# SOME ASPECTS OF GENERALIZED IMITATION IN SUBNORMAL CHILDREN

by

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"An adventure:  a novel enterprise
undertaken for its own sake"

Wilfred Noyce.

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## ABSTRACT

Explicitly rewarding the imitation of actions demonstrated by a model provides a method for training new behaviour in mentally retarded children. After such training even initially nonimitative children will often copy further novel actions even though such imitations are not rewarded (generalized imitation). A review of the literature on this topic suggested that many aspects of this phenomenon had not been adequately investigated. The research for this thesis therefore studied a number of practical aspects of imitation training in a total of fourteen initially nonimitative subnormal children. Five experiments were performed using a discrete trial paradigm.

Experiment 1 compared two methods of training generalized imitation in initially nonimitative children. The first method involved varying the actions demonstrated for imitation from trial to trial (a 'Cumulative' method). In the second method, imitation of each action was trained to criterion performance in isolation (a 'Serial' method). Both methods successfully trained imitation and generalized imitation, but the results suggested that the 'Cumulative' method was the more efficient.

Experiment 2 investigated the maintenance of imitation by intermittent reinforcement. The 'imitations' of one group of subjects were reinforced on a variable-ratio schedule and those of the other on a continuous reinforcement schedule. Both reinforcement conditions maintained 'imitations' and 'generalized imitations' at high, stable levels, but the group maintained under variable-ratio reinforcement showed greater resistance to subsequent extinction (the Partial Reinforcement Effect).

In Experiment 3, subjects who had been trained to reproduce the actions of a particular model in one setting were tested in different locations and with different models. Changes in both variables resulted in decrements in 'imitative' and 'generalized imitative' response performances.

In Experiment 4, a discrimination was established with three subjects by training imitation in the presence of a large ball and non imitation in the presence of a small ball. Imitation was then tested for various other ball sizes. Levels of imitation decreased as the test stimuli increasingly differed in size from the large ball. "Generalized imitations" occurred at about the same level as 'imitations' for each test stimulus.

In Experiment 5, all previously trained subjects were tested after an interval of three months with no formal imitation training. Some children then demonstrated decrements in imitative responding but rapidly recovered former levels of performance upon brief refresher retraining.

The results suggested that, for clinical purposes, the "imitations" and "generalized imitations" of retarded children may be expected to show some characteristics of a single functional response class. However, some parts of the present results as well as other published data indicate such an account does not completely explain all aspects of the phenomenon.

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# CHAPTER 1

## INTRODUCTION:

## THE SCOPE OF THIS THESIS

The experimental work to be described in this thesis investigated specific aspects of trained imitative behaviour in young, subnormal children. These children form a distinct if heterogeneous population whose main distinguishing feature is a lack, to varying degrees, of appropriate development in intellectual, social and self-help skills. Although these features, particularly in more extreme cases, are often compounded with a variety of obvious physical and neurological handicaps, few instances of developmental retardation can be causally linked in a direct manner with biological conditions. Accordingly, opportunities for treatment through medical procedures are limited. Nevertheless, a variety of hypothesized constructs have been proposed to account for "mental subnormality". Most have inferred that lack of normal development results from a "defective" brain. At that point, however, further explanation ceases as the nature of the "defect" can seldom be defined. Equally obscure is the exact relationship between the "defect" and the retarded individual's (observed) behaviour, the latter forming, in essence, the basis of the diagnosis.

An alternative view, derived originally from previous 'operant conditioning' - based laboratory work with animals and human subjects, still recognises the possibility of physiological defects or damage but concentrates on the influence exerted by environmental conditions over the behaviour of retardates. It is suggested that the behaviour of retarded children can profitably be viewed in terms of the interaction of an organism behaving as a unified system in an inseparable context of environmental events. That is, retardation is conceptualized in terms of observable, objectively defined and reproduceable functional relationships without either appealing to hypothetical constructs or reducing the cause of behavioural events to biological events. Chapter 2 will examine the behaviour of retardates, and particularly children, from this viewpoint and attempt to establish its usefulness.

One clear benefit derived from such functional analyses of environmental control over subnormal behaviour has been the development of principles for behaviour modification by which the response patterns of retardates may be supplemented or changed. In this context, various authors have suggested that the use of imitation, where a child copies actions demonstrated by a model, might provide a particularly efficient technique for rapid training of varied novel responses in young retardates. Chapter 3 examines various theoretical views of imitation. Of those proposed, the functional view typified in the empirical 'generalized imitation' phenomenon has most in common with the rationale of behaviour modification techniques and holds most promise of successful incorporation into these procedures. Particularly, it provides a method of training imitation in initially nonimitative children. Limited experimental work, however, also to be reviewed in Chapter 3, suggests that the control exerted over imitative behaviour by antecedent setting conditions and consequent stimuli, and also determinants of generalized imitative behaviour may vary between distinct subject populations. With the possible clinical use of generalized imitation as a training technique in view, the experiments to be described in this thesis examined various aspects of the phenomenon in a defined population to whom such training might prove of value; that is young, initially nonimitative, subnormal children. The topics for investigation are indicated in Chapter 4, and main methodological procedures considered in Chapter 5. Chapter 6 describes the experiments in detail and, finally, Chapter 7 indicates main general conclusions and attempts to place these in the wider fields of imitation and subnormality.

# CHAPTER 2

## INTRODUCTION TO SUBNORMAL BEHAVIOUR

Comprehensive reviews of the area of mental subnormality have been provided by Stevens and Heber (1964) and Clarke and Clarke (1965), among others. This chapter is intended as a brief introduction only to the field with particular emphasis on the behaviour of retardates and on indicating the possibilities of behavioural treatments for their training and education. Thus this is a selective review of papers relevant to the behaviour of subnormal individuals.

## 1. The field of subnormality

There are at present in England, Scotland and Wales approximately one million individuals of all ages classified as "mentally subnormal" and "severely subnormal". Of this group, which represents approximately 2% of the population of the United Kingdom, some 150,000 are full time residents in institutions or attend special Training Centres.

Confusion abounds in the names used to describe this population; "mentally retarded" is the term used in the United States and has also been adopted by the World Health Organization. In England and Wales the present statutory terms are "subnormal" and "severely subnormal', which have replaced the description "mentally defective", the latter still being used in Scotland. In June 1971, a government white paper ("Better Services for the Mentally Handicapped") added further complexity by introducing the term "mentally handicapped". Unfortunately, such a term appears of euphemistic rather than practical use. The implied hypothetical aetiology involves concepts that are not readily open to investigation and does not provide a theoretical framework upon which to base research into therapeutic techniques. Rather, it serves "to emphasize that our attitude should be the same as to other types of handicap; that is, to prevent it whenever possible, to assess it adequately when it occurs and to do everything possible to alleviate its severity and compensate for its effects" (p.1).

