1 1	0 0 0 0 0	0 0 0	0 0 0 0	0	2 1 1 0 0 0	2 1
	126	0 0	1 1 1 1	1 2 1 1 1	0 0 0	0 0 0 0	0	1 1 1 0 0 1	1 1
	127	0 0	1 1 0 0	0 0 0 0 0	0 0 0	0 0 0 0	0	1 0 0 0 0 0	0 0
	128	0 0	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0 0	0	0 0 0 0 0 0	0 0
	129	0 0	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0 0	0	1 0 0 0 0 0	1 0
	130	0 0	0 0 0 1	0 1 0 0 0	0 0 0	0 0 0 0	0	1 1 0 1 0 1	0 1

Table 176

Summary of percentage success in Piagetian tests (In age groups).

S.N.	A.G.	W.S.	%
1	16.0+	106	98.1
2	"	108	100
3	"	108	100
4	15.0+	94	87.0
5	"	108	100
6	"	97	89.8
7	"	88	81.5
8	"	84	77.8
9	"	106	98.1
10	14.0+	106	98.1
11	"	99	91.7
12	"	74	68.5
13	"	107	99.1
14	13.0+	107	99.1
15	"	84	77.8
16	"	85	78.7
17	"	105	97.2
18	"	52	48.1
19	"	102	94.4
20	"	40	37.0
21	"	108	100
22	"	106	98.1
23	"	100	92.6
24	"	1	0.9
25	"	87	80.6
26	12.0+	25	23.1
27	"	63	58.3
28	"	93	86.1
29	"	103	95.3
30	"	99	91.7
31	"	36	33.3
32	"	82	76.0
33	11.0+	108	100
34	"	91	84.2
35	"	97	89.8
36	"	36	33.3
37	"	27	25.0
38	"	101	93.5
39	"	105	97.2
40	"	103	95.4
41	"	94	87.0
42	"	108	100
43	"	99	91.7
44	"	14	13.0
45	"	108	100
46	"	66	61.1
47	10.0+	95	88.0
48	"	0	0
49	"	46	42.6
50	"	55	51.0
51	"	74	68.5
52	"	42	38.9
53	"	84	77.8
54	"	51	47.2
55	"	38	35.2
56	"	91	84.3
57	9.0+	1	0.9
58	"	41	38.0
59	"	0	0
60	"	88	81.5
61	"	93	86.1
62	"	89	82.4
63	"	78	72.2
64	"	95	88.0
65	"	102	94.4
66	"	98	90.7
67	"	14	13.0
68	8.0+	79	73.1
69	"	91	84.3
70	"	84	77.8
71	"	72	66.7
72	"	52	48.1
73	"	70	64.8
74	"	95	88.0
75	"	8	7.4
76	"	64	59.3
77	"	37	34.3
78	7.0+	56	51.8
79	"	33	30.6
80	"	72	66.7
81	"	20	18.5
82	"	51	47.2
83	"	26	24.1
84	"	4	3.7
85	"	51	47.2
86	"	78	72.2
87	"	39	36.1
88	"	31	28.7
89	"	43	39.8
90	"	53	49.1
91	"	47	43.5
92	6.0+	7	6.5
93	"	1	0.9
94	"	2	1.8
95	"	31	28.7
96	"	15	13.9
97	"	7	6.5
98	"	37	34.3
99	"	0	0
100	"	46	42.6
101	"	48	44.4
102	"	16	14.8
103	"	8	7.4
104	"	36	33.3
105	"	50	46.3
106	"	22	20.4
107	"	2	1.8
108	"	0	0
109	5.0+	13	12.0
110	"	12	11.1
111	"	10	9.3
112	"	60	55.5
113	"	7	6.5
114	"	78	72.2
115	"	7	6.5
116	"	16	14.8
117	"	25	23.1
118	"	25	23.1
119	"	1	0.9
120	"	1	0.9
121	"	2	1.8
122	"	0	0
123	"	40	37.0
124	"	3	2.8
125	"	18	16.7
126	"	27	25.0
127	"	1	0.9
128	"	0	0
129	"	1	0.9
130	"	6	5.5

N.B. S.N. = Subject No. W.S. = Weighted score A.G. = Age group.

Table 177

Summary of percentage success in Piagetian Tests and in age group (boys).

No.	Age group	Weighted score	%
1	16.0+	106	98.1
2	"	108	100.0
3	15.0+	94	87.0
4	"	108	100
5	14.0+	106	98.1
6	"	99	91.7
7	13.0+	107	99.1
8	"	85	78.7
9	"	102	94.4
10	"	40	37.0
11	"	106	98.1
12	"	100	92.6
13	"	1	0.9
14	12.0+	63	58.3
15	"	103	95.3
16	"	82	76.0
17	11.0+	108	100
18	"	36	33.3
19	"	101	93.5
20	"	105	97.2
21	"	103	95.4
22	"	94	87.0
23	"	108	100
24	"	99	91.7
25	10.0+	0	0
26	"	74	68.5
27	"	42	38.9
28	"	84	77.8
29	"	51	47.2
30	9.0+	1	0.9
31	"	102	94.4
32	"	14	13.0
33	8.0+	79	73.1
34	"	84	77.8
35	"	70	64.8
36	"	95	88.0
37	7.0+	72	66.7
38	"	51	47.2
39	"	26	24.1
40	"	51	47.2
41	"	78	72.2
42	"	43	39.8
43	"	47	43.5
44	6.0+	1	0.9
45	"	2	1.8
46	"	31	28.7
47	"	15	13.9
48	"	46	42.6
49	"	48	44.4
50	"	8	7.4
51	"	36	33.3
52	"	50	46.3
53	"	22	20.4
54	"	2	1.8
55	5.0+	13	12.0
56	"	7	6.5
57	"	78	72.2
58	"	25	23.1
59	"	1	0.9
60	"	1	0.9
61	"	0	0
62	"	3	2.8
63	"	18	16.7
64	"	1	0.9

Table 178

Summary of percentage success in Piagetian tests and in age groups (girls).

No.	Age group	Weighted score	%
1	16.0+	106	98.1
2	15.0+	97	89.8
3	"	88	81.5
4	"	84	77.8
5	"	106	98.1
6	14.0+	74	68.5
7	"	107	99.1
8	13.0+	84	77.8
9	"	105	97.2
10	"	52	48.1
11	"	108	100
12	"	87	80.6
13	12.0+	25	23.1
14	"	93	86.1
15	"	99	91.7
16	"	36	33.3
17	11.0+	91	84.2
18	"	97	89.8
19	"	27	25.0
20	"	14	13.0
21	"	108	100
22	"	66	61.1
23	10.0+	95	88.0
24	"	46	42.6
25	"	55	51.0
26	"	38	35.2
27	"	91	84.3
28	9.0+	41	38.0
29	"	0	0
30	"	88	81.5
31	"	93	86.1
32	"	89	82.4
33	"	78	72.2
34	"	95	88.0
35	"	98	90.7
36	8.0+	91	84.3
37	"	72	66.7
38	"	52	48.1
39	"	8	7.4
40	"	64	59.3
41	"	37	34.3
42	7.0+	56	51.8
43	"	33	30.6
44	"	20	18.5
45	"	4	3.7
46	"	39	36.1
47	"	31	28.7
48	"	53	49.1
49	6.0+	7	6.5
50	"	7	6.5
51	"	37	34.3
52	"	0	0
53	"	16	14.8
54	"	0	0
55	5.0+	12	11.1
56	"	10	9.3
57	"	60	55.5
58	"	7	6.5
59	"	16	14.8
60	"	25	23.1
61	"	2	1.8
62	"	40	37.0
63	"	27	25.0
64	"	1	0.9
65	"	0	0
66	"	6	5.5

Table 179

Percentage success in Piagetian Tests (by school and sex).

BOYS.

Test	School A.	School B.	School C.	School D.
1A	34.4	33.3	37.5	75.0
1B	36.2	33.3	35.0	73.3
2A	33.3	31.1	33.3	76.2
2B	41.7	20.0	41.7	63.5
3A	61.5	53.3	47.2	74.6
3B	35.4	28.9	25.0	61.1
4	25.0	10.0	8.3	47.6
5A	29.7	8.3	25.0	54.8
5B	40.0	28.0	26.7	62.9
6	31.2	20.0	25.0	46.0
7	37.5	33.3	33.3	66.7
8	18.7	13.3	16.7	52.4
9	40.6	20.0	31.9	62.7
10	68.7	26.7	41.7	73.8
11	46.1	45.7	60.6	71.7

GIRLS.

Test	School A.	School B.	School C.	School D.
1A	12.5	16.7	41.2	64.0
1B	23.3	21.7	35.3	64.8
2A	19.4	25.0	29.4	66.7
2B	30.5	19.4	33.3	72.0
3A	40.3	26.4	46.1	78.0
3B	33.3	16.7	22.5	41.3
4	25.0	12.5	17.6	34.0
5A	8.3	2.1	22.1	44.0
5B	33.3	16.7	24.7	20.8
6	22.2	5.5	23.5	32.0
7	27.1	8.3	29.4	65.0
8	16.7	8.3	17.6	24.0
9	23.6	16.7	30.4	55.3
10	45.8	29.2	41.2	64.0
11	45.4	51.4	53.7	71.4

ALL.

Test	School A.	School B.	School C.	School D.
1A	25.0	25.9	39.6	69.0
1B	30.7	28.1	35.2	68.7
2A	27.4	28.4	31.0	71.0
2B	36.9	19.7	36.8	68.1
3A	52.4	30.2	46.5	76.4
3B	34.5	23.4	23.6	50.4
4	25.0	11.1	13.8	40.2
5A	20.5	21.3	23.3	48.9
5B	37.1	23.0	25.5	40.0
6	27.4	13.6	24.1	38.4
7	33.0	21.8	31.0	65.8
8	17.9	11.1	17.2	37.0
9	33.3	18.5	31.0	58.7
10	58.9	27.8	41.4	68.5
11	45.8	48.3	56.6	75.3

Table 180

Summary of percentage success in Piagetian Tests.

Test	Boys (n = 64)	Girls (n= 66)	All (n = 130)
1A	48.0	40.1	44.0
1B	47.5	41.8	44.6
2A	46.9	40.9	43.8
2B	43.7	44.9	44.3
3A	56.5	53.5	55.0
3B	40.4	30.5	35.3
4	25.8	24.2	25.0
5A	32.0	24.2	28.1
5B	42.2	23.3	32.6
6	32.3	23.2	27.7
7	45.3	38.6	41.9
8	28.1	18.2	23.1
9	41.4	36.1	38.7
10	55.4	48.5	51.9
11	59.9	58.5	59.2

Table 181

Means, s.ds. of Piagetian weighted scores. One-year age group.

Age (yrs.)	n.	m.	s.d.
16	3	107.3	1.2
15	6	96.2	9.6
14	4	96.5	15.4
13	12	76.7	35.9
12	7	71.6	31.1
11	14	82.6	32.9
10	10	57.6	29.1
9	11	62.9	42.0
8	10	65.2	26.7
7	14	43.1	19.8
6	17	22.7	20.1
5	22	13.3	18.1

Table 182

Means, s.ds. percentage success in Piagetian tests. One-year age group.

16	3	99.4	1.1
15	6	89.1	8.9
14	4	89.3	14.3
13	12	71.0	33.2
12	7	66.3	28.8
11	14	76.5	30.5
10	10	53.3	26.9
9	11	58.2	38.9
8	10	60.4	24.7
7	14	39.9	18.3
6	17	21.0	18.6
5	22	12.3	16.7

Table 183

Piagetian weighted scores expressed as percentages. Two-year age groups.

Age (yrs.)	n.	Raw score m.	Raw score s.d.	mean %
15 and 16	9	99.9	9.4	92.5
13 " 14	16	81.7	32.7	75.7
11 " 12	21	79.0	32.0	73.1
9 " 10	21	60.4	35.6	55.9
7 " 8	24	52.3	25.0	48.4
5 " 6	39	17.4	19.4	16.1

Table 184

Number of instances at each stage.

	Secondary Boys (n=16) Stage			Secondary Girls (n=16) Stage			All Secondary (n=32) Stage		
	1	2	3	1	2	3	1	2	3
Test 1A	7	6	51	10	8	46	17	14	97
1B	12	4	64	11	8	61	23	12	125
2A	4	7	37	5	3	40	9	10	77
2B	4	9	35	1	10	37	5	19	72
3A	6	6	84	0	13	83	6	19	167
3B	9	16	71	26	19	51	35	35	122
4	8	5	19	8	11	13	16	16	32
5A	7	17	40	1	31	32	8	48	72
5B	10	6	64	19	12	49	29	18	113
6	16	3	29	19	6	23	35	9	52
7	10	1	53	8	6	50	18	7	103
8	3	3	10	6	3	7	9	6	17
9	8	18	70	7	16	73	15	34	143
10	2	4	26	3	3	26	5	7	52
Total	106	105	653	124	149	591	230	254	1244

	Junior Boys (n=20)			Junior Girls (n=25			All Junior (n=45)		
Test 1A	12	13	55	43	15	42	55	28	97
1B	18	10	72	48	10	67	66	20	139
2A	9	9	42	27	13	35	36	22	77
2B	13	13	34	16	24	35	29	37	69
3A	14	10	96	25	32	93	39	42	189
3B	21	26	73	45	40	65	66	66	138
4	16	10	14	24	8	18	40	18	32
5A	14	29	37	23	42	35	37	71	72
5B	23	15	62	25	36	64	48	51	126
6	32	2	26	42	13	20	74	15	46
7	24	4	52	32	14	54	56	18	106
8	5	7	8	13	8	4	18	15	12
9	14	35	71	33	65	52	47	100	123
10	5	5	30	6	13	31	11	18	61
Total	220	188	672	402	333	615	622	521	1287

	Infant Boys (n=28)			Infant Girls (n=25)			All Infants (n=58)		
Test 1A	64	31	17	62	27	11	126	58	28
1B	100	24	16	99	20	6	199	44	22
2A	49	25	10	60	10	5	109	35	15
2B	50	18	16	49	11	15	99	29	31
3A	93	34	41	94	22	34	187	56	75
3B	105	52	11	100	48	2	205	100	13
4	45	11	0	46	3	1	91	14	1
5A	66	43	3	63	32	5	129	75	8
5B	78	48	14	92	32	1	170	80	15
6	75	2	7	74	1	0	149	3	7
7	93	3	16	97	3	0	190	6	16
8	20	8	0	20	5	0	40	13	0
9	73	76	19	73	61	16	146	137	35
10	22	18	16	22	20	8	44	38	24
Total	933	393	186	951	295	104	1884	688	290

Table 185

Piagetian Tests. Mental age and operativity.

Two-year age groups.

Age	n.	m. I.Q.	m. C.A.	m. M.A.	% operativity.
15 and 16 yrs.	9	87.4	15.6	13.6	92.5
13 " 14 "	16	80.0	13.8	11.0	75.6
11 " 12 "	21	77.3	11.9	9.2	55.9
9 " 10 "	21	77.2	9.9	7.6	55.9
7 " 8 "	24	77.3	7.9	5.6	48.4
5 " 6 "	39	85.8	5.9	5.1	16.1

Table 186

Piagetian tests. Mental age and operativity.

One-year age groups.

16 years	3	98.3	16.0	15.7	99.4
15 "	6	82.0	15.4	12.6	89.0
14 "	4	82.2	14.6	12.0	89.4
13 "	12	79.2	13.5	10.7	71.0
12 "	7	77.1	12.2	9.4	66.3
11 "	14	77.4	11.5	8.9	76.5
10 "	10	75.4	10.4	7.8	53.3
9 "	11	78.8	9.4	7.4	58.2
8 "	10	77.0	8.5	6.5	60.4
7 "	14	77.5	7.5	5.8	39.9
6 "	17	82.6	6.6	5.5	21.0
5 "	22	88.2	5.4	4.8	12.3

APPENDIX G.

Details of results of the second testing of school A.

Contents

Table 187

Weighted scores on Piagetian tests. (First and second testings after three-year period). School A.

N.B. First figure indicates weighted score on first test and second figure the weighted score on second test.

BOYS.

Test	1A	1B	2A	2B	3A	3B
Subtest	1 2 3 4	1 2 3 4 5	1 2 3	1 2 3	1 2 3 4 5 6	1 2 3 4 5 6
Subject No.						
1.	1 0 0 0	0 1 0 0 0	1 1 0	2 2 1	2 2 2 2 2 2	1 1 1 1 1 1
	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
2	1 2 2 2	1 2 2 2 2	2 1 2	1 2 1	2 2 2 2 2 2	2 2 2 2 2 2
	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
3	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
4	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
5	1 0 0 0	0 0 0 0 0	0 1 0	0 0 1	2 2 2 2 2 2	1 2 2 2 2 2
	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
6	2 2 2 2	2 2 2 2 2	2 2 2	2 2 1	1 2 2 2 2 2	2 2 2 2 2 2
	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
7	0 2 2 2	2 2 2 2 2	2 2 2	2 2 1	2 2 2 2 2 2	1 1 1 1 1 1
	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
8	1 2 0 0	0 0 0 0 0	1 1 1	2 2 1	2 2 2 2 2 2	1 1 1 1 1 1
	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
9	0 1 1 2	1 1 1 1 1	1 1 1	0 2 1	0 1 0 1 1 0	1 0 1 1 1 1
	2 2 2 2	1 2 2 1 1	2 1 1	1 2 2	2 2 2 2 2 2	1 1 1 1 1 1
10	1 1 2 2	2 2 2 2 2	2 0 2	0 1 0	2 2 2 1 1 1	2 2 0 2 2 3
	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
11	0 0 1 0	0 0 0 0 0	1 0 0	0 0 1	1 1 1 2 1 1	0 1 0 0 0 0
	0 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
12	1 0 0 0	0 1 0 1 1	1 1 1	0 2 0	1 1 2 1 2 1	1 1 1 1 1 1
	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
13	1 0 0 0	0 0 0 0 0	0 1 0	2 2 0	2 2 2 2 2 2	1 1 1 1 1 1
	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2
14	1 1 1 1	1 0 0 0 0	0 0 1	0 2 0	0 1 1 0 0 0	1 0 0 0 0 0
	1 1 1 1	1 1 1 1 1	1 1 2	2 2 2	2 2 2 2 2 2	1 1 1 1 1 1
15	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	0 0 0 0 0 0
	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0	0 0 0 1 0 0	0 0 0 0 0 0
16	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	0 0 0 0 0 0
	0 0 0 0	2 0 0 0 0	0 0 0	1 1 1	2 2 2 2 2 1	0 0 0 0 0 0

Table 187 continued

Piagetian tests. (Second testing of School A children after three-year period.