For the purposes of this thesis, where extensive reference will be made to sources both British and American, the terms "mentally subnormal" and "mentally retarded" will be used interchangeably as the text demands.

Spradlin and Girardeau (1966) described the behaviour of severely retarded persons, especially those in residential centres thus:-

"(They) most frequently do not dress themselves, are not totally toilet trained, and in many instances do not even feed themselves. Their social reactions to many people vary a great deal. Some approach adults in a clinging manner, some pay little attention to adults and some avoid contact with the adults in their environment. Their interaction with peers and their verbal behaviour frequently are quite limited. Some say a few isolated words and phrases but many exhibit no intelligible speech. Their communication with other persons is more often than not limited to crying, screaming, crude gesturing and tugging at the person as a small child would do. Their responses to speech of other persons are quite limited and many do not even respond to their own names. Imitation of children or adults is often extremely limited or absent .... (They) exhibit a variety of responses to physical objects in their environment. For example, they may not respond to a toy or they may mouth the toy, attempting to rip it apart or perhaps throw it. They spend much of their time in such repetitive behaviour as rocking, rolling their heads from one side to the other, flicking their fingers in front of their eyes, masturbating, hand wringing and thumb-sucking"(p.258) .

Other features common to the subnormal population have been indicated by Stevens (1964):-

"They usually have considerable central nervous system impairment and organic pathology is present to an unusual extent. Many present other types of handicapping conditions in addition to mental retardation such as blindness, deafness, epilepsy and gross physical anomalies ... (their) life expectancy may be assumed to be far below average and most of these individuals require lifelong supportive residential care. Relatively few families are able, physically or financially to provide for this type of care and management in their own home"(p.4) .

These accounts draw attention to both organic and behavioural phenomena. In that any mentally subnormal individual may exhibit, to a varying degree, some or all of the features outlined above, the usual clinical practice of regarding the mentally retarded as a heterogeneous group appears well justified. In addition, however, many of these features may be observed in children with diagnoses of 'autism' and/or childhood schizophrenia or organic brain damage. Robinson and Robinson (1965) indicated that mental retardation, functional psychosis and brain damage are not mutually exclusive and may occur in the same individual. Such a comment may reflect, in part, inadequacies in current diagnostic techniques and syndrome categorization; it should, however, be noted that the characteristics of these conditions, their clinical management (excluding specific medication, for example, for epilepsy) and eventual methods of rehabilitation have much in common.

The most fruitful research and treatment procedures in recent years with individuals of varied diagnoses but who display delayed or abnormal behaviour development have resulted from a formulation which includes the term "developmental retardation" (Bijou, 1963). This term ".... is used in preference to such descriptions as "feebleminded", "mentally deficient", "mentally defective", or "autistic" since it avoids mentalistic implications and is neutral with respect to aetiology"(Orlando, 1961, p. 615).

Throughout this thesis, the term "developmentally retarded" will be used in a descriptive manner to embrace all individuals who exhibit markedly delayed or completely absent development of usual behaviour patterns (e.g. speech) without differentiation between possible, inferred diagnoses. Particularly the term will be used collectively in reference to both subnormal and allegedly "autistic" subjects.

## 2. Definitions of Subnormality

Because of the heterogeneous nature of the subnormal population, to date no system devised to classify the degrees or levels of retardation has been completely acceptable to all professional disciplines concerned with the welfare of this group (Stevens, 1964). Equally, the composition of an operational definition of mental subnormality has proved difficult; various attempts have, however, been made. The Mental Health Act, 1959, which is relevant for British use, defined "severe subnormality" as meaning "the illness, or arrested or incomplete development of mind which includes subnormality of intelligence and is of such a nature or degree that the patient is incapable of living an independent life or of guarding himself against serious exploitation, or will be so incapable when of an age to do so."

In the same document, "subnormality" is defined as "a state of arrested or incomplete development of mind (not amounting to severe subnormality) which includes subnormality of intelligence and is of a nature or degree which requires or is susceptible to medical treatment or other special care or training of the patient."

The American Association on Mental Deficiency speaks of "sub-average intellectual functioning which originates during the developmental period and is associated with impairment in adaptive behaviour" (Heber, 1959). In referring to the dual criteria of reduced intellectual functioning and impaired social adaptation, Heber (1959) pointed out that "it is the impairment in social adaptation which calls attention to the individual and determines the need for social or legal action on his behalf as a mentally retarded person; it is the below average intellectual functioning which distinguishes mental retardation from other disorders of human efficiency"(p.3).

Three factors are mentioned above which have typically featured in definitions of subnormal behaviour and have often been considered in the diagnosis, placement and management of any individual. These are:-

a) some formalized assessment of intellectual capacity;
b) the onset of the defect with particular reference to biological events;
c) the adequacy of social competence and adjustment of the individual.

The relevance of each factor will be considered in turn.

Assessment of Intellectual Capacity. Traditionally, the assessment of intellectual capacities has relied heavily on a comparison between an individual's performance on a number of standard (but arbitrarily chosen) tasks and what is considered to be an "average" performance for all individuals of the same chronological age. From such a comparison is derived an "intelligence quotient", a process exemplified in the Wechsler Adult Intelligence Scale (Wechsler, 1958) and Stanford Binet Intelligence Scale Form L-M (Terman and Merrill, 1960).

The use and derivation of such quotients have been widely criticized on a number of grounds. The testing of subnormal individuals can prove a particularly difficult task because of their poor motivation, concentration and manipulative skills; hence results may be of low reliability in that items are administered in an unstandardized manner. The majority of psychometric tests available require an individual's results to be interpreted by comparison with normative data gained from a large "normal" population; the applicability of such data to a specific "subnormal" population is debatable. In addition, many subnormal children are too handicapped to score on even the earliest items of "relevant" tests.

As Heber (1959) and Ullman and Krasner (1969) have pointed out, both the diagnostic labels "mentally retarded" and "mentally subnormal" and the position on most scales of degree of retardation are usually based on the intelligence quotient of an individual. Such intelligence test scores are sometimes held to reflect a hypothetical "amount of intelligence" or inborn ability, while in reality they report a test performance. An "intelligence test" requires a definition of intelligent behaviour and although retardation is diagnosed in terms of intelligence quotient, this latter is usually a statment about observed behaviour.

Hence, the criteria upon which the diagnostic labels "mentally subnormal" and similar are applied to individuals are the behaviours of such individuals, whether or not inferred hypothetical criteria are deduced from the raw data of test performance.

As dissatisfaction with "intelligence testing" has grown, attempts have been made to assess an individual's observable behaviour in wider social settings. The Vineland Scale of Social Maturity (Doll, 1953) provides a "social quotient", from interview accounts and direct observations to criteria of social competence and behaviour. Normative data from a "normal" population is, however, still used to assess developmental levels.

"The term 'backwardness' becomes meaningful as a descriptive label applying to certain mentally handicapped people only when it refers to a standard set by the achievements of the mentally handicapped themselves"(Gunzburg, 1969). The Progress Assessment Chart (Gunzburg, 1969) is essentially an inventory of social skills, knowledge of which will ease the adjustment of the mentally handicapped to community demands. The content has been specifically designed for use with this population and data are obtained by direct observation of an individual's behaviour in its usual life setting; thus is provided a qualitative picture of social function and dysfunction rather than a quantitative test score.

Thus, at present, the "assessment" of the subnormal seems, at least in part, to be moving away from attempts to measure hypothesized innate "amounts of intelligence" and towards direct behavioural observation techniques, with the implicit hope that behaviour might be altered by treatment methods to be described later (Chapter 2, section 4).

Relevant Biological Events. Previous mention has been made (p.8) of increased probability of organic pathology in the subnormal population; at the same time, however, definite aetiological organic diagnoses can be given in comparatively few cases of retardation. For example, Ullman and Krasner (1969) estimated that although about 25% of all cases of retardation are associated with explicit physiological anomalies, the remainder are not. This 25% of the subnormal population, generally those in particular need of nursing care, include a high proportion of individuals with definite brain disorders. These may be genetic in origin, the result of dietary and metabolic deficiencies and defects, or arise from pre-natal or birth injury or later trauma. The exact mechanisms by which these disorders eventually reach the point of influencing the behaviour of an individual are for the most part, unclear; in general terms, the aetiology of biological anomalies is the field of the biological and medical sciences and not primarily the concern of an account and analysis of subnormality by a science of behaviour. Examples of physiological anomalies correlated with subnormality will now be indicated, but more comprehensive accounts of the field have been given by Waisman and Gerritsen (1964) and Anderson (1964) who have attempted, where possible, to follow linkages of biochemical defects to show exactly how the nervous system (and hence behaviour) are affected by such anomalies. For present purposes, however, initial conditions only, known to be associated with subnormality, will be mentioned.

Various syndromes correlated with mental retardation and caused by chromosomal aberration have been identified; one such is that of mongolism (Down's Syndrome). Lejeunne, Gautier and Turpin (1959) and subsequent studies have found 47 instead of the normal compliment of 46 chromosomes in approximately 95% of mongoloids, the chromosome 21 being typically trisomic.

Metabolic and storage disorders have also been identified that are associated with subnormality; a relatively common example is that of Phenylketonuria, a metabolic anomaly transferred by a recessive gene, in which the brain is damaged by phenylalanine metabolites (Waisman and Gerritsen, 1964). With this and other similar such disorders, resulting physiological abnormalities can frequently be alleviated by carefully controlled dieting.

Hypo- and hyper-secretion of the endocrine glands can also produce anomalies related to retarded development. For example, Cretinism may result from hypo-secretion of the thyroid gland (Waisman and Gerritsen, 1964). Correlated often with subnormality are malformations of the skull and brain (e.g. microcephaly and hydrocephaly) and neurological disorders (e.g. cerebral palsy and epilepsy).

Adverse effects on later development can often result from acute maternal infections (e.g. rubella or syphilis), or the use of certain drugs such as L.S.D. or Thalidomide (Speirs, 1962). In these cases, damage may not be confined only to the nervous system but also extend to gross malformation of receptor organs and limbs.

Brain trauma may occur at birth from gross anoxia or other causes, or at any time throughout life. Physical damage from accidents, tumours and encephalitis and the ingestion of certain toxic chemicals (e.g. lead) can also cause dysfunction of the nervous system.

Although many of these conditions, once detected, may have diagnostic and predictive value as indicators of probable retardation of behavioural development, in many cases no medical treatment is possible. There are, however, some exceptions. Medical and dietetic treatment is possible for cretinism and phenylketonuria, success depending very much on early diagnosis. Equally, in cases of hydrocephaly (caused by blocking of the outlets for the cerebrospinal fluid from the ventricles, or failure of absorption), surgical treatment may also prove successful. In this latter instance, damage to the central nervous system through excessive internal pressure may be minimized by the early fixture of a Spitz-halter drainage valve. Abnormal anatomical structure and physiological functioning may be reflected in behaviour and particularly place limits on individual response repertoires, thus setting 'biological' constraints that limit possible achievements through behavioural treatments. Relationships between physiological functioning and behaviour will be examined later. For the present, however, the point is made that in practical terms, behaviour patterns may be changed and augmented without reference to internal workings of the central nervous system or knowledge of specific biological factors.

Approximately 75% of all cases of developmental retardation do not reveal any known physiological pathology; such persons are almost invariably mildly retarded (Zigler, 1967). Girandeau (1971) has labelled as "cultural-familial retarded" people of this level who also have a parent or sibling who is subnormal. Differences in genetic material between this population and that of the 'normal' population have not been reported, but this does not eliminate the possibility that such differences will emerge in the future. As Girardeau (1971) has emphasized: "a behavioural approach to cultural-familial retardation (or any subcategory of developmental retardation) can accomplish its aim without an assumption of genetic differences"(p.341). Furthermore, "the view that mental retardation consists of symptoms or traits which are a direct expression of the genes is totally incomparible with modern findings in biochemistry." (Zimmerman, 1965, p.178)

Social Competence and Adjustment. Most descriptions and definitions of retardation refer to a reduction in the rate at which social behaviours are normally developed. Typically there is an absence of certain behaviours from the "normal" behavioural repertoire acquired during development. Also, the frequency and topography of certain existing behaviours are usually associated with persons of a younger chronological age. In addition, socially inappropriate or abnormal behaviours that are not usually acquired in a 'normal' behavioural repertoire are frequently developed. Such behavioural "deficiencies" or "abnormalities" are usually termed "reduced adaptation" or "adjustment".

Present society makes expectations and demands on all individuals in terms of independence and social conformity. There is, within the subnormal population, a wide range of social competence. The mildly retarded adult may require a sheltered work environment, involving simple repetitive tasks and live in a locally situated hostel with considerable social independence and minimal supervision. Similarly, the mildly retarded child may attend a Local Authority Education Department "special school" in which small class sizes, pace of work and teaching methods are designed to meet the needs of the slow learner. Alternatively, subnormal individuals of all ages may be totally unable to acquire even basic self-help skills to the extent that they are totally dependent on others, either family or hospital staff and require total supervision. Equally socially undesirable or criminal acts may also bring attention to an individual.

Thus, subnormality may be indicated by a lack of social independence or a transgression of the social norms of the society in which the subnormal individual lives.