BOYS

Test	4	5A	5B	6	7	8	9	10
Subtest	1 2	1 2 3 4	1 2 3 4 5	1 2 3	1 2 3 4	1	1 2 3 4 5 6	1 2
Subject No.								
1	0 2	2 2 2 2	2 2 2 2 2	0 1 1	2 0 2 0	1	2 2 2 1 1 2	2 2
	2 2	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2 2	2	2 2 2 2 2 2	2 2
2	0 0	1 1 1 1	2 2 2 2 2	0 0 0	2 2 1 2	1	2 2 1 1 1 1	2 2
	2 0	2 1 1 2	2 2 2 2 2	2 2 2	2 2 2 2	2	2 2 2 2 2 2	2 2
3	2 2	1 1 1 1	2 2 2 2 2	2 2 2	2 2 2 2	2	2 2 2 1 1 1	2 2
	2 2	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2 2	2	2 2 2 2 2 2	2 2
4	2 2	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2 2	2	2 2 2 2 2 2	2 2
	2 2	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2 2	2	2 2 2 2 2 2	2 2
5	0 0	2 1 1 1	0 0 0 0 0	0 0 0	0 0 0 0	1	2 2 2 1 1 2	2 2
	2 0	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2 2	2	2 2 2 2 2 2	2 2
6	2 1	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2 2	2	2 2 2 1 1 1	2 2
	2 2	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2 2	2	2 2 2 2 2 2	2 2
7	2 2	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2 2	1	2 2 2 1 1 1	0 1
	2 2	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2 2	2	2 2 2 2 2 2	1 2
8	0 0	1 1 1 2	1 1 1 1 1	0 0 0	0 0 0 0	1	2 2 2 1 1 1	0 2
	2 2	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2 2	2	2 2 2 2 2 2	2 2
9	0 0	1 0 0 0	1 1 1 1 1	1 0 0	2 2 2 2	1	2 1 1 1 1 1	0 1
	1 0	1 1 1 1	1 1 1 1 1	1 1 1	2 2 2 2	1	2 2 1 2 2 1	1 2
10	1 1	1 1 0 1	2 2 1 1 1	2 2 2	2 2 2 2	1	1 2 1 1 1 1.	2 2
	2 0	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2 2	1	2 2 2 2 2 2	2 2
11	0 0	1 1 0 0	1 1 1 1 1	0 0 0	0 0 0 0	1	2 2 2 1 1 1	2 2
	1 0	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2 2	1	2 2 2 2 2 2	2 2
12	0 0	1 1 1 1	1 1 1 1 1	0 0 0	0 0 0 1	1	2 2 1 1 1 1	2 2
	0 0	1 1 1 1	2 2 2 2 2	2 2 2	2 2 2 2	2	2 2 2 2 2 2	2 2
13	0 1	1 1 1 2	1 1 1 1 1	0 0 0	0 0 0 1	1	2 2 1 1 1 1	2 2
	2 2	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2 2	2	2 2 2 2 2 2	2 2
14	0 0	1 0 0 0	0 0 1 0 0	0 0 0	0 0 0 0	0	2 2 1 1 1 0	1 1
	1 0	1 1 1 2	1 1 1 1 1	1 0 0	1 1 1 2	1	2 2 2 2 2 2	2 2
15	0 0	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0 0	0	1 0 0 0 0 0	1 0
	0 0	1 2 0 0	0 0 0 0 0	0 0 0	0 0 0 0	0	2 1 1 0 0 0	1 1
16	0 0	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0 0	0	0 0 0 0 0 0	1 0
	0 0	1 1 0 0	0 0 0 0 0	0 0 0	0 0 0 0	0	2 2 1 0 0 1	1 2

Table 188

Piagetian tests. (Second testing of School A after three-year period.)

GIRLS.

Test	1A	1B	2A	2B	3A	3B
Subtest	1 2 3 4	1 2 3 4 5	1 2 3	1 2 3	1 2 3 4 5 6	1 2 3 4 5 6
Subject No.						
1.	1 1 2 2	2 2 2 2 2	2 2 2	1 2 1	2 2 2 2 2 2	2 2 2 2 2 2
2	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
2	0 0 0 0	0 0 0 0 0	0 0 0	0 1 1	0 0 0 0 0 0	0 0 1 0 0 0
	0 0 0 0	0 0 0 0 0	0 0 0	0 1 1	2 1 0 1 2 2	0 0 0 0 0 0
3	0 0 0 0	0 0 0 0 0	0 0 0	2 1 1	2 2 2 2 2 2	1 1 1 1 1 1
	1 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
4	1 1 2 2	2 2 2 1 2	2 2 2	2 2 1	2 2 2 2 2 2	2 2 2 2 2 2
	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
5	2 1 1 2	2 2 2 2 2	1 1 1	1 2 1	2 2 2 2 2 2	2 2 2 2 2 2
	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
6	0 0 0 0	0 0 1 1 1	2 1 1	2 2 1	1 1 1 2 2 1	2 2 2 2 2 2
	Transferred to normal school.					
7	0 0 2 1	0 0 0 0 0	0 0 1	0 0 0	2 2 1 2 1 1	1 0 1 1 1 1
	1 1 2 2	2 2 2 2 2	1 2 2	2 2 2	2 2 2 2 2 2	1 1 1 1 1 1
8	1 1 1 1	1 1 1 0 1	1 1 0	0 2 0	0 0 0 0 0 0	1 1 1 1 1 1
	1 1 1 1	1 1 1 1 1	1 1 1	2 2 2	2 2 2 2 2 2	1 1 1 1 1 1
9	1 0 0 0	0 0 0 0 0	0 0 0	2 2 0	0 0 0 0 0 0	0 0 0 0 0 0
	1 1 1 1	1 1 1 1 1	1 2 1	2 2 1	2 2 2 2 2 2	2 2 2 2 2 2
10	0 0 0 0	0 0 0 0 0	1 0 0	0 2 0	0 0 0 0 0 0	0 0 0 0 0 0
	1 0 2 1	1 2 2 1 2	2 1 1	2 2 2	2 2 2 2 2 2	2 2 2 2 2 2
11	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	0 0 0 0 0 0
	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2	2 2 2 2 1 2	2 2 2 2 2 2
12	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0	0 0 0 0 0 0	0 0 0 0 0 0
	0 0 0 0	0 0 0 0 0	0 0 1	0 1 1	2 2 2 2 1 2	0 0 0 0 0 0

Table 188 continued.

Piagetian tests. (Second testing of School A children after three-year period.

GIRLS.

Test	4	5A	5B	6	7	8	9	10
Subtest	1 2	1 2 3 4	1 2 3 4 5	1 2 3	1 2 3 4	1	1 2 3 4 5 6	1 2
Subject No.								
1	2 2	1 1 1 1	2 2 2 2 2	2 2 2	2 2 2 2	2	2 2 2 1 1 1	2 2
	2 2	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2 2	2	2 2 2 2 2 2	2 2
2	0 0	1 0 0 0	0 1 0 0 0	0 0 0	0 0 0 0	0	2 2 1 1 1 0	1 1
	0 0	2 1 1 1	0 0 0 0 0	0 0 0	0 0 0 0	1	2 1 1 2 1 1	2 2.
3	0 0	2 0 0 0	1 1 1 1 1	0 0 0	0 0 0 0	1	2 1 1 1 1 1	2 2
	1 0	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2 2	1	2 2 2 2 2 2	2 2
4	2 2	1 1 1 1	2 2 2 2 2	2 2 2	2 2 2 2	2	2 2 1 2 2 1	2 2
	2 2	2 2 2 2	2 2 2 2 2	2 2 2	2 2 2 2	2	2 2 2 2 2 2	2 2
5	2 2	2 0 1 2	2 2 2 2 2	0 2 2	2 2 2 2	1	2 2 2 1 1 1	2 2
	2 2	2 2 2 1	2 2 2 2 2	2 2 2	2 2 2 2	2	2 2 2 2 2 2	2 2
6	0 0	1 1 1 2	2 2 2 2 2	0 0 0	1 1 2 0	1	2 2 1 1 1 1	2 2
	Transferred to normal school.							
7	0 0	1 0 1 1	1 1 1 1 1	0 0 0	2 2 0 0	1	2 1 0 0 0 0	1 2
	1 0	2 2 2 1	1 1 1 1 1	1 0 0	1 1 1 1	1	2 2 1 1 1 1	2 2
8	0 0	1 1 0 0	1 1 1 1 1	1 0 0	0 0 0 0	1	1 1 1 0 0 0	0 1
	0 0	1 2 0 2	1 1 1 1 1	0 0 0	0 0 0 2	11	2 2 1 1 1 1	2 2
9	0 0	1 0 0 0	1 0 0 0 0	0 0 0	0 0 0 0	1	1 1 1 0 0 0	0 1
	1 0	2 2 1 2	1 1 1 1 1	0 0 0	0 0 0 0	1	2 2 2 1 1 1	2 2
10	0 0	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0 0	1	1 1 0 0 0 0	0 0
	1 0	2 1 1 1	2 1 2 2 2	2 2 2	2 2 2 2	1	2 2 2 1 1 2	2 2
11	0 0	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0 0	0	1 0 0 0 0 0	1 0
	1 0	1 1 0 0	2 2 2 2 2	2 2 2	2 2 2 2	1	2 2 2 1 1 1	2 2
12	0 0	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0 0	0	0 0 0 0 0 0	0 0
	0 0	1 1 1 1	0 0 0 0 0	0 0 0	0 0 0 0	0	2 2 1 1 1 1	2 2

Table 189

Summary of performances on Piagetian Tests.
School A. First and second testing after three year interval.

No.	Tests IA to 10 weighted score	%	Test 11 score	%	Test IA to 10 weighted score	%	Test 11 score	%
1	97	89.8	15		108	100	deceased	
2	63	58.3	15		108	100	29	100
3	82	75.9	18		106	98.1	29	100
4	101	93.5	13		108	100	29	100
5	108	100	23		108	100	29	100
6	14	13	12		28	25.9	22	75.9
7	51	47.2	12		107	99.1	19	65.5
8	41	38	14		103	95.4	29	100
9	102	94.4	17		108	100	19	65.5
10	98	90.7	18		108	100	17	58.6
11	91	84.3	16		107	99.1	19	65.5
12	95	88	14		107	99.1	29	100
13	64	59.3	19		transferred			
14	37	34.3	12		76	70.4	13	44.8
15	33	30.6	9		76	70.4	17	58.6
16	20	18.5	16		69	63.9	29	100
17	51	47.2	17		108	100	25	86.2
18	51	47.2	4		77	71.3	23	21.3
19	78	72.2	13		105	97.2	17	58.6
20	31	28.7	20		102	94.4	22	75.9
21	46	42.6	15		100	92.6	28	96.6
22	50	46.3	11		108	100	28	96.6
23	22	20.4	19		71	65.7	18	62.1
24	7	6.5	6		90	83.3	21	72.4
25	1	0.9	1		9	8.3	16	55.2
26	2	1.8	8		94	87.0	29	100
27	0	0	13		30	27.8	15	51.7
28	1	0.9	0		27	25.0	20	69.0
m.	51.3		13.2		86.9		22.7	
s.d.	35.7		5.8		30.0		5.5	

Table 190

Test II Class inclusion School A (2nd. testing after 3 years)

Boys No.	1 a	1 b	1 c	2 a	2 b	2 c	3 a	3 b	4 a	4 b	5 a	5 b	6 a	6 b	7 a	7 b	8 a	8 b	9 a	9 b	10 a	10 b	11 a	11 b	12 a	12 b	13 a	13 b	13 c
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5	✓	✓	✓	✓	✓	✓	✓	✓	✓	·	✓	·	✓	·	✓	·	✓	·	✓	·	✓	·	✓	·	·	·	✓	✓	✓
6	✓	✓	✓	✓	✓	·	✓	✓	✓	·	✓	·	✓	·	✓	·	✓	·	✓	·	✓	✓	✓	✓	·	·	✓	✓	✓
7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8	✓	✓	✓	✓	✓	·	✓	✓	✓	·	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	·	·	✓	✓	✓
9	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	·	·	✓	·	✓	·	·	·	✓	✓	✓
10	✓	✓	✓	✓	✓	·	✓	·	✓	·	✓	·	✓	·	✓	·	✓	·	✓	·	✓	·	✓	·	✓	·	✓	✓	·
11	✓	✓	✓	✓	✓	✓	✓	·	✓	·	✓	·	✓	✓	✓	·	✓	·	✓	✓	✓	✓	✓	✓	·	·	✓	✓	✓
12	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	·	✓	✓
13	✓	✓	·	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
14	✓	✓	✓	✓	✓	·	✓	✓	✓	·	✓	·	✓	·	✓	✓	·	·	✓	·	✓	·	✓	·	·	·	✓	✓	✓
15	✓	✓	·	✓	·	✓	·	·	✓	·	✓	·	✓	·	✓	·	✓	·	✓	·	✓	·	✓	·	✓	✓	✓	✓	·
16	✓	·	·	·	·	·	✓	·	✓	✓	✓	·	·	·	·	·	·	·	✓	·	✓	·	✓	✓	·	·	·	·	·
Total	16	15	13	15	14	11	15	12	16	9	16	9	15	10	15	10	14	9	15	9	16	10	16	11	9	8	14	15	13

Girls	1 a	1 b	1 c	2 a	2 b	2 c	3 a	3 b	4 a	4 b	5 a	5 b	6 a	6 b	7 a	7 b	8 a	8 b	9 a	9 b	10 a	10 b	11 a	11 b	12 a	12 b	13 a	13 b	13 c
1	deceased.																												
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	·	✓	·	✓	·	✓	·	✓	✓	✓	·	✓	·	·	✓	✓	✓	✓
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4	✓	✓	✓	·	✓	✓	✓	✓	✓	·	✓	·	·	·	✓	✓	·	·	·	✓	✓	·	✓	·	·	·	✓	✓	✓
5	✓	✓	✓	✓	✓	·	✓	✓	✓	·	✓	·	✓	·	✓	✓	✓	·	✓	·	✓	·	✓	✓	·	·	✓	✓	·
6	left for normal day school																												
7	✓	·	·	·	·	·	✓	✓	✓	·	✓	·	✓	·	✓	·	✓	·	✓	·	✓	·	✓	·	·	✓	✓	✓	·
8	✓	✓	✓	✓	·	·	✓	✓	✓	·	✓	·	✓	·	✓	·	✓	·	✓	·	✓	·	✓	·	✓	·	✓	✓	·
9	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
10	✓	✓	✓	✓	✓	✓	✓	✓	✓	·	✓	·	✓	·	✓	·	✓	·	✓	·	✓	·	✓	·	✓	✓	✓	✓	✓
11	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
12	✓	✓	·	✓	✓	·	·	·	✓	·	✓	·	✓	·	✓	·	✓	·	✓	·	✓	·	✓	·	✓	·	✓	✓	·
Total	10	9	8	8	8	6	9	9	10	4	10	3	9	3	10	5	9	3	9	5	10	3	10	4	6	5	10	10	6
	16	24	21	23	22	20	20	21	26	13	26	12	24	13	25	15	23	12	24	14	26	13	26	15	15	13	24	25	19

Table 191

Reading (Three year comparison.)

	1974 (1st testing)			1977 (2nd testing).		
No.	R.S.	C.A.	R.A.	R.S.	C.A.	R.A.
1	100	15.5	12.0*	106	18.5	12.0*
2	92	12.8	12.0*	105	15.8	12.0*
3	79	12.2	11.1	100	15.2	12.0*
4	84	11.6	11.8	101	14.6	12.0*
5	102	11.4	12.0*	108	14.4	12.0*
6	0	11.3	5.0 N.R.	5	14.3	6.0
7	75	10.1	10.8	94	13.1	12.0*
8	22	9.8	6.3	65	12.8	9.8
9	94	9.0	12.0*	106	12.0	12.0*
10	20	9.0	6.2	72	12.0	10.3
11	4	8.9	5.4	51	11.9	8.3
12	4	8.5	5.4	94	11.5	12.0*
13	10	8.0	5.7	55	11.0	8.7
14	9	8.0	5.7	85	11.0	11.7
15	27	7.8	6.7	48	10.8	8.1
16	7	7.8	5.6	32	10.8	6.9
17	42	7.8	7.7	88	10.8	12.0*
18	2	7.5	5.3	42	10.5	7.6
19	4	7.4	5.4	40	10.4	7.6
20	12	6.8	5.9	59	9.8	9.1
21	10	6.7	5.7	46	9.7	7.9
22	35	6.2	7.1	76	9.2	10.9
23	6	6.1	5.5	46	9.1	7.9
24	0	5.5	5.0 N.R.	75	8.5	10.7
25	0	5.0	5.0 N.R.	2	8.0	5.3
26	0	5.0	5.0 N.R.	70	8.0	10.2
27	0	5.0	5.0 N.R.	60	8.0	9.2
28	0	5.0	5.0 N. R	25	8.0	6.4

No. of fluent readers (i.e. with reading age above 12.0 years) = 4

No. of fluent readers = 9

No. of non-readers (including five-year olds) = 6

No. of non-readers = 0

Mean R.A. = 6.9 years, s.d. 2.1
Mean C.A. = 8.3 years, s.d. 1.7

Mean R.A. = 9.7 years, s.d. 2.2
Mean C.A. = 11.3 years, s.d. 1.7

APPENDIX H.

Test 3A. Spontaneous Correspondence.

Contents:

Table 192

Test 3A - Spontaneous Correspondence.

SCHOOL A - BOYS.

Subtest	Number 1	2	3	4	5	6	Total	Shape 1	2	3	4	5	6	Total	Colour 1	2	3	4	5	6	Total
Subject No.																					
1	/	/	/	/	/	/	6	X	X	X	X	X	X	0	X	X	X	X	X	X	0
2	/	/	/	/	/	/	6	X	X	X	X	X	X	0	X	X	X	X	X	X	0
3	/	/	/	/	/	/	6	X	X	X	X	X	X	0	/	/	/	/	/	/	6
4	/	/	/	/	/	/	6	X	X	X	X	X	X	0	X	X	/	X	X	X	1
5	/	/	/	/	X	X	4	/	/	/	X	X	X	3	/	/	/	X	X	X	3
6	/	/	/	/	/	/	6	/	/	/	/	/	/	6	/	/	/	/	/	/	6
7	/	/	/	/	/	/	6	/	/	X	X	X	X	2	/	X	/	X	X	X	2
8	/	/	/	/	/	/	6	X	X	X	X	X	X	0	/	X	X	X	X	X	1
9	X	X	X	X	/	X	1	X	/	X	/	/	/	4	X	X	X	X	X	/	1
10	/	/	/	/	/	/	6	/	/	X	X	X	X	2	X	X	X	X	X	/	1
11	X	X	X	X	X	X	0	/	/	/	/	/	/	6	/	/	/	X	X	X	3
12	X	X	X	X	X	X	0	/	/	/	/	/	/	6	/	/	/	/	/	/	6
13	/	/	/	/	/	/	6	/	X	X	X	/	X	2	/	/	/	/	/	/	6
14	X	X	/	X	X	X	1	/	/	/	/	X	/	5	/	X	X	X	X	X	1
15	X	X	X	X	X	X	0	/	/	/	X	/	X	4	X	/	/	/	X	X	3
16	X	X	X	X	X	X	0	X	X	X	X	/	X	1	/	X	/	X	X	/	3
Totals	10	10	11	10	10	9	60	9	9	6	5	7	5	41	10	7	10	5	4	7	43

GIRLS.

Subject No.	Number 1	2	3	4	5	6	Total	Shape 1	2	3	4	5	6	Total	Colour 1	2	3	4	5	6	Total
1	/	/	/	/	/	/	6	X	X	X	X	X	X	0	/	/	/	/	/	/	6
2	X	X	X	X	X	X	0	/	/	/	/	/	/	6	/	/	/	/	/	/	6
3	/	/	/	/	/	/	6	X	X	X	/	X	X	1	X	X	X	X	X	/	1
4	/	/	/	/	/	/	6	X	X	/	/	X	X	2	X	X	X	X	X	X	0
5	/	/	/	/	/	/	6	X	/	/	/	/	X	4	X	X	X	/	/	/	3
6	X	X	/	/	/	/	4	/	/	/	/	/	/	6	/	/	/	/	/	/	6
7	/	/	/	/	/	/	6	X	X	X	X	X	X	0	/	X	X	X	X	X	1
8	X	X	X	X	X	X	0	/	/	/	/	/	X	5	/	/	/	/	/	/	6
9	/	/	X	X	X	/	3	X	/	/	X	/	X	3	/	/	/	/	/	X	5
10	X	X	X	X	X	X	0	X	/	/	/	/	/	5	/	X	/	/	/	/	5
11	X	X	X	X	X	X	0	X	X	X	X	X	/	1	X	/	/	/	X	X	3
12	X	X	X	X	X	X	0	X	X	X	X	X	X	0	X	/	/	/	X	X	3
Totals	6	6	6	6	6	7	37	3	6	7	7	6	4	33	7	7	8	9	7	7	45
Overall Totals	16	16	17	16	16	16	97	12	15	13	12	13	9	74	17	14	18	14	11	14	88

Table 193

Test 3A - Spontaneous Correspondence.

SCHOOL B - BOYS

	Number						Total	Shape						Total	Colour						Total
Subtest	1	2	3	4	5	6		1	2	3	4	5	6		1	2	3	4	5	6	
Subject No.																					
1	/	/	/	/	/	/	6	X	/	/	/	/	/	4	/	X	/	/	X	X	0
2	/	/	/	/	/	/	6	X	/	X	/	X	X	2	X	X	X	X	X	X	0
3	/	/	/	/	/	/	6	X	/	/	X	/	/	4	X	X	X	X	X	X	0
4	/	/	/	/	X	X	4	/	/	/	X	X	X	3	/	/	/	/	X	X	4
5	X	X	X	X	X	X	0	X	X	X	X	X	X	0	/	/	/	/	/	/	6
6	X	X	X	X	X	X	0	X	X	X	X	X	X	0	X	X	X	X	X	X	0
7	/	/	/	/	/	/	6	/	/	/	/	/	/	6	/	/	/	/	/	/	6
8	/	/	/	/	/	/	6	/	/	X	/	/	/	5	X	X	/	/	/	X	3
9	/	/	/	/	/	X	5	X	/	/	/	X	X	3	X	/	/	/	X	X	3
10	X	X	X	X	X	X	0	X	X	X	X	X	X	0	/	X	X	X	X	X	1
11	X	X	X	X	X	X	0	/	X	/	/	X	X	3	/	/	X	X	X	/	3
12	X	X	X	/	X	X	1	/	X	X	X	X	X	1	X	X	X	X	X	X	0
13	X	/	X	X	X	/	2	/	/	/	/	X	X	4	/	/	/	/	X	X	4
14	X	X	X	X	X	X	0	X	/	X	/	X	X	2	X	X	X	X	X	/	1
15	X	X	X	X	X	X	0	X	X	X	X	X	X	0	X	X	X	X	X	X	0
Totals	7	8	7	8	6	6	42	6	9	7	8	4	4	38	7	6	7	7	3	4	34
GIRLS																					
1	X	X	X	X	X	X	0	/	/	/	X	/	/	5	/	/	/	/	/	/	6
2	/	X	X	X	X	X	1	/	/	/	/	/	/	6	/	/	/	/	/	X	5
3	/	X	/	/	/	/	5	X	/	/	/	/	X	4	X	X	X	X	X	X	0
4	/	X	X	X	X	X	1	X	X	X	X	X	X	0	X	X	X	X	X	X	0
5	/	/	/	X	X	/	4	X	X	/	/	/	/	4	/	/	X	X	/	X	3
6	/	/	/	/	/	/	6	X	X	X	X	/	X	1	/	/	/	/	/	/	6
7	/	/	/	/	/	/	6	/	/	/	/	/	/	6	X	/	/	/	/	/	5
8	X	X	X	X	X	X	0	X	X	X	X	X	X	0	X	X	X	X	X	X	0
9	X	X	X	X	X	X	0	/	X	X	X	X	X	1	X	X	X	X	X	X	0
10	X	X	X	X	X	X	0	X	/	X	X	X	X	1	X	/	/	/	X	/	4
11	/	/	/	/	/	/	6	X	X	X	X	X	X	0	/	/	/	/	/	/	6
12	X	X	X	X	X	X	0	X	/	/	X	X	X	2	X	X	X	X	X	X	0
Totals	7	4	5	4	4	5	29	4	6	6	4	6	4	30	5	7	6	6	6	5	35
Overall Totals	14	12	12	12	10	11	71	10	15	13	12	12	8	68	12	13	13	13	9	9	69

Table 194

Test 3A - Spontaneous Correspondence.

SCHOOL C - BOYS.

	Number						Total	Shape						Total	Colour						Total
Subtest	1	2	3	4	5	6		1	2	3	4	5	6		1	2	3	4	5	6	
Subject No.																					
1	/	/	/	/	/	/	6	X	X	X	X	X	X	0	/	X	/	/	X	X	3
2	/	/	/	/	/	/	6	X	X	X	/	/	X	2	/	/	/	/	/	/	6
3	/	/	/	/	/	/	6	/	/	/	/	/	/	6	/	/	/	/	/	/	6
4	/	/	/	/	/	/	6	/	/	/	/	/	/	6	/	/	/	/	X	X	4
5	/	/	/	/	/	/	6	/	X	X	X	X	X	1	X	X	X	X	X	X	0
6	/	/	/	/	/	/	6	X	X	/	/	/	X	3	/	/	/	/	/	/	6
7	/	/	/	/	/	/	6	X	X	X	X	/	X	1	/	X	/	X	X	/	3
8	/	X	/	/	X	/	4	X	X	X	X	/	X	1	/	X	/	X	X	/	3
9	/	/	/	/	/	/	6	/	/	X	/	X	X	3	X	X	X	X	X	X	0
10	/	/	/	/	/	/	6	/	/	/	/	X	X	4	/	X	/	/	X	X	3
11	X	X	X	/	X	X	1	X	X	/	X	X	X	1	/	X	X	/	/	/	4
12	/	X	/	/	X	X	3	X	/	/	/	/	/	5	/	/	/	/	/	/	6
Totals	11	9	11	12	9	10	62	5	5	6	7	7	3	33	10	5	9	8	5	7	44

GIRLS.

1	/	/	/	/	/	/	6	X	X	X	X	X	X	0	/	/	/	/	/	/	6
2	/	/	/	/	/	/	6	X	/	/	X	/	/	4	X	X	X	X	X	X	0
3	/	/	/	/	/	/	6	/	/	/	/	/	/	6	/	/	X	X	X	X	2
4	/	/	/	/	/	/	6	/	/	/	/	/	/	6	/	/	/	/	/	X	5
5	/	/	/	/	/	/	6	/	/	X	X	X	X	2	/	X	X	X	/	X	2
6	/	/	/	X	X	X	3	/	/	X	/	/	/	5	X	X	X	X	X	X	0
7	X	X	X	X	X	X	0	X	/	/	/	/	/	5	X	X	X	X	/	X	1
8	/	/	/	/	/	/	6	X	/	X	X	X	X	1	/	/	/	/	/	/	6
9	/	/	/	/	/	/	6	X	X	X	X	X	X	0	X	X	/	X	X	X	1
10	X	/	/	/	X	X	3	X	/	/	/	/	/	5	/	X	X	X	X	X	1
11	/	X	X	X	X	X	1	/	/	X	/	X	X	3	/	X	X	X	X	X	1
12	X	X	X	X	X	X	0	/	/	X	X	X	X	2	X	X	X	X	X	X	0
13	X	/	X	X	/	X	2	X	/	/	/	/	/	5	/	/	/	X	/	/	5
14	/	/	/	/	/	/	6	X	/	/	X	X	X	2	/	X	/	X	X	/	3
15	X	/	/	X	X	X	2	X	/	X	/	/	/	4	X	X	X	X	X	X	0
16	X	X	X	X	X	X	0	/	X	/	/	/	/	5	X	X	X	X	X	X	0
17	X	X	X	X	X	X	0	X	/	/	/	/	X	4	X	/	X	/	X	X	2
Totals	10	12	11	9	9	8	59	7	14	9	10	10	9	59	9	6	6	4	6	4	35
Overall Totals	21	21	22	21	18	18	121	12	19	15	17	17	12	92	19	11	15	12	11	11	79

Table 195

Test 3A - Spontaneous Correspondence.

SCHOOL D - BOYS.

Subtest	Number 1	2	3	4	5	6	Total	Shape 1	2	3	4	5	6	Total	Colour 1	2	3	4	5	6	Total
1	/	/	/	/	/	/	6	X	X	X	/	/	/	3	X	X	X	X	X	X	0
2	/	/	/	/	/	/	6	X	/	/	/	/	X	4	X	X	/	X	/	X	2
3	/	/	/	/	/	/	6	/	/	/	/	/	/	6	/	/	/	/	/	/	6
4	/	/	/	/	/	/	6	/	X	X	X	X	X	1	/	X	X	X	X	X	1
5	/	/	/	/	/	/	6	/	/	/	/	/	/	6	/	/	/	/	X	/	5
6	/	/	/	/	/	/	6	X	/	/	/	/	/	5	/	/	X	X	/	/	4
7	/	/	/	/	/	/	6	/	/	/	/	/	/	6	/	/	X	/	/	/	5
8	/	/	/	/	/	/	6	/	/	/	/	/	/	6	/	X	X	X	X	X	1
9	/	/	/	/	/	/	6	/	/	/	/	/	/	6	/	/	/	X	/	X	4
10	X	X	X	X	X	X	0	X	/	/	/	X	X	3	/	X	/	X	X	X	2
11	/	/	/	/	/	/	6	/	/	/	/	/	/	6	/	/	/	/	/	/	6
12	/	/	/	/	/	/	6	/	/	/	/	/	/	6	/	X	/	/	/	/	5
13	/	/	/	/	/	/	6	/	X	X	/	X	X	2	/	X	X	X	X	X	1
14	/	/	/	/	/	/	6	/	/	/	/	/	/	6	/	/	/	X	X	X	3
15	/	/	/	/	/	/	6	X	/	/	/	/	/	5	X	X	X	X	X	X	0
16	/	/	/	/	/	/	6	X	X	X	X	X	X	0	X	X	X	X	X	X	0
17	/	/	/	/	/	/	6	X	X	X	X	X	X	0	X	X	X	X	X	X	0
18	/	/	/	/	/	/	6	X	X	X	X	X	X	0	X	X	X	X	X	X	0
19	/	/	/	/	/	/	6	X	X	X	X	X	X	0	X	X	X	X	X	X	0
20	X	X	X	X	/	X	1	X	X	X	X	X	X	0	/	/	/	X	/	/	5
21	/	X	X	X	X	X	1	X	X	X	X	X	X	0	X	X	X	X	X	X	0
Totals	19	18	18	18	18	18	110	10	12	12	14	12	11	71	13	8	9	5	8	7	50

GIRLS

Subtest	Number 1	2	3	4	5	6	Total	Shape 1	2	3	4	5	6	Total	Colour 1	2	3	4	5	6	Total
1	/	/	/	/	/	/	6	/	/	/	/	/	/	6	X	X	X	X	X	X	0
2	/	/	/	/	/	/	6	/	/	/	/	/	/	6	/	/	/	/	/	/	6
3	/	/	/	/	/	/	6	/	/	/	/	/	X	5	/	X	/	/	/	X	4
4	/	/	/	/	/	/	6	/	/	/	/	/	/	6	/	/	/	/	/	/	6
5	/	/	/	/	/	/	6	/	/	/	/	/	/	6	/	/	/	/	/	/	6
6	/	/	/	/	/	/	6	/	X	X	X	X	X	1	/	X	/	X	X	X	2
7	/	/	/	/	/	/	6	X	X	/	X	X	X	1	X	X	X	X	X	X	0
8	/	/	/	/	/	/	6	/	/	/	/	/	/	6	/	/	/	X	/	/	5
9	/	/	/	/	/	/	6	/	/	/	/	/	/	6	/	/	/	X	/	/	5
10	/	/	/	/	/	/	6	/	/	/	/	/	X	5	X	X	X	X	X	X	0
11	/	/	/	/	/	/	6	/	/	/	/	/	/	6	/	/	/	/	/	/	6
12	/	/	/	/	/	/	6	/	/	X	/	/	/	5	/	X	X	X	X	X	1
13	/	/	/	/	/	/	6	X	X	X	X	X	X	0	X	X	X	X	X	X	0
14	/	/	/	/	/	/	6	X	/	X	X	X	X	1	X	X	X	X	X	X	0
15	/	/	/	/	/	/	6	X	/	X	X	X	X	1	X	X	X	X	X	X	0
16	/	/	/	/	/	/	6	/	/	X	/	/	X	4	/	X	X	X	X	X	1
17	/	/	/	/	/	/	6	X	X	X	X	X	X	0	X	X	X	X	X	X	0
18	/	/	/	/	/	/	6	X	X	X	X	/	X	1	/	/	/	/	X	X	4
19	/	/	/	/	/	/	6	/	X	/	/	/	/	5	X	X	X	X	X	X	0
20	/	/	X	X	/	/	4	/	/	/	/	/	/	6	X	X	X	X	X	X	0
21	/	/	/	/	/	/	6	/	/	X	X	X	X	2	X	X	X	X	X	X	0
22	/	/	/	/	/	/	6	/	/	/	/	/	/	6	/	X	X	X	X	X	1
23	/	/	/	/	/	/	6	/	/	X	X	/	X	3	/	X	X	X	X	X	1
24	X	X	X	X	X	X	0	/	X	/	/	X	X	3	X	X	X	X	X	X	0
25	X	X	/	/	/	/	4	/	/	/	/	/	/	6	/	/	/	/	/	/	6
Totals	23	23	23	23	24	24	140	19	18	15	16	17	12	97	14	8	10	7	8	7	54
Overall Totals	42	41	41	41	43	42	250	29	30	27	30	29	23	168	27	16	19	12	16	14	104

Table 196

Test 3A - Spontaneous Correspondence (Summary of responses).

BOYS.

	Number						Total	Shape						Total	Colour						Total
Subtest	1	2	3	4	5	6		1	2	3	4	5	6		1	2	3	4	5	6	
School																					
A	10	10	11	10	10	9	60	9	9	6	5	7	5	41	10	7	10	5	4	7	45
B	7	8	7	8	6	6	42	6	9	7	8	4	4	38	7	6	7	7	3	4	34
C	11	9	11	12	9	10	62	5	5	6	7	7	3	33	10	5	9	8	5	7	44
D	19	18	18	18	19	18	110	10	12	12	14	12	11	71	13	8	9	5	8	7	50
Total	47	45	47	48	44	43	274	30	35	31	34	30	23	183	40	26	35	25	20	25	171

GIRLS.

A	6	6	6	6	6	7	37	3	6	7	7	6	4	33	7	7	8	9	7	7	45
B	7	4	5	4	4	5	29	4	6	6	4	6	4	30	5	7	6	6	6	5	35
C	10	12	11	9	9	18	59	7	14	9	10	10	9	59	9	6	6	4	6	4	35
D	23	23	23	23	24	24	140	19	18	15	16	17	12	97	14	8	10	7	8	7	54
Total	46	45	45	42	43	44	265	33	44	37	37	39	29	219	35	28	30	26	27	23	169

ALL.

A	16	16	17	16	16	16	97	12	15	13	12	13	9	74	17	14	18	14	11	14	88
B	14	12	12	12	10	11	71	10	15	13	12	12	8	68	12	13	13	13	9	9	69
C	21	21	22	21	18	18	121	12	19	15	17	17	12	92	19	11	15	12	11	11	79
D	42	41	41	41	43	42	250	29	30	27	30	29	23	168	27	12	19	12	16	14	104
Total	93	90	92	90	87	87	539	63	79	68	71	71	52	402	75	54	65	51	47	48	340

Table197

Test 3A - Spontaneous Correspondence. Analysis of responses.

BOYS — Number only

School	Number	n.	%
A	6	16	37.5
B	1	15	6.7
C	1	12	8.3
D	6	21	28.6
Totals	14	64	21.9

GIRLS — Number only

School	Number	n.	%
A	3	12	25.0
B	0	12	0
C	2	17	11.8
D	7	25	28.0
Totals	12	66	18.2

BOYS — Number and shape

School	Number	n.	%
A	1	16	6.25
B	4	15	26.7
C	3	12	25.0
D	11	21	52.4
Totals	19	64	29.7

GIRLS — Number and shape

School	Number	n.	%
A	1	12	8.3
B	3	12	25.0
C	3	17	17.6
D	15	25	60.0
Totals	22	66	33.3

BOYS — Number and colour

School	Number	n.	%
A	3	16	18.7
B	2	15	13.3
C	4	12	33.3
D	7	21	33.3
Totals	16	64	25.0

GIRLS — Number and colour

School	Number	n.	%
A	2	12	16.7
B	3	12	25.0
C	3	17	17.6
D	9	25	36.0
Totals	17	66	25.7

BOYS — Number, colour and shape

School	Number	n.	%
A	2	16	12.5
B	2	15	13.3
C	2	12	16.7
D	7	21	33.3
Totals	13	64	20.3

GIRLS — Number, colour and shape.

School	Number	n.	%
A	2	12	16.7
B	1	12	8.3
C	1	17	5.9
D	8	25	32.0
Totals	12	66	18.2

WHOLE SAMPLE.

	n.	%
Number only	26	20.0
Number and shape	41	31.5
Number and colour	33	25.4
Number, colour and shape	25	19.2

Table 198

Test 3A - Spontaneous Correspondence. Percentage summary of responses.

GIRLS

C.A. Years	Number %	Shape %	Colour %
5.0 to 6.0	26.9	50.0	43.6
6.1 " 7.0	41.7	36.1	19.4
7.1 " 8.0	64.6	56.2	62.5
8.1 " 9.0	75.0	52.8	33.3
9.1 " 10.0	76.2	54.8	21.4
10.1 " 11.0	100.0	36.7	16.7
11.1 " 12.0	63.3	63.3	43.3
12.1 " 13.0	75.0	83.3	54.2
13.1 " 14.0	100.0	60.0	53.3
14.1 " 15.0	100.0	72.2	77.8
15.1 " 16.0	100.0	70.8	66.7
BOYS.			
5.0 " 6.0	22.7	33.3	31.8
6.1 " 7.0	53.0	45.4	48.5
7.1 " 8.0	83.3	44.4	27.8
8.1 " 9.0	100.0	52.8	47.2
9.1 " 10.0	0	0	0
10.1 " 11.0	68.7	46.7	40.0
11.1 " 12.0	95.8	43.7	66.7
12.1 " 13.0	100.0	33.3	33.3
13.1 " 14.0	85.7	76.2	38.1
14.1 " 15.0	100.0	91.7	66.7
15.1 " 16.0	100.0	58.3	37.5
ALL.			
5.0 " 6.0	25.0	42.4	38.2
6.1 " 7.0	49.0	42.1	38.2
7.1 " 8.0	72.6	51.2	47.6
8.1 " 9.0	87.5	52.8	40.3
9.1 " 10.0	66.7	47.9	18.7
10.1 " 11.0	86.7	41.7	28.3
11.1 " 12.0	83.3	51.3	57.7
12.1 " 13.0	85.7	61.9	45.2
13.1 " 14.0	91.7	69.4	44.4
14.1 " 15.0	100.0	80.0	73.3
15.1 " 16.0	100.0	64.6	52.1

APPENDIX I.

Photostat of computor sheets.