Labels such as "subnormal" and "retarded" are social classifications which will dictate a society's attitudes to such persons and will determine how other people behave in their presence. The government White Paper "Better Services for the Mentally Handicapped" stated that its aims were "to invite greater sympathy and tolerance on the part of the public for the mentally handicapped"(p.1) . Such "sympathy" and "tolerance" may include an expectation of lack of certain skills or emission of behaviours at inappropriate times or inappropriate situations by a retardate which will then be encouraged. Also, the labelled person is regarded as being in no way responsible for his actions.

Thus, in practical terms, despite difficulties in the definition of a heterogeneous population and often uncertainty about precise mechanisms involved, three main factors of "tested intelligence" (or observed behaviour), organic abnormality and (observed behaviour) social adjustment may be relevant for consideration in the detection, diagnosis and treatment of the subnormal individual.

3. Analyses of Subnormal Behaviour

Difficulty has arisen in attempts to establish direct causal factors that will account for subnormal behaviour patterns. Any successful model will need to combine both biological and behavioural features and comment how one group may affect or lead to the other. Analyses have been attempted that lay emphasis on possible biological causation of subnormality whilst others stress the functional control of the behaviour of the retardate.

Biological Analyses. The traditional medical model holds that problem behaviour of any kind is a symptom of an underlying, usually physical aetiology. As previously indicated (p.13), about 25% of the subnormal population show evidence of biological abnormality but in few cases have these abnormalities been shown to account directly for the retardation. In the past, the concept of "defective intelligence" has been said to be generated by processes such as hereditary, familial, constitutional, intrinsic or indigeneous factors, and modified by detrimental environmental, extrinsic or exogenous factors (e.g. Tredgold and Soddy, 1963).

Retardation is also viewed as a biological anomaly (a "defective brain") which limits the ability to learn. Kugelmass (1954) stated that ".... mental deficiency is a symptom of cerebral dysfunction" (p.10). Stafford-Clark (1963) described mongols as "placid and happy idiots whose whole bodies bear ample evidence of the widespread constitutional nature of their abnormality" (p.90).

Such comments do not, however, indicate the manner in which the hypothesized defects give rise to the behaviour of the retardate. Indeed, approaches such as these assert that causes of retarded behaviour are biological rather than encourage an investigation of possible relationships between biological functions and behaviour.

Skinner has examined some of the pitfalls of hypothetico-deductive methods of studying behaviour, including appeals to inner entities of which behaviour is said to be a sign or symptom. The process of inferring causes from behaviour has been traced (Skinner, 1953) in which adjectives used initially to describe behaviour eventually acquire the status of traits (e.g. "intelligence") with causal properties. "But at no point .... do we make contact with any event outside of the behaviour itself which justifies the claim of a causal connection"(Skinner, 1953, p.202).

Indeed, Zimmerman (1965) has stated that a search for a single cause of retardation such as defective intelligence or defective neural cells is "futile". Such a search represents views which are remnants of dualism in which the brain and external world are seen as separate causal entities. As Ullman and Krasner (1969) pointed out, a retarded person, albeit brain injured, continues to interact with his environment and to be changed by his experience.

Girardeau (1971) suggested that biological scientists interested in behaviour should ask specific questions within the form: "what procedures are necessary and sufficient to change X set of biological characteristics so that Y behaviour may be more difficult or easier to develop, maintain, reduce or eliminate?" (p.342).

Functional Analyses. As indicated previously, the overt behaviour of a retarded person determines his diagnosis, the social label attached to him, the attitudes of society towards him and the way in which others deal with him and behave in his presence. Much recent research on retardation has studied the observable behaviour of subnormal individuals.

A science of behaviour in which the functional relationships between operationally defined environmental events and behaviours are empirically determined was proposed by Skinner (1938) and has been defined with its distinguishing features explained elsewhere (Skinner, 1966).

Briefly, an organism is conceptualized as a source of responses, which are divided into two functional classes:-

a) "respondents", which are controlled primarily by preceding stimulation and are largely insensitive to consequent stimulation, and

b) "operants", which are freely emitted behaviours controlled primarily by consequent stimulation, their attachment to preceding ("discriminative") stimuli being dependent upon the stimulus consequences made in the presence of these "discriminative stimuli".

"Operant conditioning" is the procedure of changing the probability of emission of a behaviour by making contingent a class of stimulus events called "reinforcers". The nature of such stimuli is, in general terms, theoretically limitless, although in practice some have been found more effective than others, particularly in regard to specific species or types of organisms; empirically, any stimulus event may be said to act as a reinforcer if its occurrence after a response alters the subsequent probability of emission of that response. Experimentally, stimuli such as food, electric shock or social approval have been found to have this effect, either in their occurrence or removal contingent upon the relevant behaviour; for maximum effect, however, reinforcement should follow as soon as possible the response upon which it is contingent. Considerable control can be exerted over behaviour by manipulating the conditions under which responses can be exerted over behaviour by manipulating the conditions under which responses can be reinforced; the various ways in which these conditions are specified are known collectively as "schedules of reinforcement".

The systematic use of a functional analysis of behaviour has encompassed many organisms and has been extended to cover child development (Bijou and Baer, 1961, 1965). Bijou (1966) defines behavioural (or psychological) development as "progressive changes in interactions between the individual as a total functioning biological system and environmental events" (p.2).

A functional analysis of retarded development views the retardate as an individual with a limited repertoire of behaviour resulting from previous interactions between him- or herself and the environment (Zimmerman, 1965); "..... biological, physical and social conditions of development deviate in the direction of slowing down the pace of successive interactional changes"(Bijou, 1966, p.2). Retarded behaviour is regarded as a function of these conditions, all of which are treated as independent variables, but whose interrelations and relationships with behaviour are, in reality, complex (Bijou, 1963, 1966; Zimmerman, 1965). It is, however, customary to isolate conditions and behaviour wherever possible for investigative purposes.

As indicated previously (p.18) retarded behaviour is frequently attributed solely to physiological aetiology. It is becoming increasingly clear that physiological factors lead ultimately to behavioural deficiencies only in a variety of indirect and complex ways. "Since biological anomalies range from mild to severe, the effect of such conditions on psychological (behavioural) development extends from inconsequential to devastating"(Bijou, 1966, p.7).