Contents:	Table	Page
(i) Raw scores on all tests, C.A., I.Q., means and s.ds.		
(ii) Pearson correlation and partial correlation.		
Whole sample	199-202	423-427
All boys	203-205	428-430
All girls	206-208	431-433
All with shunts	209-211	434-437
All without shunts	212a-213	438-440

Table 199

ALL PUPILS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	16.0	28	93	47	105	3	106	8	10	6	6	12	12	4	8	10	4	8	2	12	4	29	79	35
2	16.0	35	121	79	110	0	108	8	10	6	6	12	12	4	8	10	6	8	2	12	4	29	132	24
3	16.0	23	116	73	18	2	103	8	10	6	6	12	12	4	8	10	6	8	2	12	4	29	84	41
4	15.8	34	93	72	100	0	94	8	10	6	6	12	12	4	8	0	4	8	0	12	4	21	79	25
5	15.5	33	116	77	108	7	108	8	10	6	6	12	12	4	8	10	6	8	2	12	4	29	110	24
6	15.5	18	96	56	100	3	97	8	10	6	4	12	12	4	4	10	6	8	2	9	4	15	74	37
7	15.4	21	54	46	85	7	88	8	10	6	6	9	10	2	4	7	3	8	1	12	2	28	56	42
8	15.1	20	95	62	104	5	84	8	10	6	6	12	2	3	8	2	3	8	0	12	4	26	90	34
9	15.0	21	103	69	100	7	106	8	10	6	6	12	12	4	7	9	6	8	2	12	4	17	83	39
10	14.9	32	111	73	91	4	105	8	10	6	6	12	10	4	8	10	6	8	2	12	4	29	83	42
11	14.9	28	102	54	100	2	99	8	10	5	6	10	12	4	5	10	6	8	2	9	4	14	78	34
12	14.6	20	113	71	96	7	74	8	10	6	6	12	2	0	4	0	0	8	2	12	4	21	82	45
13	14.1	28	52	50	105	6	107	8	10	6	6	12	12	4	8	10	5	8	2	12	4	28	86	43
14	13.8	32	91	66	93	2	107	8	10	6	6	12	11	4	8	10	6	8	2	12	4	29	83	36
15	13.8	22	73	46	15	16	34	8	10	6	6	12	8	0	4	9	0	7	0	11	3	17	64	34
16	13.6	21	40	32	17	12	85	8	10	6	4	10	10	2	5	9	0	8	1	8	4	10	67	33
17	13.7	32	99	66	71	1	105	8	9	5	6	12	12	4	7	10	6	8	2	12	4	22	110	20
18	13.5	12	53	49	73	7	52	4	5	4	4	12	0	2	4	0	0	4	0	9	4	14	61	41
19	13.5	20	61	33	7	4	96	8	10	6	5	12	12	0	4	10	6	8	2	10	3	14	63	30
20	13.4	18	56	34	41	7	40	4	2	3	3	11	3	1	1	5	0	0	0	6	1	14	73	31
21	13.4	29	104	74	100	1	108	8	10	6	6	12	12	4	8	10	6	8	2	12	4	29	100	33
22	13.3	36	117	78	110	1	106	8	10	6	6	12	12	4	8	10	5	8	2	11	4	29	109	31
23	13.2	23	77	58	95	5	100	8	10	6	4	11	11	4	6	10	4	8	2	12	4	17	88	40
24	13.1	17	19	26	0	15	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	28	47	42
25	13.1	23	78	49	71	2	87	8	10	6	6	12	9	0	4	10	4	7	0	8	3	17	86	40
26	12.9	13	59	25	25	11	25	0	2	0	2	6	6	0	2	4	0	0	0	2	1	11	63	29
27	12.8	34	84	43	92	1	63	1	1	2	5	12	6	2	8	5	2	4	1	10	4	18	96	29
28	12.7	17	77	35	41	8	93	8	10	6	6	12	9	2	3	9	5	8	2	11	2	22	85	36
29	12.6	30	76	38	41	2	103	8	10	6	6	12	11	2	8	10	4	8	2	12	4	29	83	29
30	12.5	28	75	55	71	1	99	8	10	6	6	12	12	0	8	10	3	8	1	11	4	16	80	27
31	12.5	16	62	47	44	10	36	1	2	4	4	10	0	2	6	0	0	0	0	5	2	19	62	41
32	12.2	32	85	48	79	10	82	7	9	5	4	12	12	0	4	10	0	7	1	8	3	18	71	45
33	11.9	19	102	73	91	2	108	8	10	6	6	12	12	4	8	10	6	8	2	12	4	29	93	33
34	11.8	25	45	28	11	6	91	7	10	6	3	12	11	4	4	10	4	7	1	8	4	29	78	37
35	11.7	21	59	50	16	11	97	8	10	6	6	12	12	4	5	10	4	8	2	7	3	29	87	35
36	11.7	21	61	26	0	19	36	4	5	1	2	5	6	0	0	5	0	0	0	7	1	18	53	36
37	11.6	14	31	18	10	10	27	0	0	0	2	7	6	0	2	5	0	0	0	4	1	10	58	30
38	11.6	26	99	59	84	1	101	8	10	6	6	12	12	4	4	10	6	8	2	9	4	13	80	28
39	11.5	20	87	55	30	1	105	8	10	6	5	12	12	4	8	10	6	6	2	12	4	26	83	27
40	11.4	18	78	55	74	15	103	8	10	6	6	12	12	2	7	10	6	6	2	12	4	18	89	27
41	11.4	20	73	65	83	6	94	8	10	5	6	12	10	2	6	8	4	6	1	12	4	24	90	23
42	11.4	27	83	56	102	5	108	8	10	6	6	12	12	4	8	10	6	8	2	12	4	23	97	28
43	11.3	19	59	45	33	5	99	8	10	6	6	12	10	2	7	10	4	8	2	10	4	29	77	37
44	11.3	21	40	9	0	12	14	0	0	0	2	0	1	0	1	1	0	0	0	7	2	12	51	42
45	11.2	28	81	51	42	2	108	8	10	6	6	12	12	4	8	10	6	8	2	12	4	18	71	36
46	11.0	24	61	30	31	6	66	8	10	4	5	12	1	0	3	3	0	8	0	9	3	19	77	31
47	10.9	21	52	40	22	3	95	8	10	6	6	12	12	2	8	10	1	8	1	9	4	22	80	34
48	10.7	8	52	11	53	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	53	40
49	10.7	19	33	24	0	17	46	1	2	2	2	9	5	0	6	9	0	0	0	8	2	11	59	42
50	10.7	14	52	32	42	4	55	0	1	4	4	12	1	4	8	0	0	8	0	9	4	24	86	29

Table 199. All pupils.

Table 199 continued(All pupils.)

51	10.3	23	74	35	9	6	74	6	9	5	6	12	3	4	7	2	0	4	0	12	4	27	70	27
52	10.3	18	54	34	15	6	42	6	8	3	3	7	1	0	2	0	0	0	0	8	4	12	58	39
53	10.2	16	66	42	51	11	84	8	10	6	4	12	10	0	4	9	0	8	2	8	3	29	82	38
54	10.1	20	57	31	75	3	51	1	0	1	1	12	11	0	5	5	0	0	1	10	4	12	82	34
55	10.1	16	50	44	75	4	38	2	1	0	6	9	5	0	4	5	0	0	0	3	3	26	91	37
56	10.0	16	67	32	69	8	91	8	10	6	4	11	12	4	4	10	3	8	1	8	2	21	93	26
57	9.9	11	36	9	0	23	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	53	39
58	9.8	19	60	30	22	2	41	0	0	0	4	12	6	0	2	5	0	0	1	7	4	14	75	27
59	9.8	8	26	3	0	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	48	51
60	9.7	23	48	35	36	7	88	8	10	6	6	8	1	4	8	8	6	8	0	11	4	24	85	31
61	9.6	21	70	51	67	4	93	8	10	6	6	12	11	2	8	5	4	8	0	9	4	14	102	30
62	9.4	17	57	37	7	1	89	8	10	6	6	11	4	4	8	3	6	8	1	10	4	27	92	26
63	9.1	16	63	33	22	12	78	4	8	5	3	7	12	2	4	10	4	3	2	10	4	21	78	31
64	9.0	7	43	17	0	18	7	0	0	0	0	0	0	0	0	0	0	0	1	4	2	13	80	29
65	9.0	23	65	35	94	6	102	8	10	6	5	11	12	3	8	10	6	8	2	9	4	17	88	37
66	9.0	24	61	36	20	7	98	6	9	6	5	12	12	4	4	10	6	8	2	10	4	18	88	23
67	9.0	17	68	34	63	4	95	8	10	6	5	12	12	3	5	10	0	8	1	11	4	16	78	30
68	8.9	19	64	39	45	18	79	6	3	6	4	12	10	0	5	10	3	8	1	8	3	29	79	31
69	8.9	15	50	33	4	5	91	2	10	3	4	12	12	4	5	10	4	8	1	9	4	16	80	25
70	8.8	16	37	17	55	8	84	8	10	5	3	11	10	2	7	7	1	8	1	8	3	11	80	27
71	8.7	13	30	21	3	13	72	8	10	4	3	12	12	0	1	9	4	6	0	1	2	6	70	34
72	8.6	16	40	30	0	15	52	8	10	4	5	6	5	0	1	6	2	0	0	2	3	27	74	35
73	8.5	24	41	33	34	17	70	6	9	6	4	12	11	0	4	8	0	0	1	6	3	29	80	27
74	8.5	19	63	45	4	2	95	6	10	6	5	12	6	4	8	10	6	8	1	9	4	14	93	25
75	8.4	13	27	21	0	13	8	1	0	0	1	1	0	0	2	0	0	0	0	3	0	13	63	25
76	8.0	20	57	28	10	5	64	0	3	4	5	8	12	0	5	10	0	4	1	8	4	19	87	26
77	8.0	11	49	31	9	20	37	5	0	1	0	9	5	0	3	5	0	4	1	3	3	12	64	36
78	7.9	20	61	22	35	9	56	4	0	5	6	11	6	0	5	5	0	1	0	9	4	25	78	32
79	7.8	11	59	32	27	12	33	4	4	2	2	0	6	0	2	5	1	0	1	5	1	9	79	34
80	7.8	14	44	25	8	8	72	8	9	6	4	10	6	2	1	7	3	6	0	8	2	28	81	32
81	7.8	9	54	27	7	19	20	1	0	0	4	2	6	0	1	1	0	0	1	3	1	16	71	36
82	7.8	21	43	26	42	10	51	5	0	3	5	12	6	0	5	5	0	0	1	9	2	17	75	22
83	7.7	13	41	31	23	14	26	2	0	0	4	5	4	0	1	4	0	0	0	4	2	19	78	24
84	7.5	7	38	3	0	22	4	0	0	0	0	0	0	0	0	0	0	0	0	0	4	6	48	46
85	7.5	16	49	29	2	13	51	4	5	3	3	3	5	0	1	10	1	8	1	6	1	4	70	21
86	7.4	14	56	31	4	11	78	6	10	4	1	9	10	2	2	7	6	8	1	8	4	13	90	25
87	7.3	19	44	33	21	4	39	4	4	1	3	7	6	0	2	5	0	0	0	5	2	20	69	29
88	7.2	14	50	21	51	19	31	0	0	0	0	12	1	0	8	2	0	0	1	5	2	24	93	20
89	7.2	11	34	7	0	22	43	4	5	4	3	8	5	0	3	3	0	0	1	6	1	18	53	36
90	7.0	16	22	22	8	8	53	6	5	4	5	12	2	0	4	2	0	0	0	9	4	15	112	26
91	7.0	17	63	31	2	13	47	5	4	3	3	8	2	2	5	5	1	1	0	7	1	17	88	39
92	6.9	13	42	16	0	23	7	2	1	0	1	0	0	0	0	0	0	0	0	3	0	8	53	39
93	6.9	6	12	13	40	30	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	85	31
94	6.9	13	20	13	0	22	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	9	80	33
95	6.8	11	54	17	12	18	31	1	0	1	1	6	1	0	3	5	0	0	1	8	4	20	99	48
96	6.8	14	44	18	0	16	15	0	0	1	2	0	0	2	1	4	0	1	0	2	2	11	78	32
97	6.8	0	36	10	0	24	7	4	0	0	2	0	0	0	0	0	0	0	0	0	1	18	70	34
98	6.7	20	46	28	4	13	37	6	3	2	4	9	0	0	4	0	0	0	0	7	2	26	100	28
99	6.7	17	10	19	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	66	31
100	6.7	10	54	20	10	12	46	1	3	3	2	8	6	0	4	5	0	0	1	9	4	15	92	29

Table 199 continued (All pupils).

101	6.7	17	55	30	0	20	48	4	6	3	4	11	5	0	4	2	0	0	0	6	3	14	80	24
102	6.6	20	27	21	0	21	14	0	0	0	1	5	2	0	0	0	0	0	0	5	1	17	78	35
103	6.6	15	24	21	0	15	10	1	0	0	0	0	0	2	0	0	0	0	0	6	1	10	56	45
104	6.6	17	34	18	0	17	36	0	2	1	3	10	6	0	4	5	0	0	0	3	2	29	89	34
105	6.2	21	50	22	35	11	50	1	0	1	5	12	6	1	5	5	0	1	1	8	4	11	110	22
106	6.1	15	52	29	6	14	22	4	1	1	2	2	1	0	1	1	0	0	0	7	2	19	110	33
107	6.0	8	9	15	0	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	64	42
108	6.0	13	38	15	11	7	60	8	10	5	5	12	2	3	4	2	0	0	0	7	2	12	94	24
109	5.9	10	30	17	0	19	13	1	0	0	2	0	0	0	4	0	0	0	0	5	1	8	80	39
110	5.9	9	50	40	3	14	12	0	0	0	0	0	0	2	1	0	0	0	0	5	4	15	99	34
111	5.8	15	28	15	3	13	10	1	1	1	6	4	0	0	2	0	6	0	0	0	1	9	87	41
112	5.8	8	44	18	0	22	7	1	0	0	0	0	0	0	3	0	0	0	0	2	1	18	95	30
113	5.7	13	57	35	0	24	78	8	10	6	4	2	10	2	2	9	6	8	1	6	2	13	105	31
114	5.6	9	20	12	0	26	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	12	72	34
115	5.5	14	42	18	0	15	7	0	0	1	2	0	0	0	0	1	0	0	1	2	0	6	90	39
116	5.5	12	20	19	0	14	16	0	1	0	0	0	6	0	0	2	0	1	0	5	1	0	85	30
117	5.3	14	72	37	2	11	25	7	1	2	3	1	1	0	4	0	0	1	0	3	2	22	115	27
118	5.3	15	30	15	0	19	25	1	1	1	4	2	3	0	0	2	0	0	0	8	3	26	100	24
119	5.3	5	6	18	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	53	47
120	5.2	10	17	17	0	27	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	69	35
121	5.2	9	18	15	0	26	2	0	0	0	0	0	0	0	0	0	0	0	0	1	1	8	92	40
122	5.2	8	20	6	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	70	28
123	5.2	15	25	18	0	24	40	5	4	0	0	9	6	0	4	3	0	1	1	6	1	4	84	33
124	5.2	14	9	19	0	18	3	1	0	0	0	0	0	0	0	0	0	0	0	1	1	7	100	33
125	5.1	14	30	21	0	16	18	4	0	3	0	1	0	0	3	0	0	0	0	4	3	11	101	29
126	5.1	14	32	21	0	16	27	2	0	1	2	3	6	0	2	5	0	0	0	4	2	9	96	23
127	5.0	14	15	14	0	23	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	13	80	43
128	5.0	11	21	11	0	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	78	36
129	5.0	6	8	0	0	27	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	75	43
130	5.0	13	56	22	0	17	6	0	0	0	0	0	0	0	1	1	0	0	0	4	0	7	115	22

Table 200 means and s.ds. whole sample.

MEAN	9.5	17.7	54.9	33.6	32.1	11.6	54.4	4.3	5.1	3.2	3.4	7.5	5.8	1.4	3.8	3.0	1.9	3.6	0.7	6.8	2.6	16.9	80.9	32.9
STDV	3.2	7.1	26.8	18.6	36.8	7.8	38.2	3.4	4.6	2.6	2.3	5.1	4.9	1.7	2.9	4.1	2.5	3.8	0.8	4.0	1.5	8.1	16.0	6.7

Table 201. All pupils.

PEARSON CORRELATION COEFFICIENTS

1	1.00																							
2	0.69	1.00																						
3	0.76	0.73	1.00																					
4	0.77	0.76	0.89	1.00																				
5	0.74	0.68	0.76	0.79	1.00																			
6	-0.69	-0.74	-0.74	-0.74	-0.64	1.00																		
7	0.69	0.75	0.78	0.80	0.69	-0.80	1.00																	
8	0.59	0.62	0.68	0.71	0.56	-0.65	0.88	1.00																
9	0.64	0.63	0.67	0.71	0.56	-0.67	0.91	0.93	1.00															
10	0.65	0.67	0.71	0.73	0.61	-0.71	0.93	0.90	0.92	1.00														
11	0.64	0.72	0.73	0.74	0.63	-0.79	0.84	0.78	0.76	0.83	1.00													
12	0.64	0.69	0.66	0.67	0.62	-0.76	0.86	0.72	0.74	0.80	0.80	1.00												
13	0.59	0.67	0.65	0.67	0.60	-0.65	0.87	0.71	0.77	0.76	0.67	0.73	1.00											
14	0.57	0.58	0.65	0.69	0.58	-0.66	0.77	0.62	0.69	0.70	0.61	0.57	0.58	1.00										
15	0.60	0.71	0.71	0.74	0.67	-0.74	0.83	0.65	0.66	0.75	0.76	0.80	0.64	0.70	1.00									
16	0.56	0.63	0.62	0.62	0.51	-0.62	0.86	0.70	0.76	0.77	0.67	0.71	0.60	0.57	0.62	1.00								
17	0.54	0.58	0.65	0.69	0.54	-0.59	0.79	0.69	0.74	0.71	0.64	0.53	0.69	0.76	0.61	0.70	1.00							
18	0.66	0.63	0.69	0.73	0.63	-0.67	0.89	0.81	0.86	0.87	0.71	0.69	0.75	0.73	0.69	0.76	0.77	1.00						
19	0.55	0.56	0.69	0.65	0.60	-0.54	0.77	0.59	0.63	0.65	0.55	0.58	0.76	0.60	0.60	0.75	0.70	0.69	1.00					
20	0.67	0.75	0.78	0.77	0.66	-0.80	0.88	0.74	0.75	0.82	0.79	0.81	0.70	0.68	0.82	0.69	0.60	0.74	0.66	1.00				
21	0.54	0.62	0.67	0.67	0.57	-0.75	0.79	0.62	0.65	0.72	0.71	0.76	0.64	0.61	0.75	0.62	0.54	0.65	0.57	0.80	1.00			
22	0.50	0.57	0.58	0.61	0.45	-0.55	0.62	0.56	0.52	0.60	0.66	0.60	0.47	0.49	0.62	0.48	0.43	0.48	0.45	0.62	0.56	1.00		
23	-0.09	0.29	0.34	0.36	0.27	-0.28	0.31	0.27	0.19	0.25	0.30	0.24	0.21	0.30	0.38	0.21	0.31	0.22	0.26	0.33	0.36	0.30	1.00	
24	0.11	-0.18	-0.14	-0.12	-0.03	0.25	-0.22	-0.16	-0.13	-0.15	-0.22	-0.26	-0.23	-0.14	-0.25	-0.19	-0.13	-0.12	-0.09	-0.23	-0.22	-0.13	-0.49	1.00
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

Table 201. All pupils.

Table 202. All pupils.

PARTIAL CORRELATIONS, AGE EXCLUDED

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
2		1.00																						
3		0.43	1.00																					
4		0.49	0.74	1.00																				
5		0.54	0.46	0.52	1.00																			
6		-0.50	-0.45	-0.45	-0.27	1.00																		
7		0.52	0.54	0.58	0.37	-0.62	1.00																	
8		0.57	0.44	0.51	0.24	-0.41	0.81	1.00																
9		0.54	0.36	0.44	0.17	-0.41	0.84	0.90	1.00															
10		0.59	0.44	0.49	0.26	-0.47	0.88	0.85	0.86	1.00														
11		0.49	0.48	0.51	0.29	-0.62	0.72	0.64	0.60	0.70	1.00													
12		0.45	0.36	0.37	0.29	-0.58	0.76	0.56	0.56	0.66	0.66	1.00												
13		0.44	0.39	0.41	0.29	-0.41	0.80	0.55	0.62	0.61	0.47	0.57	1.00											
14		0.51	0.40	0.47	0.29	-0.44	0.63	0.43	0.51	0.53	0.38	0.32	0.36	1.00										
15		0.52	0.50	0.54	0.43	-0.57	0.72	0.47	0.45	0.60	0.60	0.68	0.44	0.54	1.00									
16		0.41	0.36	0.36	0.18	-0.39	0.79	0.56	0.63	0.65	0.49	0.55	0.36	0.37	0.44	1.00								
17		0.33	0.43	0.50	0.26	-0.35	0.69	0.55	0.60	0.57	0.45	0.28	0.55	0.65	0.42	0.57	1.00							
18		0.52	0.39	0.46	0.27	-0.39	0.80	0.70	0.76	0.77	0.49	0.46	0.60	0.58	0.50	0.63	0.65	1.00						
19		0.50	0.50	0.43	0.34	-0.20	0.64	0.39	0.43	0.46	0.51	0.35	0.65	0.42	0.41	0.64	0.58	0.52	1.00					
20		0.53	0.56	0.54	0.33	-0.62	0.77	0.59	0.57	0.68	0.64	0.67	0.52	0.48	0.70	0.51	0.39	0.54	0.48	1.00				
21		0.40	0.47	0.47	0.30	-0.61	0.68	0.45	0.47	0.58	0.55	0.64	0.47	0.43	0.63	0.45	0.35	0.47	0.39	0.70	1.00			
22		0.56	0.35	0.40	0.14	-0.32	0.44	0.38	0.30	0.42	0.51	0.42	0.24	0.28	0.46	0.28	0.21	0.23	0.24	0.44	0.40	1.00		
23		0.49	0.63	0.67	0.49	-0.48	0.52	0.40	0.32	0.41	0.47	0.38	0.33	0.42	0.55	0.32	0.43	0.38	0.37	0.52	0.49	0.40	1.00	
24		-0.36	-0.34	-0.31	-0.16	0.45	-0.41	-0.27	-0.27	-0.29	-0.58	-0.43	-0.37	-0.45	-0.39	-0.30	-0.22	-0.26	-0.18	-0.41	-0.33	-0.21	-0.48	1.00

Table 202. All pupils.

Table 203.

ALL BOYS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	16.0	35.	121.	79.	110.	0.	108.	8.	10.	6.	6.	12.	12.	4.	8.	10.	6.	8.	2.	12.	4.	29.	132.	24.
2	16.0	23.	116.	73.	18.	2.	108.	8.	10.	6.	6.	12.	12.	4.	8.	10.	6.	8.	2.	12.	4.	29.	84.	41.
3	15.8	34.	98.	72.	100.	0.	94.	8.	10.	6.	6.	12.	12.	4.	8.	0.	4.	8.	0.	12.	4.	21.	79.	25.
4	15.5	33.	116.	77.	108.	7.	108.	8.	10.	6.	6.	12.	12.	4.	8.	10.	6.	8.	2.	12.	4.	29.	110.	24.
5	14.9	32.	111.	73.	91.	4.	106.	8.	10.	6.	6.	12.	10.	4.	8.	10.	6.	8.	2.	12.	4.	29.	83.	42.
6	14.9	28.	102.	54.	100.	2.	99.	8.	10.	5.	6.	10.	12.	4.	5.	10.	6.	8.	2.	9.	4.	14.	78.	34.
7	13.8	32.	91.	66.	93.	2.	107.	8.	10.	6.	6.	12.	11.	4.	8.	10.	6.	8.	2.	12.	4.	29.	83.	36.
8	13.8	21.	40.	32.	17.	12.	85.	8.	10.	6.	4.	10.	10.	2.	5.	9.	0.	8.	1.	8.	4.	10.	67.	33.
9	13.5	20.	61.	33.	7.	4.	96.	8.	10.	6.	5.	12.	12.	0.	4.	10.	6.	8.	2.	10.	3.	14.	63.	30.
10	13.4	18.	56.	34.	41.	7.	40.	4.	2.	3.	3.	11.	3.	1.	1.	5.	0.	0.	0.	6.	1.	14.	73.	31.
11	13.3	36.	117.	78.	110.	1.	106.	8.	10.	6.	6.	12.	12.	4.	8.	10.	5.	8.	2.	11.	4.	29.	109.	31.
12	13.2	23.	77.	58.	95.	5.	100.	8.	10.	6.	4.	11.	11.	4.	6.	10.	4.	8.	2.	12.	4.	17.	88.	40.
13	13.1	17.	19.	26.	0.	15.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	28.	47.	42.
14	12.8	34.	84.	43.	92.	1.	63.	1.	1.	2.	5.	12.	6.	2.	8.	5.	2.	4.	1.	10.	4.	18.	96.	29.
15	12.6	30.	76.	38.	41.	2.	103.	8.	10.	6.	6.	12.	11.	2.	8.	10.	4.	8.	2.	12.	4.	29.	83.	29.
16	12.2	32.	85.	48.	79.	10.	82.	7.	9.	5.	4.	12.	12.	0.	4.	10.	0.	7.	1.	8.	3.	18.	71.	45.
17	11.9	19.	102.	73.	91.	2.	108.	8.	10.	6.	6.	12.	12.	4.	8.	10.	6.	8.	2.	12.	4.	29.	93.	33.
18	11.7	21.	61.	26.	0.	19.	36.	4.	5.	1.	2.	5.	6.	0.	0.	5.	0.	0.	0.	7.	1.	18.	53.	36.
19	11.6	26.	99.	59.	84.	1.	101.	8.	10.	6.	6.	12.	12.	4.	4.	10.	6.	8.	2.	9.	4.	13.	80.	28.
20	11.5	20.	87.	55.	30.	1.	105.	8.	10.	6.	5.	12.	12.	4.	8.	10.	6.	6.	2.	12.	4.	26.	83.	27.
21	11.4	18.	78.	55.	74.	13.	103.	8.	10.	6.	6.	12.	12.	2.	7.	10.	6.	6.	2.	12.	4.	18.	89.	27.
22	11.4	20.	73.	65.	83.	6.	94.	8.	10.	5.	6.	12.	10.	2.	6.	8.	4.	6.	1.	12.	4.	24.	90.	23.
23	11.4	27.	83.	56.	102.	5.	108.	8.	10.	6.	6.	12.	12.	4.	8.	10.	6.	8.	2.	12.	4.	23.	97.	28.
24	11.3	19.	59.	45.	33.	5.	99.	8.	10.	6.	6.	12.	10.	2.	7.	10.	4.	8.	2.	10.	4.	29.	77.	37.
25	10.7	8.	52.	11.	53.	20.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	4.	53.	40.
26	10.3	23.	74.	35.	9.	6.	74.	6.	9.	5.	6.	12.	3.	4.	7.	2.	0.	4.	0.	12.	4.	27.	70.	27.
27	10.3	18.	54.	34.	15.	6.	42.	6.	8.	3.	3.	7.	1.	0.	2.	0.	0.	0.	0.	8.	4.	12.	58.	39.
28	10.2	16.	66.	42.	51.	11.	84.	8.	10.	6.	4.	12.	10.	0.	4.	9.	0.	8.	2.	8.	3.	29.	82.	38.
29	10.1	20.	57.	31.	75.	3.	51.	1.	0.	1.	1.	12.	11.	0.	5.	5.	0.	0.	1.	10.	4.	12.	82.	34.
30	9.9	11.	36.	9.	0.	23.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	4.	53.	39.
31	9.0	23.	65.	35.	94.	6.	102.	8.	10.	6.	5.	11.	12.	3.	8.	10.	6.	8.	2.	9.	4.	17.	88.	37.
32	9.0	17.	68.	34.	63.	4.	95.	8.	10.	6.	5.	12.	12.	3.	5.	10.	0.	8.	1.	11.	4.	16.	78.	30.
33	8.9	19.	64.	39.	45.	18.	79.	6.	3.	6.	4.	12.	10.	0.	5.	10.	3.	8.	1.	8.	3.	29.	79.	31.
34	8.8	16.	37.	17.	55.	8.	84.	8.	10.	5.	3.	11.	10.	2.	7.	7.	1.	8.	1.	8.	3.	11.	80.	27.
35	8.5	24.	41.	33.	34.	17.	70.	6.	9.	6.	4.	12.	11.	0.	4.	8.	0.	0.	1.	6.	3.	29.	80.	27.
36	8.5	19.	63.	45.	4.	2.	95.	6.	10.	6.	5.	12.	6.	4.	8.	10.	6.	8.	1.	9.	4.	14.	93.	25.
37	7.8	14.	44.	25.	8.	8.	72.	8.	9.	6.	4.	10.	6.	2.	1.	7.	3.	6.	0.	8.	2.	28.	81.	32.
38	7.8	21.	43.	26.	42.	10.	51.	3.	0.	3.	5.	12.	6.	0.	5.	5.	0.	0.	1.	9.	2.	17.	75.	22.
39	7.7	13.	41.	31.	23.	14.	26.	2.	0.	0.	4.	5.	4.	0.	1.	4.	0.	0.	0.	4.	2.	19.	78.	24.
40	7.5	16.	49.	29.	2.	13.	51.	4.	5.	3.	3.	3.	5.	0.	1.	10.	1.	8.	1.	6.	1.	4.	70.	21.
41	7.4	14.	56.	31.	4.	11.	78.	6.	10.	4.	1.	9.	10.	2.	2.	7.	6.	8.	1.	8.	4.	13.	90.	25.
42	7.2	11.	34.	7.	0.	22.	43.	4.	5.	4.	3.	8.	5.	0.	3.	3.	0.	0.	1.	6.	1.	18.	53.	36.
43	7.0	17.	63.	31.	2.	13.	47.	5.	4.	3.	3.	8.	2.	2.	5.	5.	1.	1.	0.	7.	1.	17.	88.	39.
44	6.9	6.	12.	13.	40.	30.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	85.	31.
45	6.9	13.	20.	13.	0.	22.	2.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.	9.	80.	33.
46	6.8	11.	54.	17.	12.	18.	31.	1.	0.	1.	1.	6.	1.	0.	3.	5.	0.	0.	1.	8.	4.	20.	99.	48.
47	6.8	14.	44.	18.	0.	16.	15.	0.	0.	1.	2.	0.	0.	2.	1.	4.	0.	1.	0.	2.	2.	11.	78.	32.
48	6.7	10.	54.	20.	10.	12.	46.	1.	3.	3.	2.	8.	6.	0.	4.	5.	0.	0.	1.	9.	4.	15.	92.	29.
49	6.7	17.	55.	30.	0.	20.	48.	4.	6.	3.	4.	11.	5.	0.	4.	2.	0.	0.	0.	6.	3.	14.	80.	24.
50	6.6	15.	24.	21.	0.	15.	10.	1.	0.	0.	0.	0.	0.	2.	0.	0.	0.	0.	0.	6.	1.	10.	56.	45.

Table 203 continued. All boys.

51	6.6	17.	34.	18.	0.	17.	36.	0.	2.	1.	3.	10.	6.	0.	4.	5.	0.	0.	0.	3.	2.	29.	89.	34.
52	6.2	21.	50.	22.	35.	11.	50.	1.	0.	1.	5.	12.	6.	1.	5.	5.	0.	1.	1.	8.	4.	11.	110.	22.
53	6.1	15.	52.	29.	6.	14.	22.	4.	1.	1.	2.	2.	1.	0.	1.	1.	0.	0.	0.	7.	2.	19.	110.	33.
54	6.0	8.	9.	15.	0.	23.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.	64.	42.
55	5.9	10.	30.	17.	0.	19.	13.	1.	0.	0.	2.	0.	0.	0.	4.	0.	0.	0.	0.	5.	1.	8.	80.	39.
56	5.7	13.	57.	35.	0.	24.	78.	8.	10.	6.	4.	2.	10.	2.	2.	9.	6.	8.	1.	6.	2.	13.	105.	31.
57	5.6	9.	20.	12.	0.	26.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	12.	72.	34.
58	5.3	14.	72.	37.	2.	11.	25.	7.	1.	2.	3.	1.	1.	0.	4.	0.	0.	1.	0.	3.	2.	22.	115.	27.
59	5.3	5.	6.	18.	0.	28.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	11.	53.	47.
60	5.2	10.	17.	17.	0.	27.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	3.	69.	35.
61	5.2	8.	20.	6.	0.	28.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	9.	70.	28.
62	5.2	14.	9.	19.	0.	18.	3.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	1.	7.	100.	33.
63	5.1	14.	30.	21.	0.	16.	18.	4.	0.	3.	0.	1.	0.	0.	3.	0.	0.	0.	0.	4.	3.	11.	101.	29.
64	5.0	6.	8.	0.	0.	27.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	75.	43.
MEAN	9.5	18.6	57.7	35.3	35.7	11.9	57.9	4.6	5.3	3.4	3.3	7.6	6.3	1.5	4.0	5.5	2.1	3.8	0.8	7.0	2.7	17.1	81.6	32.6
STDV	3.3	7.8	29.9	20.3	38.8	8.5	39.7	3.3	4.6	2.5	2.3	5.1	4.9	1.7	3.0	4.2	2.6	3.8	0.8	4.2	1.4	8.6	16.9	6.7

Table 204 (boys)

PEARSON CORRELATION COEFFICIENTS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	1.00																							
2	0.59	1.00																						
3	0.75	0.57	1.00																					
4	0.76	0.66	0.86	1.00																				
5	0.79	0.57	0.79	0.83	1.00																			
6	-0.65	-0.69	-0.65	-0.70	-0.65	1.00																		
7	0.69	0.75	0.71	0.76	0.69	-0.80	1.00																	
8	0.57	0.61	0.60	0.66	0.57	-0.59	0.84	1.00																
9	0.64	0.65	0.62	0.69	0.58	-0.67	0.90	0.94	1.00															
10	0.68	0.69	0.68	0.75	0.64	-0.73	0.91	0.86	0.91	1.00														
11	0.62	0.68	0.64	0.69	0.61	-0.79	0.79	0.75	0.74	0.83	1.00													
12	0.64	0.66	0.60	0.67	0.61	-0.74	0.84	0.72	0.74	0.79	0.75	1.00												
13	0.51	0.60	0.52	0.56	0.46	-0.59	0.80	0.59	0.68	0.65	0.55	0.61	1.00											
14	0.52	0.49	0.52	0.58	0.53	-0.60	0.76	0.57	0.66	0.70	0.51	0.56	0.52	1.00										
15	0.58	0.66	0.62	0.70	0.66	-0.70	0.79	0.59	0.62	0.73	0.67	0.78	0.50	0.66	1.00									
16	0.54	0.66	0.51	0.54	0.43	-0.60	0.82	0.63	0.72	0.70	0.58	0.64	0.93	0.53	0.55	1.00								
17	0.49	0.58	0.53	0.57	0.50	-0.56	0.78	0.67	0.73	0.70	0.60	0.50	0.64	0.74	0.54	0.67	1.00							
18	0.70	0.66	0.69	0.73	0.65	-0.68	0.89	0.78	0.85	0.86	0.68	0.73	0.67	0.73	0.69	0.68	0.73	1.00						
19	0.49	0.48	0.64	0.58	0.50	-0.41	0.66	0.46	0.52	0.53	0.59	0.44	0.67	0.58	0.44	0.61	0.62	0.59	1.00					
20	0.67	0.76	0.72	0.74	0.67	-0.73	0.84	0.69	0.73	0.81	0.73	0.75	0.57	0.64	0.76	0.61	0.54	0.77	0.56	1.00				
21	0.53	0.55	0.61	0.64	0.53	-0.70	0.75	0.56	0.60	0.70	0.66	0.71	0.52	0.58	0.68	0.55	0.48	0.65	0.43	0.74	1.00			
22	0.47	0.53	0.49	0.54	0.51	-0.51	0.61	0.53	0.50	0.60	0.65	0.55	0.35	0.52	0.60	0.40	0.39	0.51	0.38	0.60	0.58	1.00		
23	-0.23	0.19	0.19	0.24	0.14	-0.22	0.24	0.22	0.17	0.20	0.23	0.18	0.10	0.23	0.28	0.08	0.23	0.15	0.16	0.26	0.22	0.28	1.00	
24	0.26	-0.09	-0.02	0.02	0.14	0.21	-0.12	-0.04	-0.04	-0.01	-0.04	-0.16	-0.15	-0.10	-0.18	-0.13	-0.02	-0.02	-0.02	-0.16	-0.12	-0.13	-0.55	1.00

Table 205 (boys)

PARTIAL CORRELATIONS, AGE EXCLUDED

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
2		1.00																						
3		0.23	1.00																					
4		0.41	0.67	1.00																				
5		0.20	0.49	0.58	1.00																			
6		-0.51	-0.33	-0.43	-0.28	1.00																		
7		0.58	0.39	0.51	0.33	-0.64	1.00																	
8		0.42	0.31	0.43	0.23	-0.36	0.76	1.00																
9		0.44	0.28	0.41	0.16	-0.44	0.82	0.71	1.00															
10		0.48	0.36	0.44	0.24	-0.51	0.84	0.79	0.84	1.00														
11		0.50	0.33	0.43	0.25	-0.65	0.64	0.62	0.57	0.70	1.00													
12		0.46	0.24	0.37	0.23	-0.56	0.72	0.57	0.56	0.63	0.58	1.00												
13		0.43	0.24	0.30	0.10	-0.39	0.72	0.43	0.54	0.48	0.34	0.43	1.00											
14		0.27	0.24	0.34	0.22	-0.40	0.65	0.39	0.50	0.56	0.28	0.34	0.35	1.00										
15		0.48	0.33	0.43	0.39	-0.52	0.66	0.39	0.39	0.56	0.48	0.65	0.49	0.51	1.00									
16		0.50	0.19	0.23	0.01	-0.37	0.73	0.47	0.58	0.54	0.37	0.45	0.90	0.35	0.34	1.00								
17		0.41	0.29	0.35	0.21	-0.37	0.70	0.54	0.62	0.57	0.43	0.28	0.53	0.66	0.37	0.55	1.00							
18		0.42	0.34	0.43	0.22	-0.41	0.78	0.65	0.74	0.74	0.44	0.50	0.51	0.61	0.49	0.51	0.62	1.00						
19		0.27	0.47	0.37	0.22	-0.15	0.52	0.25	0.32	0.30	0.13	0.20	0.56	0.44	0.23	0.47	0.50	0.40	1.00					
20		0.60	0.43	0.49	0.30	-0.53	0.70	0.51	0.52	0.66	0.54	0.55	0.36	0.46	0.62	0.39	0.32	0.56	0.37	1.00				
21		0.34	0.37	0.43	0.21	-0.55	0.62	0.36	0.40	0.55	0.50	0.57	0.34	0.41	0.53	0.37	0.30	0.46	0.23	0.61	1.00			
22		0.35	0.24	0.31	0.25	-0.31	0.44	0.36	0.29	0.43	0.52	0.37	0.14	0.37	0.45	0.20	0.21	0.28	0.19	0.43	0.45	1.00		
23		0.42	0.55	0.65	0.54	-0.50	0.56	0.43	0.43	0.49	0.49	0.44	0.26	0.42	0.51	0.25	0.40	0.45	0.32	0.57	0.42	0.45	1.00	
24		-0.31	-0.33	-0.28	-0.11	0.52	-0.43	-0.24	-0.27	-0.27	-0.27	-0.45	-0.34	-0.28	-0.43	-0.34	-0.17	-0.29	-0.17	-0.47	-0.31	-0.30	-0.53	1.00

Table 206.