Zimmerman (1965) comments that "normal behavioural development usually follows a sequence in which a hierarchy of levels of skills are successively 'tripped off' as the child develops. Each new skill acquired introduces the child to a broader environment" (p.182). A physically impaired child cannot perform tasks involving response components which he is unable to execute; hence the consequences of such tasks in terms of further physical and social stimuli available are curtailed, altering the nature and progression of stimulating conditions in a retardate's environment. Similarly, as a result of organic impairment, some stimuli never become accessible to certain children (e.g. the blind or deaf), hence reducing the range of discriminative and reinforcing stimuli in the common environment which can control behaviour. The physically impaired child may also suffer from restricted stimulation because of his appearance. As Zimmerman (1965) said of this relationship: "Children of grotesque physical appearance may be avoided by others, or others may react to the strange child, but in an abnormal and restrained manner. These results superimpose social deprivation upon physical defect"(p.182). Again, biological deficits may act to slow down ease or rates of learning, with the result that the child becomes discouraged and either lacks persistence or refuses to attempt tasks as a means of avoiding failure and its consequences.

In a general comment on all "limiting biological factors", Bijou and Baer (1961) have suggested that they be regarded as "setting conditions" for behaviour.

Further "social" conditions of development may also be lacking or inadequate, both in terms of reinforcement and discrimination histories. Bijou (1963, 1966) and Ferster (1961) have discussed how such instances may lead to retarded behavioural development, while acknowledging that empirical data are lacking for the subnormal population. Clarke and Clarke (1959), however, noted that severely retarded hospitalized adolescents showed increases in "intelligence quotient" scores (and therefore, perhaps greater social adaptation) soon after they were moved to a "more stimulating" environment.

Established behaviour may be eliminated when reinforcements are made infrequent or produced in inadequate amounts (Spradlin, Girardeau and Corte, 1965) or when extinction ("the removal of contingent stimulus conditions that maintain the behaviour") (Spradlin, Girardeau and Hom, 1966) or noncontingent reinforcement (Redd and Birnbrauer, 1969) are introduced.

As Bijou (1966) points out "an analysis of retardation should take into account the processes that fail to initiate new chains of behaviour as well as those that fail to maintain behaviour all established" (p.12). Failure to perpetuate a class of behaviour in strength not only eliminates it from a person's repertoire but also renders almost impossible in later development the establishment of behaviour elaborations that are necessary for adequate adjustment. For example, Ferster (1961) emphasized that "verbal behaviour depends entirely for its development and maintenance on reinforcements supplied by an audience. Because of the possibility of prolonged extinction and infrequent, intermittent reinforcement, speech and social behaviour are the most vulnerable aspects of the child's repertoire" (p.444).

Equally punishment ("contingent aversive stimulation") can suppress the behaviour of retarded children (e.g. Risley, 1968) and frequently total suppression can follow just one, or very few presentations of a response-contingent aversive stimulus. As Bijou (1966) has observed, "more than one clinical account has been given of a young child who stopped talking following a traumatic physical episode" (p.15). Not only can aversive stimulation limit the development of "normal" behavioural repertoires, it may result in the development of maladjusted avoidance behaviours (Ferster, 1958).

Ullman and Krasner (1969) have discussed how "retarded" and other "abnormal" behaviour is frequently reinforced and maintained unknowingly by other people in society in a manner similar to that which Parsons (1951) called the "sick" social role behaviours of "patient" and "therapist". Essentially "abnormal" behaviour by the "patient" may be reinforced by attention from the "therapist" who is also reinforced by the temporary cessation of the aversive behaviour; the patient's retarded behaviour is maintained by unfortunate contingencies of reinforcement.

Thus, a functional model of the behaviour of retardates suggests that such behaviour is controlled by present stimulus conditions; the causes of the behaviour are empirically viewed as those environmental events, including biological events or processes which are effective in influencing the occurrence or non-occurrence of behaviour patterns. In that such events are operationally definable, no appeal is made to hypothesized "internal" processes and all aspects of the model are open to empirical study. Many functionally orientated studies of developmentally retarded behaviour have been made; attention will be drawn to those with relevance to the present thesis at appropriate points in the text.

## 4. Behaviour Modification

A science of behaviour provides not only an experimentally verifiable model of retardation, but also practical principles whereby behaviour patterns of subnormal individuals may be altered. Indeed, although perhaps a little naive as a total explanation of subnormality, the most encouraging result of the systematic application of a functional analysis to the behaviour of the developmentally retarded and other populations has been the wealth of successful therapeutic procedures that have resulted (Spradlin and Girardeau, 1966; Nawas and Braun, 1970 a, b, c). Commonly labelled "methods of behaviour modification", these procedures are concerned with the decrease in frequency and elimination of undesirable behaviours, the increase in frequency of adaptive behaviour patterns and the acquisition of new, desired behaviours.

Elimination of behaviour. Behaviour patterns occur which are either injurious to the individual who emits them, unpleasant or aversive to others, or which interfere with training procedures. Behaviour modification methods suggest various ways in which the frequency of such behaviour patterns may be decreased. Thus, Wolf, Birnbrauer, Lawler and Williams (1970) eliminated vomiting behaviour through extinction while Muttar, Peck, Whitlow and Fraser (1975) stopped self-mutilation by a young subnormal girl using a contingent punishment procedure. Gardner (1969) has reviewed the use of such punishment procedures with the mentally retarded.

"Time out" methods, which involve the removal of an individual from a setting that appears to possess unreadily identifiable reinforcing elements, have been used to eliminate undesirable behaviour (Nawas and Braun, 1970 b). Gardner (1971), however, points out that "time out" procedures with the retarded may be effective for a number of reasons:-

a) the removal of the possibility of positive reinforcement for the undesired behaviour, or of the child receiving any positive reinforcers for any behaviour for a period of time, or

b) the suppressing effects of the presentation of acquired aversive stimuli.

The separate contributions of these have not been evaluated in studies involving the mentally retarded. "Therefore treatment strategies used in specific cases must be an aspect of a carefully planned programme which evolves from a systematic behavioural analysis of the individual being treated" (p.113).

Increase of behaviour frequency. The most common technique in practice for increasing the frequency of adaptive or desirable behaviour is the use of contingent "positive reinforcement" (a stimulus which increases the probability of occurrence of a response). Clearly, the range of relevant behaviours to be encouraged is vast in persons of limited repertoires. Girardeau and Spradlin (1964) increased the frequency of self-grooming skills in severely subnormal children by such a method.

Avoidance and escape procedures have been used to increase frequency of behaviour. This technique employs aversive or noxious stimuli (e.g. shock or restraint) which the person either avoids (prevents the occurrence of) or escapes (terminates the occurrence) by responding. There has not, however, been extensive systematic study of these procedures with retardates.

Acquisition of new behaviours. New behaviours that are not part of an individual's repertoire can be trained through "shaping" (Nawas and Braun, 1970 c), a technique long recognized in operant learning settings with animals. The therapist begins with whatever behaviour the retarded person brings to the training situation; by selective reinforcement, that behaviour is changed so that a given terminal performance is progressively more closely approximated. This is commonly known as the "method of successive approximations" (e.g. Skinner, 1967).