ALL GIRLS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	16.0	28.	93.	47.	105.	3.	106.	8.	10.	6.	6.	12.	12.	4.	8.	10.	4.	8.	2.	12.	4.	29.	79.	35.
2	15.5	18.	96.	56.	100.	3.	97.	6.	10.	6.	4.	12.	12.	4.	4.	10.	6.	8.	2.	9.	4.	15.	74.	37.
3	15.4	21.	54.	46.	85.	7.	88.	8.	10.	6.	6.	9.	10.	2.	4.	7.	3.	8.	1.	12.	2.	28.	56.	42.
4	15.1	20.	95.	62.	104.	5.	84.	8.	10.	6.	6.	12.	2.	3.	8.	2.	3.	8.	0.	12.	4.	26.	90.	34.
5	15.0	21.	103.	69.	100.	7.	106.	8.	10.	6.	6.	12.	12.	4.	7.	9.	6.	8.	2.	12.	4.	17.	83.	39.
6	14.6	20.	113.	71.	96.	7.	74.	8.	10.	6.	6.	12.	2.	0.	4.	0.	0.	8.	2.	12.	4.	21.	82.	45.
7	14.1	28.	52.	50.	105.	6.	107.	8.	10.	6.	6.	12.	12.	4.	8.	10.	5.	8.	2.	12.	4.	28.	86.	43.
8	13.8	22.	73.	46.	15.	16.	34.	8.	10.	6.	6.	12.	8.	0.	4.	9.	0.	7.	0.	11.	3.	17.	64.	34.
9	13.7	32.	99.	66.	71.	1.	105.	8.	9.	5.	6.	12.	12.	4.	7.	10.	6.	8.	2.	12.	4.	22.	110.	20.
10	13.5	12.	53.	49.	73.	7.	52.	4.	5.	4.	4.	12.	0.	2.	4.	0.	0.	4.	0.	9.	4.	14.	61.	41.
11	13.4	29.	104.	74.	100.	1.	108.	8.	10.	6.	6.	12.	12.	4.	8.	10.	6.	8.	2.	12.	4.	29.	100.	33.
12	13.1	23.	78.	49.	71.	2.	87.	8.	10.	6.	6.	12.	9.	0.	4.	10.	4.	7.	0.	8.	3.	17.	86.	40.
13	12.9	13.	59.	25.	25.	11.	25.	0.	2.	0.	2.	6.	6.	0.	2.	4.	0.	0.	0.	2.	1.	11.	63.	29.
14	12.7	17.	77.	35.	41.	8.	93.	8.	10.	6.	6.	12.	9.	2.	3.	9.	5.	8.	2.	11.	2.	22.	85.	36.
15	12.5	28.	75.	55.	71.	1.	99.	8.	10.	6.	6.	12.	12.	0.	8.	10.	3.	8.	1.	11.	4.	16.	80.	27.
16	12.5	16.	62.	47.	44.	10.	36.	1.	2.	4.	4.	10.	0.	2.	6.	0.	0.	0.	0.	5.	2.	19.	62.	41.
17	11.8	25.	45.	28.	11.	6.	91.	7.	10.	6.	3.	12.	11.	4.	4.	10.	4.	7.	1.	8.	4.	29.	78.	37.
18	11.7	21.	59.	50.	16.	11.	97.	8.	10.	6.	6.	12.	12.	4.	5.	10.	4.	8.	2.	7.	3.	29.	87.	35.
19	11.6	14.	31.	18.	10.	10.	27.	0.	0.	0.	2.	7.	6.	0.	2.	5.	0.	0.	0.	4.	1.	10.	58.	30.
20	11.3	21.	40.	9.	0.	12.	14.	0.	0.	0.	2.	0.	1.	0.	1.	1.	0.	0.	0.	7.	2.	12.	51.	42.
21	11.2	28.	81.	51.	42.	2.	108.	8.	10.	6.	6.	12.	12.	4.	8.	10.	6.	8.	2.	12.	4.	18.	71.	36.
22	11.0	24.	61.	30.	31.	6.	66.	8.	10.	4.	5.	12.	1.	0.	3.	3.	0.	8.	0.	9.	3.	19.	77.	31.
23	10.9	21.	52.	40.	22.	3.	95.	6.	10.	6.	6.	12.	12.	2.	8.	10.	1.	8.	1.	9.	4.	22.	80.	34.
24	10.7	19.	33.	24.	0.	17.	46.	1.	2.	2.	2.	9.	5.	0.	6.	9.	0.	0.	0.	8.	2.	11.	59.	42.
25	10.7	14.	52.	32.	42.	4.	55.	0.	1.	4.	4.	12.	1.	4.	8.	0.	0.	8.	0.	9.	4.	24.	86.	29.
26	10.1	16.	50.	44.	75.	4.	38.	2.	1.	0.	6.	9.	5.	0.	4.	5.	0.	0.	0.	3.	3.	26.	91.	37.
27	10.0	16.	67.	32.	69.	8.	91.	8.	10.	6.	4.	11.	12.	4.	4.	10.	3.	8.	1.	8.	2.	21.	93.	26.
28	9.8	19.	60.	30.	22.	2.	41.	0.	0.	0.	4.	12.	6.	0.	2.	5.	0.	0.	1.	7.	4.	14.	75.	27.
29	9.8	8.	26.	3.	0.	21.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.	48.	51.
30	9.7	23.	48.	35.	36.	7.	88.	8.	10.	6.	6.	8.	1.	4.	8.	8.	6.	8.	0.	11.	4.	24.	85.	31.
31	9.6	21.	70.	51.	67.	4.	93.	8.	10.	6.	6.	12.	11.	2.	8.	5.	4.	8.	0.	9.	4.	14.	102.	30.
32	9.4	17.	57.	37.	7.	1.	89.	8.	10.	6.	6.	11.	4.	4.	8.	3.	6.	8.	1.	10.	4.	27.	92.	26.
33	9.1	16.	63.	33.	22.	12.	78.	4.	8.	5.	3.	7.	12.	2.	4.	10.	4.	3.	2.	10.	4.	21.	78.	31.
34	9.0	7.	43.	17.	0.	18.	7.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	4.	2.	13.	80.	29.
35	9.0	24.	61.	36.	20.	7.	98.	6.	9.	6.	5.	12.	12.	4.	4.	10.	6.	8.	2.	10.	4.	18.	88.	23.
36	8.9	15.	50.	33.	4.	5.	91.	5.	10.	3.	4.	12.	12.	4.	5.	10.	4.	8.	1.	9.	4.	16.	80.	25.
37	8.7	13.	30.	21.	3.	13.	72.	8.	10.	4.	3.	12.	12.	0.	1.	9.	4.	6.	0.	1.	2.	6.	70.	34.
38	8.6	16.	40.	30.	0.	15.	52.	8.	10.	4.	5.	6.	5.	0.	1.	6.	2.	0.	0.	2.	3.	27.	74.	35.
39	8.4	13.	27.	21.	0.	13.	8.	1.	0.	0.	1.	1.	0.	0.	2.	0.	0.	0.	0.	3.	0.	13.	63.	25.
40	8.0	20.	57.	28.	10.	5.	64.	0.	3.	4.	5.	8.	12.	0.	5.	10.	0.	4.	1.	8.	4.	19.	87.	26.
41	8.0	11.	49.	31.	9.	20.	37.	3.	0.	1.	0.	9.	5.	0.	3.	5.	0.	4.	1.	3.	3.	12.	64.	36.
42	7.9	20.	61.	22.	35.	9.	56.	4.	0.	5.	6.	11.	6.	0.	5.	5.	0.	1.	0.	9.	4.	25.	78.	32.
43	7.8	11.	59.	32.	27.	12.	33.	4.	4.	2.	2.	0.	6.	0.	2.	5.	1.	0.	1.	5.	1.	9.	79.	34.
44	7.8	9.	54.	27.	7.	19.	20.	1.	0.	0.	4.	2.	6.	0.	1.	1.	0.	0.	1.	3.	1.	16.	71.	36.
45	7.5	7.	38.	3.	0.	22.	4.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	4.	6.	48.	46.
46	7.3	19.	44.	33.	21.	4.	39.	4.	4.	1.	3.	7.	6.	0.	2.	5.	0.	0.	0.	5.	2.	20.	69.	29.
47	7.2	14.	50.	21.	51.	19.	31.	0.	0.	0.	0.	12.	1.	0.	8.	2.	0.	0.	1.	5.	2.	24.	93.	20.
48	7.0	16.	22.	22.	8.	8.	53.	6.	5.	4.	5.	12.	2.	0.	4.	2.	0.	0.	0.	9.	4.	15.	112.	26.
49	6.9	13.	42.	16.	0.	23.	7.	2.	1.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	3.	0.	8.	53.	39.
50	6.8	0.	36.	10.	0.	24.	7.	4.	0.	0.	2.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	18.	70.	34.

Table 206 continued. (Girls).

51	6.7	20.	46.	28.	4.	13.	37.	6.	3.	2.	4.	9.	0.	0.	4.	0.	0.	0.	0.	7.	2.	26.	100.	28.
52	6.7	17.	10.	19.	0.	20.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	4.	66.	31.
53	6.6	20.	27.	21.	0.	21.	14.	0.	0.	0.	1.	5.	2.	0.	0.	0.	0.	0.	0.	5.	1.	17.	78.	35.
54	6.0	13.	38.	15.	11.	7.	60.	8.	10.	5.	5.	12.	2.	3.	4.	2.	0.	0.	0.	7.	2.	12.	94.	24.
55	5.9	9.	50.	40.	3.	14.	12.	0.	0.	0.	0.	0.	0.	2.	1.	0.	0.	0.	0.	5.	4.	15.	99.	34.
56	5.8	15.	28.	15.	3.	13.	10.	1.	1.	1.	6.	4.	0.	0.	2.	0.	6.	0.	0.	0.	1.	9.	87.	41.
57	5.8	8.	44.	18.	0.	22.	7.	1.	0.	0.	0.	0.	0.	0.	3.	0.	0.	0.	0.	2.	1.	18.	95.	30.
58	5.5	14.	42.	18.	0.	15.	7.	0.	0.	1.	2.	0.	0.	0.	0.	1.	0.	0.	1.	2.	0.	6.	90.	39.
59	5.5	12.	20.	19.	0.	14.	16.	0.	1.	0.	0.	0.	6.	0.	0.	2.	0.	1.	0.	5.	1.	0.	85.	30.
60	5.3	15.	30.	15.	0.	19.	25.	1.	1.	1.	4.	2.	3.	0.	0.	2.	0.	0.	0.	8.	3.	26.	100.	24.
61	5.2	9.	18.	15.	0.	26.	2.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	1.	8.	92.	40.
62	5.2	15.	25.	18.	0.	24.	40.	5.	4.	0.	0.	9.	6.	0.	4.	3.	0.	1.	1.	6.	1.	4.	84.	33.
63	5.1	14.	32.	21.	0.	16.	27.	2.	0.	1.	2.	3.	6.	0.	2.	5.	0.	0.	0.	4.	2.	9.	96.	23.
64	5.0	14.	15.	14.	0.	23.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	13.	80.	43.
65	5.0	11.	21.	11.	0.	21.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	13.	78.	36.
66	5.0	13.	56.	22.	0.	17.	6.	0.	0.	0.	0.	0.	0.	0.	1.	1.	0.	0.	0.	4.	0.	7.	115.	22.
MEAN	9.5	16.9	52.2	31.9	28.7	11.3	50.9	4.0	4.8	2.9	3.4	7.4	5.3	1.2	3.6	4.5	1.7	3.3	0.6	6.5	2.5	16.8	80.2	33.2
STDV	3.2	6.1	23.3	16.8	34.7	7.2	36./	3.4	4.6	2.6	2.3	5.0	4.8	1.7	2.8	4.1	2.3	3.7	0.8	3.9	1.5	7.5	15.2	6.7

Table 207 (Girls)

PEARSON CORRELATION COEFFICIENTS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	1.00																							
2	0.79	1.00																						
3	0.78	0.82	1.00																					
4	0.78	0.82	0.91	1.00																				
5	0.70	0.76	0.74	0.76	1.00																			
6	-0.73	-0.79	-0.81	-0.78	-0.65	1.00																		
7	0.70	0.76	0.84	0.83	0.69	-0.82	1.00																	
8	0.61	0.63	0.75	0.76	0.56	-0.72	0.91	1.00																
9	0.64	0.62	0.71	0.73	0.54	-0.68	0.92	0.93	1.00															
10	0.62	0.65	0.74	0.74	0.57	-0.71	0.95	0.94	0.93	1.00														
11	0.66	0.77	0.83	0.81	0.65	-0.79	0.91	0.82	0.79	0.84	1.00													
12	0.64	0.73	0.73	0.68	0.64	-0.77	0.88	0.73	0.74	0.81	0.86	1.00												
13	0.68	0.72	0.76	0.76	0.71	-0.72	0.94	0.82	0.85	0.87	0.81	0.85	1.00											
14	0.63	0.66	0.76	0.78	0.64	-0.73	0.77	0.68	0.72	0.70	0.71	0.58	0.63	1.00										
15	0.61	0.75	0.79	0.77	0.68	-0.79	0.86	0.71	0.70	0.77	0.85	0.83	0.77	0.74	1.00									
16	0.58	0.61	0.70	0.68	0.58	-0.66	0.90	0.77	0.79	0.84	0.78	0.78	0.88	0.61	0.69	1.00								
17	0.59	0.57	0.72	0.77	0.58	-0.62	0.80	0.71	0.74	0.73	0.68	0.55	0.73	0.78	0.66	0.72	1.00							
18	0.63	0.62	0.71	0.73	0.61	-0.67	0.89	0.85	0.87	0.87	0.74	0.65	0.83	0.73	0.69	0.84	0.80	1.00						
19	0.62	0.62	0.72	0.71	0.68	-0.66	0.86	0.71	0.73	0.77	0.73	0.71	0.85	0.62	0.75	0.87	0.78	0.78	1.00					
20	0.66	0.75	0.83	0.79	0.65	-0.86	0.91	0.80	0.78	0.82	0.86	0.88	0.82	0.71	0.86	0.76	0.66	0.72	0.75	1.00				
21	0.56	0.69	0.73	0.70	0.61	-0.80	0.83	0.69	0.70	0.74	0.76	0.81	0.76	0.64	0.82	0.68	0.60	0.65	0.71	0.86	1.00			
22	0.53	0.61	0.64	0.66	0.41	-0.58	0.64	0.59	0.54	0.62	0.67	0.64	0.57	0.46	0.64	0.55	0.45	0.46	0.51	0.64	0.55	1.00		
23	0.03	0.35	0.45	0.44	0.36	-0.34	0.37	0.32	0.20	0.30	0.37	0.28	0.31	0.35	0.47	0.32	0.38	0.28	0.34	0.38	0.49	0.32	1.00	
24	-0.04	-0.25	-0.23	-0.23	-0.17	0.29	-0.31	-0.27	-0.23	-0.30	-0.41	-0.35	-0.31	-0.19	-0.30	-0.24	-0.22	-0.23	-0.14	-0.30	-0.32	-0.12	-0.43	1.00

Table 208 (Girls)

PARTIAL CORRELATIONS, AGE EXCLUDED

2		1.00																						
3		0.54	1.00																					
4		0.52	0.77	1.00																				
5		0.46	0.44	0.48	1.00																			
6		-0.50	-0.56	-0.49	-0.30	1.00																		
7		0.46	0.65	0.63	0.39	-0.62	1.00																	
8		0.31	0.55	0.58	0.22	-0.50	0.85	1.00																
9		0.24	0.44	0.48	0.17	-0.40	0.86	0.89	1.00															
10		0.34	0.52	0.53	0.25	-0.48	0.92	0.91	0.89	1.00														
11		0.55	0.66	0.62	0.35	-0.60	0.83	0.69	0.64	0.73	1.00													
12		0.48	0.48	0.38	0.35	-0.62	0.80	0.55	0.57	0.69	0.75	1.00												
13		0.40	0.51	0.50	0.45	-0.45	0.89	0.70	0.73	0.78	0.66	0.74	1.00											
14		0.34	0.55	0.60	0.35	-0.50	0.59	0.47	0.53	0.50	0.51	0.29	0.36	1.00										
15		0.56	0.62	0.59	0.45	-0.64	0.77	0.54	0.50	0.63	0.75	0.71	0.61	0.57	1.00									
16		0.31	0.50	0.45	0.30	-0.43	0.85	0.65	0.67	0.76	0.65	0.65	0.82	0.38	0.52	1.00								
17		0.21	0.52	0.61	0.28	-0.34	0.67	0.55	0.59	0.58	0.49	0.28	0.56	0.65	0.47	0.58	1.00							
18		0.26	0.45	0.49	0.30	-0.41	0.81	0.75	0.78	0.78	0.56	0.43	0.71	0.56	0.50	0.75	0.68	1.00						
19		0.26	0.49	0.46	0.43	-0.38	0.75	0.53	0.55	0.63	0.54	0.52	0.74	0.38	0.59	0.81	0.65	0.64	1.00					
20		0.49	0.66	0.58	0.34	-0.73	0.84	0.66	0.61	0.70	0.76	0.78	0.68	0.50	0.77	0.62	0.44	0.51	0.58	1.00				
21		0.48	0.57	0.52	0.37	-0.69	0.74	0.53	0.54	0.61	0.62	0.71	0.63	0.45	0.73	0.53	0.40	0.47	0.56	0.79	1.00			
22		0.37	0.43	0.47	0.07	-0.33	0.44	0.40	0.31	0.44	0.50	0.47	0.35	0.19	0.46	0.35	0.20	0.19	0.27	0.45	0.36	1.00		
23		0.53	0.67	0.67	0.48	-0.46	0.48	0.37	0.24	0.35	0.46	0.34	0.38	0.43	0.57	0.37	0.45	0.34	0.41	0.48	0.56	0.36	1.00	
24		-0.36	-0.32	-0.31	-0.20	0.38	-0.40	-0.31	-0.27	-0.34	-0.51	-0.42	-0.38	-0.21	-0.35	-0.26	-0.25	-0.26	-0.15	-0.36	-0.36	-0.12	-0.43	1.00
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

Table 209

ALL WITH SHUNTS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	16.0	28.	93.	47.	105.	3.	106.	8.	10.	6.	6.	12.	12.	4.	8.	10.	4.	8.	2.	12.	4.	29.	79.	35.
2	15.8	34.	98.	72.	100.	0.	94.	8.	10.	6.	6.	12.	12.	4.	8.	0.	4.	8.	0.	12.	4.	21.	79.	25.
3	15.0	21.	103.	69.	100.	7.	106.	8.	10.	6.	6.	12.	12.	4.	7.	9.	6.	8.	2.	12.	4.	17.	83.	39.
4	14.9	32.	111.	73.	91.	4.	106.	8.	10.	6.	6.	12.	10.	4.	8.	10.	6.	8.	2.	12.	4.	29.	83.	42.
5	14.9	28.	102.	54.	100.	2.	99.	8.	10.	5.	6.	10.	12.	4.	5.	10.	6.	8.	2.	9.	4.	14.	78.	34.
6	14.6	20.	113.	71.	96.	7.	74.	8.	10.	6.	6.	12.	2.	0.	4.	0.	0.	8.	2.	12.	4.	21.	82.	45.
7	13.8	32.	91.	66.	93.	2.	107.	8.	10.	6.	6.	12.	11.	4.	8.	10.	6.	8.	2.	12.	4.	29.	83.	36.
8	13.8	22.	73.	46.	15.	16.	34.	8.	10.	6.	6.	12.	8.	0.	4.	9.	0.	7.	0.	11.	3.	17.	64.	34.
9	13.8	21.	40.	32.	17.	12.	85.	8.	10.	6.	4.	10.	10.	2.	5.	9.	0.	8.	1.	8.	4.	10.	67.	33.
10	13.5	12.	53.	49.	73.	7.	52.	4.	5.	4.	4.	12.	0.	2.	4.	0.	0.	4.	0.	9.	4.	14.	61.	41.
11	13.4	29.	104.	74.	100.	1.	108.	8.	10.	6.	6.	12.	12.	4.	8.	10.	6.	8.	2.	12.	4.	29.	100.	33.
12	13.3	36.	117.	78.	110.	1.	106.	8.	10.	6.	6.	12.	12.	4.	8.	10.	5.	8.	2.	11.	4.	29.	109.	31.
13	13.2	23.	77.	58.	95.	5.	100.	8.	10.	6.	4.	11.	11.	4.	6.	10.	4.	8.	2.	12.	4.	17.	88.	40.
14	13.1	17.	19.	26.	0.	15.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	28.	47.	42.
15	13.1	23.	78.	49.	71.	2.	87.	8.	10.	6.	6.	12.	9.	0.	4.	10.	4.	7.	0.	8.	3.	17.	86.	40.
16	12.9	13.	59.	25.	25.	11.	25.	0.	2.	0.	2.	6.	6.	0.	2.	4.	0.	0.	0.	2.	1.	11.	63.	29.
17	12.7	17.	77.	35.	41.	8.	93.	8.	10.	6.	6.	12.	9.	2.	3.	9.	5.	8.	2.	11.	2.	22.	85.	36.
18	12.5	28.	75.	55.	71.	1.	99.	8.	10.	6.	6.	12.	12.	0.	8.	10.	3.	8.	1.	11.	4.	16.	80.	27.
19	12.5	16.	62.	47.	44.	10.	36.	1.	2.	4.	4.	10.	0.	2.	6.	0.	0.	0.	0.	5.	2.	19.	62.	41.
20	12.2	32.	85.	48.	79.	10.	82.	7.	9.	5.	4.	12.	12.	0.	4.	10.	0.	7.	1.	8.	3.	18.	71.	45.
21	11.9	19.	102.	73.	91.	2.	108.	8.	10.	6.	6.	12.	12.	4.	8.	10.	6.	8.	2.	12.	4.	29.	93.	33.
22	11.8	25.	45.	28.	11.	6.	91.	7.	10.	6.	3.	12.	11.	4.	4.	10.	4.	7.	1.	8.	4.	29.	78.	37.
23	11.7	21.	59.	50.	16.	11.	97.	8.	10.	6.	6.	12.	12.	4.	5.	10.	4.	8.	2.	7.	3.	29.	87.	35.
24	11.7	21.	61.	26.	0.	19.	36.	4.	5.	1.	2.	5.	6.	0.	0.	5.	0.	0.	0.	7.	1.	18.	53.	36.
25	11.6	14.	31.	18.	10.	10.	27.	0.	0.	0.	2.	7.	6.	0.	2.	5.	0.	0.	0.	4.	1.	10.	58.	30.
26	11.5	20.	87.	55.	30.	1.	105.	8.	10.	6.	5.	12.	12.	4.	8.	10.	6.	6.	2.	12.	4.	26.	83.	27.
27	11.4	18.	78.	55.	74.	13.	103.	8.	10.	6.	6.	12.	12.	2.	7.	10.	6.	6.	2.	12.	4.	18.	89.	27.
28	11.4	20.	73.	65.	83.	6.	94.	8.	10.	5.	6.	12.	10.	2.	6.	8.	4.	6.	1.	12.	4.	24.	90.	23.
29	11.4	27.	83.	56.	102.	5.	108.	8.	10.	6.	6.	12.	12.	4.	8.	10.	6.	8.	2.	12.	4.	23.	97.	28.
30	11.3	19.	59.	45.	33.	5.	99.	8.	10.	6.	6.	12.	10.	2.	7.	10.	4.	8.	2.	10.	4.	29.	77.	37.
31	11.3	21.	40.	9.	0.	12.	14.	0.	0.	0.	2.	0.	1.	0.	1.	1.	0.	0.	0.	7.	2.	12.	51.	42.
32	11.2	28.	81.	51.	42.	2.	108.	8.	10.	6.	6.	12.	12.	4.	8.	10.	6.	8.	2.	12.	4.	18.	71.	36.
33	11.0	24.	61.	30.	31.	6.	66.	8.	10.	4.	5.	12.	1.	0.	3.	3.	0.	8.	0.	9.	3.	19.	77.	31.
34	10.9	21.	52.	40.	22.	3.	95.	6.	10.	6.	6.	12.	12.	2.	8.	10.	1.	8.	1.	9.	4.	22.	80.	34.
35	10.7	8.	52.	11.	53.	20.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	4.	53.	40.
36	10.7	19.	33.	24.	0.	17.	46.	1.	2.	2.	2.	9.	5.	0.	6.	9.	0.	0.	0.	8.	2.	11.	59.	42.
37	10.7	14.	52.	32.	42.	4.	55.	0.	1.	4.	4.	12.	1.	4.	8.	0.	0.	8.	0.	9.	4.	24.	86.	29.
38	10.3	23.	74.	35.	9.	6.	74.	6.	9.	5.	6.	12.	3.	4.	7.	2.	0.	4.	0.	12.	4.	27.	70.	27.
39	10.3	18.	54.	34.	15.	6.	42.	6.	8.	3.	3.	7.	1.	0.	2.	0.	0.	0.	0.	8.	4.	12.	58.	39.
40	10.2	16.	66.	42.	51.	11.	84.	8.	10.	6.	4.	12.	10.	0.	4.	9.	0.	8.	2.	8.	3.	29.	82.	38.
41	10.1	16.	50.	44.	75.	4.	38.	2.	1.	0.	6.	9.	5.	0.	4.	5.	0.	0.	0.	3.	3.	26.	91.	37.
42	10.0	16.	67.	32.	69.	8.	91.	8.	10.	6.	4.	11.	12.	4.	4.	10.	3.	8.	1.	8.	2.	21.	93.	26.
43	9.9	11.	36.	9.	0.	23.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	4.	53.	39.
44	9.8	8.	26.	3.	0.	21.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.	48.	51.
45	9.7	23.	48.	35.	36.	7.	88.	8.	10.	6.	6.	8.	1.	4.	8.	8.	6.	8.	0.	11.	4.	24.	85.	31.
46	9.6	21.	70.	51.	67.	4.	95.	8.	10.	6.	6.	12.	11.	2.	8.	5.	4.	8.	0.	9.	4.	14.	102.	30.
47	9.1	16.	63.	33.	22.	12.	78.	4.	8.	5.	3.	7.	12.	2.	4.	10.	4.	3.	2.	10.	4.	21.	78.	31.
48	9.0	23.	65.	35.	94.	6.	102.	8.	10.	6.	5.	11.	12.	3.	8.	10.	6.	8.	2.	9.	4.	17.	88.	37.
49	8.7	13.	30.	21.	3.	13.	72.	8.	10.	4.	3.	12.	12.	0.	1.	9.	4.	6.	0.	1.	2.	6.	70.	34.
50	8.6	16.	40.	30.	0.	15.	52.	8.	10.	4.	5.	6.	5.	0.	1.	6.	2.	0.	0.	2.	3.	27.	74.	35.

Table 209. Shunts.

Table 209 continued. (All with shunts.)

51	8.5	24.	41.	33.	34.	17.	70.	6.	9.	6.	4.	12.	11.	0.	4.	8.	0.	0.	1.	6.	3.	29.	80.	27.
52	8.4	13.	27.	21.	0.	13.	8.	1.	0.	0.	1.	1.	0.	0.	2.	0.	0.	0.	0.	3.	0.	13.	63.	25.
53	8.0	11.	49.	31.	9.	20.	37.	3.	0.	1.	0.	9.	5.	0.	3.	5.	0.	4.	1.	3.	3.	12.	64.	36.
54	7.9	20.	61.	22.	35.	9.	56.	4.	0.	5.	6.	11.	6.	0.	5.	5.	0.	1.	0.	9.	4.	25.	78.	32.
55	7.8	11.	59.	32.	27.	12.	33.	4.	4.	2.	2.	0.	6.	0.	2.	5.	1.	0.	1.	5.	1.	9.	79.	34.
56	7.8	14.	44.	25.	8.	8.	72.	8.	9.	6.	4.	10.	6.	2.	1.	7.	3.	6.	0.	8.	2.	28.	81.	32.
57	7.8	9.	54.	27.	7.	19.	20.	1.	0.	0.	4.	2.	6.	0.	1.	1.	0.	0.	1.	3.	1.	16.	71.	36.
58	7.7	13.	41.	31.	23.	14.	26.	2.	0.	0.	4.	5.	4.	0.	1.	4.	0.	0.	0.	4.	2.	19.	78.	24.
59	7.5	7.	38.	3.	0.	22.	4.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	4.	6.	48.	46.
60	7.5	16.	49.	29.	2.	13.	51.	4.	5.	3.	3.	3.	5.	0.	1.	10.	1.	8.	1.	6.	1.	4.	70.	21.
61	7.3	19.	44.	33.	21.	4.	39.	4.	4.	1.	3.	7.	6.	0.	2.	5.	0.	0.	0.	5.	2.	20.	69.	29.
62	7.2	14.	50.	21.	51.	19.	31.	0.	0.	0.	0.	12.	1.	0.	8.	2.	0.	0.	1.	5.	2.	24.	93.	20.
63	7.2	11.	34.	7.	0.	22.	43.	4.	5.	4.	3.	8.	5.	0.	3.	3.	0.	0.	1.	6.	1.	18.	53.	36.
64	7.0	17.	63.	31.	2.	13.	47.	5.	4.	3.	3.	8.	2.	2.	5.	5.	1.	1.	0.	7.	1.	17.	88.	39.
65	6.9	13.	42.	16.	0.	23.	7.	2.	1.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	3.	0.	8.	53.	39.
66	6.9	6.	12.	13.	40.	30.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	85.	31.
67	6.9	13.	20.	13.	0.	22.	2.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.	9.	80.	33.
68	6.8	0.	36.	10.	0.	24.	7.	4.	0.	0.	2.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	18.	70.	34.
69	6.7	20.	46.	28.	4.	13.	37.	6.	3.	2.	4.	9.	0.	0.	4.	0.	0.	0.	0.	7.	2.	26.	100.	28.
70	6.7	17.	55.	30.	0.	20.	48.	4.	6.	3.	4.	11.	5.	0.	4.	2.	0.	0.	0.	6.	3.	14.	80.	24.
71	6.6	20.	27.	21.	0.	21.	14.	0.	0.	0.	1.	5.	2.	0.	0.	0.	0.	0.	0.	5.	1.	17.	78.	35.
72	6.6	15.	24.	21.	0.	15.	10.	1.	0.	0.	0.	0.	0.	2.	0.	0.	0.	0.	0.	6.	1.	10.	56.	45.
73	6.2	21.	50.	22.	35.	11.	50.	1.	0.	1.	5.	12.	6.	1.	5.	5.	0.	1.	1.	8.	4.	11.	110.	22.
74	6.0	8.	9.	15.	0.	23.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.	64.	42.
75	5.9	10.	30.	17.	0.	19.	13.	1.	0.	0.	2.	0.	0.	0.	4.	0.	0.	0.	0.	5.	1.	8.	80.	39.
76	5.9	9.	50.	40.	3.	14.	12.	0.	0.	0.	0.	0.	0.	2.	1.	0.	0.	0.	0.	5.	4.	15.	99.	34.
77	5.8	15.	28.	15.	3.	13.	10.	1.	1.	1.	6.	4.	0.	0.	2.	0.	6.	0.	0.	0.	1.	9.	87.	41.
78	5.8	8.	44.	18.	0.	22.	7.	1.	0.	0.	0.	0.	0.	0.	3.	0.	0.	0.	0.	2.	1.	18.	95.	30.
79	5.7	13.	57.	35.	0.	24.	78.	8.	10.	6.	4.	2.	10.	2.	2.	9.	6.	8.	1.	6.	2.	13.	105.	31.
80	5.6	9.	20.	12.	0.	26.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	12.	72.	34.
81	5.5	14.	42.	18.	0.	15.	7.	0.	0.	1.	2.	0.	0.	0.	0.	1.	0.	0.	1.	2.	0.	6.	90.	39.
82	5.3	15.	30.	15.	0.	19.	25.	1.	1.	1.	4.	2.	3.	0.	0.	2.	0.	0.	0.	8.	3.	26.	100.	24.
83	5.3	5.	6.	18.	0.	28.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	11.	53.	47.
84	5.2	10.	17.	17.	0.	27.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	3.	69.	35.
85	5.2	9.	18.	15.	0.	26.	2.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	1.	8.	92.	40.
86	5.2	15.	25.	18.	0.	24.	40.	5.	4.	0.	0.	9.	6.	0.	4.	3.	0.	1.	1.	6.	1.	4.	84.	33.
87	5.0	14.	15.	14.	0.	23.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	13.	80.	43.
88	5.0	11.	21.	11.	0.	21.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	13.	78.	36.
89	5.0	6.	8.	0.	0.	27.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	75.	43.
90	5.0	13.	56.	22.	0.	17.	6.	0.	0.	0.	0.	0.	0.	0.	1.	1.	0.	0.	0.	4.	0.	7.	115.	22.
MEAN	9.5	17.2	53.4	33.0	31.2	12.8	50.9	4.2	5.0	3.0	3.3	7.0	5.4	1.2	3.5	4.6	1.7	3.4	0.6	6.3	2.4	16.7	77.7	34.3
STDV	3.1	7.1	26.2	18.8	36.2	8.0	38.9	3.4	4.6	2.7	2.3	5.1	4.9	1.6	3.0	4.3	2.4	3.7	0.8	4.2	1.5	8.3	15.3	6.5

Table 211. All with shunts.

PARTIAL CORRELATIONS, AGE EXCLUDED

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
2		1.00																						
3		0.47	1.00																					
4		0.49	0.75	1.00																				
5		0.33	0.60	0.63	1.00																			
6		-0.53	-0.49	-0.53	-0.38	1.00																		
7		0.58	0.60	0.64	0.48	-0.61	1.00																	
8		0.47	0.52	0.55	0.31	-0.44	0.85	1.00																
9		0.47	0.47	0.52	0.27	-0.41	0.86	0.94	1.00															
10		0.47	0.50	0.54	0.33	-0.47	0.88	0.86	0.89	1.00														
11		0.51	0.55	0.56	0.38	-0.64	0.72	0.67	0.63	0.71	1.00													
12		0.50	0.43	0.47	0.36	-0.53	0.76	0.63	0.61	0.69	0.66	1.00												
13		0.47	0.45	0.48	0.36	-0.38	0.82	0.68	0.71	0.67	0.52	0.57	1.00											
14		0.34	0.42	0.48	0.37	-0.44	0.62	0.39	0.42	0.52	0.35	0.31	0.39	1.00										
15		0.52	0.53	0.59	0.51	-0.57	0.72	0.46	0.45	0.59	0.58	0.71	0.48	0.58	1.00									
16		0.43	0.38	0.39	0.25	-0.38	0.79	0.68	0.70	0.68	0.50	0.53	0.85	0.36	0.45	1.00								
17		0.37	0.47	0.51	0.44	-0.41	0.70	0.59	0.61	0.59	0.52	0.30	0.60	0.66	0.47	0.60	1.00							
18		0.37	0.45	0.50	0.39	-0.42	0.79	0.73	0.74	0.78	0.52	0.51	0.59	0.55	0.50	0.63	0.61	1.00						
19		0.29	0.54	0.50	0.46	-0.22	0.65	0.47	0.48	0.50	0.53	0.35	0.64	0.45	0.44	0.61	0.57	0.53	1.00					
20		0.60	0.64	0.62	0.38	-0.59	0.77	0.63	0.61	0.70	0.66	0.65	0.50	0.53	0.71	0.50	0.43	0.57	0.47	1.00				
21		0.43	0.45	0.52	0.38	-0.55	0.67	0.51	0.51	0.60	0.60	0.63	0.45	0.45	0.62	0.40	0.36	0.47	0.34	0.66	1.00			
22		0.40	0.36	0.43	0.19	-0.46	0.49	0.41	0.37	0.46	0.51	0.49	0.31	0.36	0.43	0.32	0.24	0.24	0.28	0.48	0.45	1.00		
23		0.48	0.66	0.69	0.63	-0.52	0.63	0.47	0.46	0.51	0.57	0.49	0.47	0.49	0.59	0.42	0.52	0.54	0.45	0.57	0.50	0.43	1.00	
24		-0.30	-0.34	-0.31	-0.21	0.37	-0.39	-0.28	-0.27	-0.27	-0.37	-0.43	-0.37	-0.20	-0.41	-0.29	-0.16	-0.24	-0.12	-0.43	-0.32	-0.32	-0.49	1.00

Table 212

Table 212.

ALL WITHOUT SHUNTS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	16.0	35.	121.	79.	110.	0.	108.	8.	10.	6.	6.	12.	12.	4.	8.	10.	6.	8.	2.	12.	4.	29.	132.	24.
2	16.0	23.	116.	73.	18.	2.	108.	8.	10.	6.	6.	12.	12.	4.	8.	10.	6.	8.	2.	12.	4.	29.	84.	41.
3	15.5	33.	116.	77.	108.	7.	108.	8.	10.	6.	6.	12.	12.	4.	8.	10.	6.	8.	2.	12.	4.	29.	110.	24.
4	15.5	18.	96.	56.	100.	3.	97.	6.	10.	6.	4.	12.	12.	4.	4.	10.	6.	8.	2.	9.	4.	15.	74.	37.
5	15.4	21.	54.	46.	85.	7.	88.	8.	10.	6.	6.	9.	10.	2.	4.	7.	3.	8.	1.	12.	2.	28.	56.	42.
6	15.1	20.	95.	62.	104.	5.	84.	8.	10.	6.	6.	12.	2.	3.	8.	2.	3.	8.	0.	12.	4.	26.	90.	34.
7	14.1	28.	52.	50.	105.	6.	107.	8.	10.	6.	6.	12.	12.	4.	8.	10.	5.	8.	2.	12.	4.	28.	86.	43.
8	13.7	32.	99.	66.	71.	1.	105.	8.	9.	5.	6.	12.	12.	4.	7.	10.	6.	8.	2.	12.	4.	22.	110.	20.
9	13.5	20.	61.	33.	7.	4.	96.	8.	10.	6.	5.	12.	12.	0.	4.	10.	6.	8.	2.	10.	3.	14.	63.	30.
10	13.4	18.	56.	34.	41.	7.	40.	4.	2.	3.	3.	11.	3.	1.	1.	5.	0.	0.	0.	6.	1.	14.	73.	31.
11	12.8	34.	84.	43.	92.	1.	63.	1.	1.	2.	5.	12.	6.	2.	8.	5.	2.	4.	1.	10.	4.	18.	96.	29.
12	12.6	30.	76.	38.	41.	2.	103.	8.	10.	6.	6.	12.	11.	2.	8.	10.	4.	8.	2.	12.	4.	29.	83.	29.
13	11.6	26.	99.	59.	84.	1.	101.	8.	10.	6.	6.	12.	12.	4.	4.	10.	6.	8.	2.	9.	4.	13.	80.	28.
14	10.1	20.	57.	31.	75.	3.	51.	1.	0.	1.	1.	12.	11.	0.	5.	5.	0.	0.	1.	10.	4.	12.	82.	34.
15	9.8	19.	60.	30.	22.	2.	41.	0.	0.	0.	4.	12.	6.	0.	2.	5.	0.	0.	1.	7.	4.	14.	75.	27.
16	9.4	17.	57.	37.	7.	1.	89.	8.	10.	6.	6.	11.	4.	4.	8.	3.	6.	8.	1.	10.	4.	27.	92.	26.
17	9.0	7.	43.	17.	0.	18.	7.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	4.	2.	13.	80.	29.
18	9.0	24.	61.	36.	20.	7.	98.	6.	9.	6.	5.	12.	12.	4.	4.	10.	6.	8.	2.	10.	4.	18.	88.	23.
19	9.0	17.	68.	34.	63.	4.	95.	8.	10.	6.	5.	12.	12.	3.	5.	10.	0.	8.	1.	11.	4.	16.	78.	30.
20	8.9	19.	64.	39.	45.	18.	79.	6.	3.	6.	4.	12.	10.	0.	5.	10.	3.	8.	1.	8.	3.	29.	79.	31.
21	8.9	15.	50.	33.	4.	5.	91.	5.	10.	3.	4.	12.	12.	4.	5.	10.	4.	8.	1.	9.	4.	16.	80.	25.
22	8.8	16.	37.	17.	55.	8.	84.	8.	10.	5.	3.	11.	10.	2.	7.	7.	1.	8.	1.	8.	3.	11.	80.	27.
23	8.5	19.	63.	45.	4.	2.	95.	6.	10.	6.	5.	12.	6.	4.	8.	10.	6.	8.	1.	9.	4.	14.	93.	25.
24	8.0	20.	57.	28.	10.	5.	64.	0.	3.	4.	5.	8.	12.	0.	5.	10.	0.	4.	1.	8.	4.	19.	87.	26.
25	7.8	21.	43.	26.	42.	10.	51.	3.	0.	3.	5.	12.	6.	0.	5.	5.	0.	0.	1.	9.	2.	17.	75.	22.
26	7.4	14.	56.	31.	4.	11.	78.	6.	10.	4.	1.	9.	10.	2.	2.	7.	6.	8.	1.	8.	4.	13.	90.	25.
27	7.0	16.	22.	22.	8.	8.	53.	6.	5.	4.	5.	12.	2.	0.	4.	2.	0.	0.	0.	9.	4.	15.	112.	26.
28	6.8	11.	54.	17.	12.	18.	31.	1.	0.	1.	1.	6.	1.	0.	3.	5.	0.	0.	1.	8.	4.	20.	99.	48.
29	6.8	14.	44.	18.	0.	16.	15.	0.	0.	1.	2.	0.	0.	2.	1.	4.	0.	1.	0.	2.	2.	11.	78.	32.
30	6.7	17.	10.	19.	0.	20.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	4.	66.	31.
31	6.7	10.	54.	20.	10.	12.	46.	1.	3.	3.	2.	8.	6.	0.	4.	5.	0.	0.	1.	9.	4.	15.	92.	29.
32	6.6	17.	34.	18.	0.	17.	36.	0.	2.	1.	3.	10.	6.	0.	4.	5.	0.	0.	0.	3.	2.	29.	89.	34.
33	6.1	15.	52.	29.	6.	14.	22.	4.	1.	1.	2.	2.	1.	0.	1.	1.	0.	0.	0.	7.	2.	19.	110.	33.
34	6.0	13.	38.	15.	11.	7.	60.	8.	10.	5.	5.	12.	2.	3.	4.	2.	0.	0.	0.	7.	2.	12.	94.	24.
35	5.5	12.	20.	19.	0.	14.	16.	0.	1.	0.	0.	0.	6.	0.	0.	2.	0.	1.	0.	5.	1.	0.	85.	30.
36	5.3	14.	72.	37.	2.	11.	25.	7.	1.	2.	3.	1.	1.	0.	4.	0.	0.	1.	0.	3.	2.	22.	115.	27.
37	5.2	8.	20.	6.	0.	28.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	9.	70.	28.
38	5.2	14.	9.	19.	0.	18.	3.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	1.	7.	100.	33.
39	5.1	14.	30.	21.	0.	16.	18.	4.	0.	3.	0.	1.	0.	0.	3.	0.	0.	0.	0.	4.	3.	11.	101.	29.
40	5.1	14.	32.	21.	0.	16.	27.	2.	0.	1.	2.	3.	6.	0.	2.	5.	0.	0.	0.	4.	2.	9.	96.	23.
MEAN	9.6	18.9	58.3	35.0	34.1	8.9	62.1	4.5	5.2	3.5	3.6	8.6	6.7	1.6	4.3	5.8	2.3	4.1	0.9	7.8	3.0	17.4	88.1	29.7
STDV	3.6	6.9	28.1	18.2	38.7	6.8	36.1	3.3	4.6	2.4	2.2	4.8	4.7	1.7	2.7	3.8	2.7	3.9	0.8	3.5	1.3	7.7	15.4	6.0

Table 212 continued. All without shunts.