While this method can potentially be used to shape any simple behaviour within the individual's physical capabilities, such a procedure is often, in practice, painstaking and time consuming. Also, each unit of desired behaviour must be separately shaped in turn. Considerable economy could be achieved if the individual under training would imitate, on first presentation, any action specifically modelled by the therapist. In this way, a novel unit of behaviour within the retardate's ability could be introduced into the repertoire of that individual without resort to prolonged shaping techniques. However, as commented by Gardner (1971), "(in retardates) skills in imitating the behaviour of others are frequently poorly developed or absent" (p.277).

Flanders (1968) went so far as to claim "the success, promise and utility of imitation as a behaviour modification technique is beyond any doubt". The potential value of imitation in the training of subnormals has certainly been acknowledged by various authors (Bandura, 1965a; Nawas and Braun, 1970b; Sherman and Baer, 1969). But, as Sherman and Baer (1969) point out "in spite of the apparent usefulness of imitation procedures in behavioural development, they have not been extensively used to modify behavioural deficits" (p.202). Again, Nawas and Braun (1970b) echo "the field of imitation remains largely uncharted with mental deficients" (p.20).

With these varied comments in mind the next chapter reviews the field of imitation, particularly to assess the possibilties for inclusion and use of such behaviour in education and training programmes with young, subnormal children.

## Summary

This chapter provides a brief introduction to the field of subnormality, with particular emphasis on the behaviour patterns of retardates. The main distinguishing feature of this heterogeneous population is a lack, to varying degrees, of appropriate development in intellectual, self-help and social behaviours. Various organic conditions are often associated with such developmental retardation but, in many cases, causal relationships between the biological condition and the behaviour are tenuous; medically based treatment procedures are correspondingly limited in scope.

Hypothesized 'explanations' to account for subnormal behaviour in terms of biological defects have proved unsatisfactory as the proposed variables involved are not open to scrutiny and investigation. In contrast, analyses of such behaviour (or its lack) in terms of the control exerted by observable and reproducable environmental events have produced publicly verifiable demonstrations of how developmentally retarded behaviour patterns might come about, also taking into account biological defects. In particular, the rationale of such investigations has been successfully extended to include training and remediation procedures for retardates that include techniques for supplementing their behavioural repertoires. At the same time, in practical terms, the training of separate new responses in retardates by 'behaviour modification' methods may take considerable time. Various authors have suggested that the use of imitation might provide particularly efficient techniques for rapid training of varied novel behaviours.

# CHAPTER 3

## SELECTIVE REVIEW OF LITERATURE ON IMITATION

Chapter 2 has outlined views proposed to account for the behaviour patterns of subnormal individuals. In particular, functional analyses have emphasized the control exerted over retardate behaviour by antecedent and consequent stimuli and formed the bases of various behaviour modification procedures by which these response patterns may be altered. Specifically, it has been suggested that, in such a context, imitation might provide techniques to supplement and widen the behavioural repertoires of developmental retardates. This chapter is intended to review imitation as a potentially important behaviour for training and educating subnormal children.

## 1. Views of Imitation

"An observer is said to "imitate" a model when observation of that model's behaviour, or of expressions attributing certain behaviour to the model, affects the observer so that his subsequent behaviour becomes more similar to that of the model, ..... the study of imitative behaviour is concerned with causal relationships between the behaviour of the model and that of the observer"(Flanders, 1968, p.316) .

More specifically, Gewirtz and Stingle (1968) state "after the action of a model has been witnessed, the observer will often exhibit a response resembling the behaviour of the model. This response class, termed "imitation" does not, however, consist of a specific set of responses classifiable by content or similarity alone. Rather, a behaviour is termed "imitative" if it is matched to the cues provided by the model's action and is similar to his behaviour but is not the result of common stimulus antecedents or environmental constraints" (p.374).

As these definitions indicate, the most elementary form of imitation involves, on a given occasion, similarity of behaviour between one model and a single observer. To minimize confusion, throughout this thesis standard terms will be used for the behaviour of each member of this dyad; a unit of behaviour demonstrated by the model will be termed an "action" and consequent, similar behaviour emitted by the observer an "imitation" or "response".

Imitation has been studied in a variety of contexts including persuasive communication, conformity, collective behaviour, suggestibility, leadership and social learning. Perhaps the single most prolific such research area has been the role of imitation in child development. Gewirtz (1968) introduces the field thus:-
"... there are conventionally thought to be at least two processes by which children acquire both social behaviour patterns and the values and attitudes they reflect. The first involves social learning based on direct instrumental training; with specific socialization goals in view, reinforcing agencies are relatively explicit about responses the child must attain and these they attempt to shape through differential reinforcement. This direct-training process may be more or less efficient. There is, however, a second type of learning which is thought by some to proceed without direct tuition and to play the greater role in socialization. This learning occurs through the process ordinarily termed 'imitation'" (p.136).

Commonly, "imitation" indicates the immediate reproduction of discrete modelled behavioural units. The term "identification" has however, been used (e.g. Bronfenbrenner, 1960; Freud, 1920; Kagan, 1958; Sears, 1957) to describe and explain a variety of related phenomena. For example, while Gewirtz and Stingle (1968) suggested that "identification" "..... usually refers to the adoption by an individual of perceived abstract psychological characteristics of a model, such as motives, attitudes, values, roles or affective states" (p.375), Mowrer (1950) equated the term simply with performance of the model's behaviour in the latter's absence. Correspondingly, attempts to relate the concepts of "imitation" and "identification" (Bandura, 1962; Gewirtz, 1961; Mowrer, 1950; Sanford, 1955) vary considerably both in definitions used and end points achieved. Bandura (1968) commented on the resultant confusion: "there is little concensus about differentiating criteria; the phenomena have become hopelessly entangled in semantics as a result of efforts to differentiate various forms of matching behaviour. For example, on the basis of numerous arbitrary criteria one finds distinctions among "imitation", "identification", "introjection", "incorporation", "internalization", "copying" and "role-taking", to mention only a few of the more popular varieties" (p.218).

It would seem that the use of such terms attempts a distinction between immediate reproduction of specific modelled behaviours and a "higher-order" imitation which may involve a time interval before responding or change in either antecedent setting events or imitative behaviour emitted by the observer. Again, Bandura (1968) pointed out ".... unless it can be shown that learning of different classes of matching behaviour is governed by separate independent variables, distinctions proposed in terms of forms of emulated actions are not only gratuitous, but breed unnecessary confusion" (p.219).

With behavioural therapeutic measures for retarded development as a possible goal, this review and thesis will primarily deal with factors affecting imitation as defined at the start of this section; that is, the observable accurate reproduction by an observer of discrete behavioural units explicitly demonstrated by a model.

The different terms indicated above are, however, one facet of assorted views about the nature of processes underlying imitative behaviour. Theorists have evoked various combinations of "internal structures", "mediating processes", antecedent setting events, contingent reinforcement and different types of learning to account for such imitative phenomena. For convenience, these theoretical views may be considered to fall into three broad categories, comprising imitation as:-

a) an aspect of the individual's total cognitive functioning;

b) a unique process for the acquisition of novel behaviour;

c) a particular instance of a more general type of learning, such as classical or instrumental conditioning.

These three broad theoretical orientations tend to emphasize different specific aspects of imitation in human development, but have features in common and are not necessarily mutually exclusive. Each view will now be considered in more detail.

Imitation and Cognitive Development. Various authors, including Baldwin (1906) and Piaget (1951) have suggested that imitation is a natural and active tendency in the human infant, and that this tendency is necessary to account, in part, for the infant's cognitive and social development. Piaget (1950) has postulated that cognitive development comprises a sequence of progressive phases or periods which are typified by particular internalized ways of organizing or structuring ("thinking about") the world, called "schemata" (singular = "schema"); these schemata (or "mental structures") give rise to characteristic kinds of behaviour and change through experience, which includes behavioural interaction with the environment. Development is seen as an increasing adaptation to cope with the environment through the continual reorganisation and increased sophistication of these schemata.

This adaptation involves an interaction between two processes, namely "assimilation" and "accommodation". "Assimilation" indicates that the child relates what he perceives to his existing knowledge and understanding, fitting unfamiliar stimuli into his available schemata. New perceptions or new knowledge may be distorted to fit neatly into the child's existing view of the world. Conversely, "accommodation" operates as variations in environmental circumstances demand coping, which modifies existing schemata; that is, the child modifies his internal reference system so that it is congruent with external reality.

For example, "one of the clearest instances of accommodation occurs when the child faithfully imitates the behaviour of a parent .... (the child) is attempting to perceive the behaviour of another with maximal accuracy and alter his own behaviour so that it matches that of another"(Mussen, Konger and Kagan, 1969, p.303).

Piaget (1951) states "it is through being assimilated directly or indirectly to a schema which is identical or analogous that the modelled action gives rise to this imitative accommodation" (p.73). Thus, a cognitive theory of imitation suggests the imitative function undergoes progressive changes as the individual develops, and the level of cognitive structural organization directly influences his imitation; at a given time, actions are only imitated according to cognitive structures available.

Imitation as a Unique Process for the Acquisition of Novel Behaviour.

In more recent analyses of imitative behaviour, Bandura (1968) and Aronfreed (1968) have emphasized that human subjects appear to learn, without any obvious instrumental training, new behaviours merely by observing a model perform them; it is not necessary for the observer to make any response at the time. Such phenomena, these authors contend, indicate the importance of perceptual and other symbolic (internal) processes in imitative learning; through "observational learning" (Bandura, 1968) of modelled action stimuli, the observer acquires "internal representational responses" that mediate subsequent behavioural reproduction.

It is hypothesized that the acquisition of imitative behaviour involves two representational systems, imaginal and verbal. Firstly imagery formation is assumed to occur in that stimuli from the model's behaviour elicit perceptual responses in the observer that become sequentially associated and centrally integrated through temporal contiguity. After repeated stimulation, these perceptual responses form imaginal representations of the stimuli involved. Thus, through observation, transitory phenomena produce durable, retrievable images of modelled behavioural sequences. Equally, it was argued, observed events might be coded verbally, greatly facilitating retrieval and reproduction of imitative behaviour. Aronfreed (1968) goes further in maintaining that affective value is always attached to such internal cognitive representations of observed behaviour.

In addition, Bandura (1968) has described four interrelated subprocesses, each with specific controlling variables, "which markedly influence the degree and content of observational learning" (p.221). These are:-

1. Attention. Before reproducing modelled actions, an observer must attend to, recognize and differentiate distinctive features of the model's actions. Exposure to sequences of behaviour alone does not guarantee attention will be paid to the cues provided. Thus motivational conditions and prior training in discriminative observation may strongly influence environmental features of most interest to an observer.

2. Retention. Observers may acquire patterns of behaviour observationally and retain these over-extended periods, even though the response tendencies are rarely, if ever, activated into (public) overt performance. It is claimed that symbolic coding operations may be even more efficient than rehearsal processes in facilitating long term retention, albeit through vivid imagery or abbreviated verbal systems.

3. Motoric Reproduction. Symbolic representations guide and determine overt performance in a manner essentially similar to that of external stimuli in representational guidance; the controlling stimuli are symbolic counterparts of stimulus events. Consequently, the same variables (e.g. complexity) operate in the motor reproduction of either form of a given behaviour.

4. Incentive and Motivation. A person may possess the capacity to acquire, retain and reproduce modelled behaviour but not be

activated to do so because of inappropriate incentive conditions. Once reinforcement to the observer or others is introduced, however, observational learning is likely to occur and perhaps be translated into behaviour, the emission of which may be controlled conventionally by reinforcement.

This behaviour need not be limited to mere mimicry. Bandura claims that an observer may abstract relevant attributes and formulate response guiding rules based on a model's actions in a given situation; later the observer may embody the derived rule to respond in a manner similar to that adopted by the model in similar circumstances. Thus, innovative behaviour may also be generated.

In summary, Bandura (1968) and Aronfreed (1968) propose a two-phase model of imitation. The acquisition of imitative behaviour is said to be based on "observational learning" involving internal representations of perceived behavioural stimuli. Performance of these acquired behaviours is then primarily controlled by extrinsic, self-administered or vicariously experienced reinforcement. Thus, appeal is made to both internal mediational processes and external reinforcing events.

Imitation as a Specific Case of More General Learning. When attempting to explain imitative behaviour, theorists have largely relied upon available learning paradigms. Thus a crude temporal sequence is evident in theoretical views of imitation which corresponds with progress in general models of behaviour acquisition and change through learning.

Early writers (James, 1890; McDougall, 1908; Morgan, 1896; Tarde, 1903) offered detailed analyses of imitative phenomena in terms of innate instinctual tendencies. Bagehot (1873) had stated "children are born mimics" (p.101). Later, however, the resort to imitation as an explanatory concept that was itself innate, and therefore beyond explanation and reasonable investigation, was viewed as unsatisfactory.

The 'associationistic' view of learning stressed temporal contiguity between events, an instance of which occurs in "classical conditioning" procedures (when an association in time is formed between conditioned and unconditioned stimuli). Thus, Humphrey (1921) claimed that imitative acts are merely a case of conditioned reflex activity, an internal mediating process. "Imitation ceases when the reflex has disappeared by 'lack of support' from the primary stimulus" (p.4). Similarly, Allport (1924) and Watson (1925) regarded imitation as learned through the process of classical conditioning and Holt (1931) proposed a framework of child imitative development based on such a paradigm.