PEARSON CORRELATION COEFFICIENTS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	1.00																							
2	0.73	1.00																						
3	0.79	0.70	1.00																					
4	0.84	0.78	0.91	1.00																				
5	0.79	0.72	0.67	0.73	1.00																			
6	-0.68	-0.67	-0.68	-0.67	-0.54	1.00																		
7	0.74	0.69	0.73	0.76	0.62	-0.79	1.00																	
8	0.56	0.47	0.56	0.64	0.47	-0.59	0.81	1.00																
9	0.61	0.45	0.55	0.62	0.46	-0.66	0.90	0.87	1.00															
10	0.64	0.54	0.62	0.67	0.53	-0.65	0.91	0.88	0.89	1.00														
11	0.69	0.72	0.67	0.70	0.57	-0.79	0.85	0.72	0.72	0.81	1.00													
12	0.63	0.60	0.58	0.55	0.57	-0.78	0.85	0.59	0.67	0.73	0.80	1.00												
13	0.60	0.61	0.58	0.59	0.53	-0.64	0.83	0.49	0.65	0.65	0.60	0.69	1.00											
14	0.61	0.55	0.64	0.71	0.53	-0.65	0.79	0.68	0.83	0.72	0.67	0.56	0.53	1.00										
15	0.61	0.70	0.67	0.68	0.59	-0.72	0.81	0.64	0.65	0.74	0.80	0.74	0.56	0.64	1.00									
16	0.61	0.61	0.62	0.60	0.47	-0.62	0.86	0.50	0.67	0.71	0.66	0.72	0.92	0.60	0.60	1.00								
17	0.67	0.60	0.67	0.76	0.43	-0.58	0.83	0.68	0.80	0.75	0.61	0.56	0.65	0.79	0.59	0.69	1.00							
18	0.67	0.57	0.64	0.70	0.53	-0.61	0.91	0.76	0.88	0.85	0.69	0.61	0.75	0.78	0.68	0.78	0.86	1.00						
19	0.70	0.66	0.70	0.66	0.54	-0.62	0.80	0.50	0.62	0.64	0.60	0.62	0.81	0.60	0.59	0.82	0.78	0.72	1.00					
20	0.74	0.66	0.71	0.71	0.66	-0.80	0.89	0.68	0.72	0.78	0.80	0.82	0.72	0.61	0.80	0.70	0.63	0.71	0.73	1.00				
21	0.47	0.48	0.64	0.55	0.43	-0.72	0.74	0.45	0.56	0.60	0.60	0.71	0.61	0.53	0.72	0.65	0.56	0.59	0.66	0.79	1.00			
22	0.58	0.56	0.63	0.63	0.46	-0.38	0.60	0.52	0.44	0.57	0.68	0.52	0.39	0.40	0.70	0.45	0.46	0.51	0.46	0.62	0.48	1.00		
23	-0.09	0.25	0.27	0.28	0.06	-0.10	0.03	0.16	0.00	0.03	0.09	-0.04	-0.12	0.12	0.27	-0.10	0.07	-0.07	-0.04	0.11	0.28	0.24	1.00	
24	0.22	-0.13	-0.00	0.02	0.16	0.16	-0.07	-0.08	-0.07	-0.06	-0.12	-0.10	-0.08	-0.09	-0.06	-0.03	-0.08	-0.03	0.02	0.05	-0.03	0.22	-0.28	1.00

Table 212 continued. (Without shunts).

Table 213. All without shunts.

Table 213. All without shunts.

PARTIAL CORRELATIONS, AGE EXCLUDED

2		1.00																						
3		0.30	1.00																					
4		0.46	0.74	1.00																				
5		0.35	0.13	0.19	1.00																			
6		-0.34	-0.33	-0.25	-0.02	1.00																		
7		0.31	0.35	0.36	0.07	-0.59	1.00																	
8		0.10	0.24	0.37	0.06	-0.34	0.70	1.00																
9		0.01	0.14	0.23	-0.06	-0.42	0.84	0.80	1.00															
10		0.14	0.25	0.31	0.06	-0.39	0.85	0.83	0.81	1.00														
11		0.44	0.29	0.32	0.06	-0.60	0.70	0.56	0.53	0.67	1.00													
12		0.26	0.16	0.04	0.14	-0.62	0.72	0.37	0.47	0.55	0.65	1.00												
13		0.32	0.21	0.19	0.11	-0.40	0.72	0.24	0.45	0.43	0.31	0.51	1.00											
14		0.19	0.33	0.46	0.10	-0.40	0.64	0.52	0.73	0.54	0.43	0.29	0.26	1.00										
15		0.47	0.38	0.38	0.21	-0.52	0.68	0.46	0.44	0.58	0.65	0.58	0.31	0.42	1.00									
16		0.31	0.30	0.21	-0.01	-0.35	0.76	0.24	0.47	0.52	0.42	0.55	0.87	0.36	0.36	1.00								
17		0.22	0.32	0.49	-0.22	-0.24	0.67	0.50	0.66	0.56	0.28	0.23	0.42	0.64	0.31	0.49	1.00							
18		0.15	0.24	0.34	0.00	-0.28	0.82	0.63	0.80	0.74	0.42	0.33	0.59	0.62	0.47	0.63	0.75	1.00						
19		0.30	0.33	0.19	-0.04	-0.28	0.59	0.19	0.34	0.36	0.22	0.31	0.69	0.30	0.28	0.70	0.58	0.48	1.00					
20		0.26	0.31	0.23	0.18	-0.61	0.75	0.47	0.50	0.59	0.59	0.68	0.50	0.30	0.65	0.48	0.27	0.43	0.44	1.00				
21		0.24	0.51	0.32	0.11	-0.63	0.67	0.26	0.39	0.45	0.43	0.60	0.46	0.35	0.62	0.52	0.38	0.43	0.53	0.76	1.00			
22		0.24	0.33	0.31	-0.00	0.03	0.30	0.29	0.13	0.32	0.48	0.24	0.06	0.06	0.53	0.15	0.12	0.20	0.09	0.34	0.29	1.00		
23		0.46	0.56	0.67	0.22	-0.23	0.15	0.26	0.07	0.11	0.20	0.03	-0.08	0.23	0.41	-0.06	0.18	-0.01	0.04	0.27	0.36	0.37	1.00	
24		-0.43	-0.30	-0.31	-0.03	0.43	-0.35	-0.25	-0.27	-0.27	-0.38	-0.31	-0.27	-0.29	-0.25	-0.21	-0.32	-0.24	-0.20	-0.17	-0.15	0.11	-0.27	1:00
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

APPENDIX J.

Statistical analyses.

Contents

Key to multivariate analysis :- Variables.

1.	Raven's C.P.M.
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4.	Reading
5.	Bender Gestalt.
	Piagetian Tests.
6.	1A
7.	1B
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9.	2B
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20.	10
21.	I.Q.
22.	Pultibec

Table 214

Multivariate analysis. Boys and girls.

Test	1	2	3	4	5	6	7	8	9	10	11
Means	17.7	54.9	33.6	32.1	11.6	4.3	5.1	3.2	3.4	7.5	5.8
Boys	18.6	57.7	35.3	36.7	11.9	4.6	5.3	3.4	3.3	7.6	6.3
Girls	16.9	52.2	31.9	28.7	11.3	4.0	4.8	2.9	3.4	7.4	5.3
Test	12	13	14	15	16	17	18	19	20	21	22
Means	1.4	3.8	5.0	1.9	3.6	0.7	6.8	2.6	16.9	80.9	32.9
Boys	1.5	4.0	5.5	2.1	3.8	0.8	7.0	2.7	17.1	81.6	32.6
Girls	1.2	3.6	4.5	1.7	3.3	0.6	6.5	2.6	16.8	80.2	33.2

Chi^2 = 19.92, d.f. = 22 not significant. When variable 22 (Pultibec) excluded

Chi^2 = 18.34, d.f. = 21 not significant.

As above but with I.Q. (variable 21) excluded

Chi^2 = 18.34, d.f. = 21 not significant.

When variables 21 (I.Q) and 22 (Pultibec) excluded

Chi^2 = 18.27, d.f. = 20 not significant.

Table 215

Multivariate analysis. Shunts and non-shunts.

Test	1	2	3	4	5	6	7	8	9	10	11
Means	17.7	54.9	33.6	32.1	11.6	4.3	5.1	3.2	3.3	7.5	5.8
Shunts	17.2	53.4	33.0	31.2	12.8	4.2	5.0	3.0	3.2	7.0	5.4
Non-shunts	18.9	58.3	35.0	34.1	8.9	4.5	5.2	3.5	3.6	8.6	6.7
Test	12	13	14	15	16	17	18	19	20	21	22
Means	1.4	3.8	5.0	1.8	3.6	0.7	6.7	2.6	16.9	80.9	32.9
Shunts	1.2	3.5	4.6	1.6	3.4	0.6	6.3	2.4	16.7	77.7	34.3
Non-shunts	1.7	4.3	5.9	2.3	4.1	0.9	7.8	3.0	17.2	88.1	29.7

Chi^2 = 42.4, d.f. 22 $p < .01$

When variables 21 (I.Q.) and 22 (Pultibec) excluded, chi^2 = 20.1, d.f.20 n.s.

Table 216

Multivariate analysis.

Piagetian tests. With and without shunts.

	Test 1A	1B	2A	2B	3A	3B	4	5A
Means	4.3	5.1	3.2	3.3	7.5	5.8	1.4	3.8
Shunt	4.2	5.0	3.0	3.2	7.0	5.4	1.2	3.5
No shunt	4.5	5.2	3.5	3.6	8.6	6.7	1.7	4.3

	Test 5B	6	7	8	9	10	11
Means	5.0	1.8	3.6	0.7	6.7	2.6	16.9
Shunt	4.6	1.6	3.4	0.6	6.3	2.4	16.7
No shunt	5.9	2.3	4.1	0.9	7.8	3.0	17.2

Chi^2 = 19.7 d.f. = 15 n.s.

Table 217

Multivariate analysis.

Piagetian Tests. Boys and Girls.

	Test 1A	1B	2A	2B	3A	3B	4	5A
Means	4.3	5.1	3.2	3.4	7.5	5.8	1.4	3.8
Boys	4.6	5.3	3.4	3.3	7.6	6.3	1.5	4.0
Girls	4.0	4.8	2.9	3.4	7.4	5.3	1.3	3.6

	Test 5B	6	7	8	9	10	11
Means	5.0	1.9	3.6	0.7	6.8	2.6	16.9
Boys	5.5	2.1	3.8	0.8	7.0	2.7	17.1
Girls	4.5	1.7	3.3	0.6	6.5	2.5	16.8

Chi^2 = 12.06 d.f. = 15 not significant.

Table 218

Difference between means (t. test).
Boys (n = 64) and Girls (n = 66).

	Raven's C.P.M.	E.P.V.T.	C.V.S.	Reading	Bender Gestalt	Piagetian	I.Q.	Pultibec.
t_c =	1.38	1.19	1.03	1.08	0.652	1.04	0.5	0.51

Table 219

Difference between means (t. test).
Boys and Girls - Individual Piagetian tests.

	1A	1B	2A	2B	3A	3B	4	5A
t_c =	1.03	0.62	1.14	0.25	0.227	1.175	1.001	0.786

	5B	6	7	8	9	10	11
t_c =	1.374	.928	0.759	1.428	0.703	0.791	0.212

Table 220

Difference between means(t. tests).
With and without shunts.

	Raven's C.P.M.	E.P.V.T.	C.V.S.	Reading	Bender Gestalt	Piagetian	I.Q.	Pultibec.
t_c =	1.28	0.937	0.573	0.4027	2.86**	1.59	3.8	3.93**

Table 221

Difference between means (t. test).
Individual Piagetian tests - with and without shunts.

	1A	1B	2A	2B	3A	3B	4	5A
t_c =	0.474	0.228	1.054	0.709	1.72	1.438	1.262	1.4

	5B	6	7	8	9	10	11
t_c =	1.595	1.209	0.959	1.98*	2.118*	2.314*	0.467

Note t_t required for sig. at 5% = 1.98 at 1% = 2.58.

Table 222

Correlation Co-efficients.

Piagetian Tests with I.Q. (One-year age groups).

Age	n.	Correlation	Significance
16 yrs.	3	0.57	n.s.
15 "	6	0.53	n.s.
14 "	4	0.27	n.s.
13 "	12	0.77	.01
12 "	7	0.60	n.s.
11 "	14	0.87	.01
10 "	10	0.59	n.s.
9 "	11	0.80	.01
8 "	10	0.79	.01
7 "	14	0.48	n.s.
6 "	17	0.66	.01
5 "	22	0.46	.05

Table 223

Correlation Coefficient. Piagetian tests with I.Q. (Two-year age groups.)

15 and 16	9	0.51	n.s.
13 " 14	16	0.58	.05
11 " 12	21	0.50	.05
9 " 10	21	0.52	.05
7 " 8	24	0.40	.05
5 " 6	39	0.43	.01

Table 224

Correlation Coefficient. Piagetian tests with I.Q.

School Department.

Department	n.	Correlation.	Significance.
Secondary	32	0.6	.01
Juniors	45	0.75	.01
Infants	53	0.29	.01

Table 225

English Picture Vocabulary Test. One-year age groups.

Age	Mean C.A.	Mean raw score.	s.d.	Mean Voc. age.
16 yrs.	16.0	110	14.9	17.9
15 "	15.4	93.7	20.9	13.4
14 "	14.6	94.5	28.7	13.5
13 "	13.5	72.3	28.2	10.2
12 "	12.6	74.0	10.0	10.4
11 "	11.5	68.5	21.4	9.8
10 "	10.4	55.7	11.4	7.9
9 "	9.4	54.3	14.2	7.5
8 "	8.5	45.8	13.0	6.6
7 "	7.5	47.0	11.4	6.8
6 "	6.6	35.7	16.1	5.5
5 "	5.4	29.5	17.4	5.1

Table 226

English Picture Vocabulary Test. Two-year age groups.

15 & 16 yrs.	15.6	99.1	19.9	14.8
13 & 14 "	13.8	77.9	29.1	11.1
11 & 12 "	11.9	70.3	18.3	9.9
9 & 10 "	9.9	55.0	12.6	7.9
7 & 8 "	7.9	46.5	11.8	6.6
5 & 6 "	5.9	32.2	16.9	5.2

Table 227

Crichton Vocabulary Scale. One-year age groups.

Age	Mean C.A.	m.raw score	s.d.	m.vocab. age.
16 yrs.	16.0	66.3	17.0	12.7
15 "	15.4	63.7	11.4	12.5
14 "	14.6	62.0	11.7	12.0
13 "	13.5	50.9	17.6	10.6
12 "	12.6	41.6	9.9	9.6
11 "	11.5	44.3	18.9	10.0
10 "	10.4	32.5	9.6	8.4
9 "	9.4	29.1	13.9	7.8
8 "	8.5	29.8	8.6	7.9
7 "	7.5	24.3	9.1	6.9
6 "	6.6	19.1	5.7	6.0
5 "	5.4	18.5	9.2	5.9

Table 228

Crichton Vocabulary Scale. Two-year age groups.

15 & 16 yrs.	15.6	64.6	12.5	12.5
13 & 14 "	13.8	53.7	16.7	10.9
11 & 12 "	11.9	43.4	16.2	9.8
9 & 10 "	9.9	30.7	11.9	8.1
7 & 8 "	7.9	26.6	9.1	7.4
5 & 6 "	5.9	18.8	7.8	6.0

Table 229

Comparison of Vocabulary ages with norm. One-year age groups.

Age (yrs.)	E.P.V.T. Raw score	E.P.V.T. Voc. age.	C.V.S. Raw score	C.V.S. voc. age.
16	110	17.9	66.3	13.5
15	93.7	13.2	63.7	13.0
14	94.5	13.4	63.0	12.5
13	72.3	10.1	50.9	10.5
12	74.0	10.5	41.6	9.5
11	68.5	9.9	44.3	10.0
10	55.7	7.9	32.5	8.5
9	54.3	7.5	29.1	8.0
8	45.8	6.7	29.8	8.0
7	47.0	6.9	24.3	7.0
6	35.7	5.5	19.1	6.0
5	29.5	5.1	18.5	6.0

Table 230

Perceptual age. Two-year groups.

Age (yrs.)	Bender Gestalt	Raven's C.P.M.
15 and 16	8.0 years	10.5 years
13 " 14	6.7 "	10.3 "
11 " 12	6.3 "	9.0 "
9 " 10	5.7 "	7.5 "
7 " 8	5.3 "	6.5 "
5 " 6	4.5 " (approx.)	5.0 "

Table 231

Perceptual age. One-year age groups.

16	9.5 years	11.2 years
15	7.0 "	10.1 "
14	7.0 "	10.8 "
13	6.6 "	9.5 "
12	6.6 "	9.6 "
11	6.3 "	8.7 "
10	6.0 "	7.5 "
9	5.5 "	7.4 "
8	5.3 "	7.3 "
7	5.0 "	5.7 "
6	4.5 " (approx.)	5.3 "
5	4.5 " "	4.5 " (approx.)

Table 232

Comparison of mean chronological ages with mean of Bender Gestalt error scores.

BOYS.

School	No.	Mean error scores	s.d.	Mean C.A.	s.d.	Mean of normal error scores for C.A.
A	16	10.7	8.3	8.3	2.5	3.3
B	15	17.1	9.8	9.0	3.2	1.5
C	12	13.3	5.7	7.7	2.4	4.9
D	21	8.5	8.2	11.8	3.3	1.1
ALL.	64	11.9	8.7	9.5	3.3	1.5
GIRLS.						
A	12	12.1	7.8	8.5	2.9	2.4
B	12	15.5	7.1	8.6	2.2	2.4
C	17	13.4	7.3	7.7	2.8	4.3
D	25	7.4	5.1	11.7	2.9	1.1
ALL.	66	11.2	7.2	9.3	3.3	1.5
BOYS AND GIRLS.						
A	28	11.3	8.0	8.4	2.7	2.7
B	27	16.4	8.6	8.8	2.7	2.0
C	29	13.4	6.5	7.7	2.6	4.3
D	46	7.9	6.6	11.7	3.0	1.3
ALL.	130	11.6	7.9	9.5	3.2	1.6

3

Table 233

Reading.

Means and standard deviations of raw scores and reading ages in one-year age groups.

Age	n.	Raw score m.	Raw score s.d.	Mean Reading age (years)
16 yrs.	3	77.7	51.7	10.9
15 "	6	99.5	7.8	12.0 fluent
14 "	4	98.0	5.9	12.0 fluent
13 "	12	57.7	39.8	9.0
12 "	7	56.1	24.5	8.9
11 "	14	43.4	36.1	7.6
10 "	10	41.1	28.1	7.4
9 "	11	30.1	31.7	6.6
8 "	10	16.4	20.4	6.0
7 "	14	16.4	16.9	6.0
6 "	17	6.9	12.3	5.5
5 "	22	0.4	1.0	5.0

Table 234

Reading ages. School Department.

Dept.	n.	m. C.A.	s.d.	m. reading age.
Infants	53	6.3	0.9	6.4
Juniors	45	10.1	1.2	6.8
Seniors	32	14.0	1.2	10.4

Infants 5 - 7 Juniors 8 - 11 Seniors 12 - 16

Table 235

Reading. Two-year groups.

Age	m. C.A.	m. raw score	s.d.	m. reading age.
15 & 16 yrs.	15.6	92.2	28.7	> 12.0
13 & 14 "	13.8	67.8	38.6	9.9
11 & 12 "	11.9	47.6	32.7	8.0
9 & 10 "	9.9	35.3	29.8	6.9
7 & 8 "	7.9	16.4	18.0	< 6.4
5 & 6 "	5.9	3.2	8.7	< 6.4

Table 236.

Reading (Age groups above 9 yrs. of age.)

Age	n.	Non-readers.	Needing remedial help.	Acceptable*	Fluent**
16 yrs.	3	0	1	0	2
15 "	6	0	0	0	6
14 "	4	0	0	0	4
13 "	12	1	4	3	4
12 "	7	0	5	1	1
11 "	14	2	7	3	2
10 "	10	1	6	3	0
9 "	11	3	5	2	1
	67	7	28	12	20
Percentage		10.4	41.8	17.9	29.9

* less than 1 year's retardation.

** > than reading age of 12.0 years.

Table 237.

Reading. With and without shunts (over 9 years of age).

	Non-readers	Needing remedial programme.	Satisfactory	Fluent.
With shunt	5	24	5	12
%	10.9	52.1	10.9	26.1
Without shunt	2	8	3	8
%	9.5	38.1	14.3	38.1