More recently, Mowrer (1950, 1960) has advanced a theory of imitative learning, postulating that cues from a model's behaviour acquire "secondary affective reinforcing properties" through temporal contiguity with primary reinforcers; imitation then gains secondary reinforcement value for the copier and is thereby maintained. In similar vein, Sheffield (1961) commented that delayed imitation also involved mediating perceptual and symbolic responses, possessing cue properties brought about by contiguity.

Miller and Dollard (1941) regarded imitation as an instance of instrumental learning. Social cues serve as discriminative stimuli and the observer's responses are differentially reinforced according to correspondence with the model's actions; matching behaviour not leading to reinforcement will not be learned. Eventually the observer will generalize imitative behaviour to other situations through identification of relevant discriminative cues. Thus imitation is seen primarily as dependent upon reinforcement. In a preliminary analysis, Skinner (1953) briefly indicated how cues from a model's action may become discriminative for the extrinsic reinforcement of matching responses.

Such an approach to imitative behaviour has, however, been largely developed and typified by views and investigations of a single empirical phenomenon, that of "generalized imitation". In an introductory experiment, Baer and Sherman (1964) showed that children's imitations of a limited set of actions demonstrated by a puppet could be controlled by extrinsic reinforcement; concurrently, other novel actions demonstrated by the puppet were also imitated although never extrinsically reinforced. These additional imitations (termed "generalized imitations") continued only when intermixed with other, reinforced imitations. Later investigations have replicated the phenomenon and within the functional operant behaviour framework, confirmed the primary controlling influences of contingent reinforcement and antecedent setting events on a wide range of (reinforced) "imitative"and (nonreinforced) "generalized imitative" behaviours. Thus, Gewirtz and Stingle (1968) concluded that imitative behaviour may be regarded as "an operant response class containing a potentially unlimited number of functionally equivalent behaviours" (p.375).

In summary, a spectrum of theoretical views of imitation have been described; these may accentuate a variety of hypothesized "mental structures" or "internal mediating processes" (Allport, 1924; Humphrey, 1921; Mowrer, 1950, 1960; Piaget, 1950; Sheffield, 1961), the controlling role of reinforcement (Baer and Sherman, 1964; Gewirtz and Stingle, 1968; Miller and Dollard, 1941) or a combination of both (Aronfreed, 1968; Bandura, 1968).

Attention has been previously drawn (p.19) to difficulties of inferring internal cause processes for either the occurrence or absence of a unit of behaviour. As Gewirtz and Stingle (1968) comment ".... the only indices of implicit response or cognitive processes are the very imitative behaviour outcomes these implicit events are postulated to explain; .... although there is a sense in which all organisms must somehow bridge the gap between relevant experience and later response outcomes, the means whereby this is achieved is not obvious. Thus, theoretical approaches may differ not only in the ways by which they explain this gap-bridging process but also in the utility of even postulating such processes at all" (p.377).

In such a way might all theories of imitation that advocate "internal mediating processes or structures" be criticized. Particular viewpoints may be taken to task over further specific points. Classical conditioning explanations (Allport, 1924; Holt, 1931) emphasize the model's action that becomes conditioned to random behaviour, the observer's matching response being regarded as a chance event. In view of the rapidity with which imitative behaviour develops, a reliance on chance matching appears somewhat unrealistic. Again, the elaborate mediational theory of Aronfreed (1968) assumes that affective value is always attached to the child's cognitive representation of an observed action; if so, the value of such affect requires to be empirically demonstrated and indexed.

The functional view of imitative behaviour ("generalized imitation"), which stresses the control exerted by setting events and reinforcement, has much in common with the rationale of behaviour modification techniques previously described. In that both sets of independent variables thought to operate may be readily manipulated by a therapist, this approach to imitation would, of all, appear to hold most potential in the training of developmentally retarded individuals.

## 2. Experimental Studies of Imitative Behaviour

Section 1 of this chapter, reviewing theories of imitation, suggested that the functional view associated with the phenomenon of generalized imitation seemed to be the position most closely related to the theoretical framework of behaviour modification and its previous practical applications. Section 2 now turns to a selective review of experimental investigations that bear on the theoretical positions outlined in Section 1. Several of these viewpoints have generated empirically testable predictions about imitation; Flanders (1968) and Bandura (1968) have comprehensively reviewed numerous relevant studies.

Within the field are commonly found, albeit with variations, two distinct experimental paradigms, those of "free response emission" and "discrete trial presentation". The former design involves observation by a subject of a model who demonstrates a variety of behaviours with a common theme (e.g. "aggression"); the subject's subsequent spontaneously emitted behaviour (reinforced or unreinforced) over a prolonged time interval is then compared with that of subjects who had no exposure to the model. Within the "discrete trial" paradigm, a single model will demonstrate a specific action (e.g. tapping table or saying "aah") to the subject in a standard experimental setting for a limited maximum trial duration. Dependent upon experimental conditions, imitation may or may not be reinforced, after which a constant time interval elapses before the next trial. This latter design has typically featured in the empirical study of the "generalized imitation" phenomenon.

The present review will be selective, with emphasis on research involving child subjects, and, for reasons previously indicated (see p.42) largely reflect the operant behaviour "generalized imitation" paradigm; results arising from other theoretical viewpoints and methodologies will, however, be noted when relevant. Three aspects of imitation relevant to behaviour modification procedures will be examined:-

a) the acquisition of imitative behaviour;

b) the control exerted by consequent stimuli;

and

c) the influence of antecedent setting events.

The Acquisition of Imitative Behaviour. In what way does a previously nonimitative child attain a "behavioural disposition" to copy the actions of others? From observational study, Piaget (1951) has described "natural" stages in such development for a "normal" child. At age 3 months, actions provided by another, which are similar to the child's established behaviour patterns, will prolong or elicit the child's response; such "pseudo-imitation" may, for example, be shown when crying by another will prolong or trigger the infant's own crying. By age 18 months, the child will have progressed to imitation of a novel action when the model is no longer present, or even playful "make believe" at being another person. "Normative" data for items to be found in scales of infant development provide similar evidence of such a progression. Thus, Bayley (1969) reported that the "average" age when an infant imitates a smile without additional stimulation is 2.1 months; "patacake" is copied at 9.7 months, patting a doll at 12 months and by 16.7 months the infant will imitate a model in building a three-cube tower. These findings suggest that, rather than dramatic "all or none" acquisition, the unexceptional child will show developmental increments in the observation and copying of behaviours. Indeed, Berry (1974) has suggested that elicited (verbal) imitation might be a "useful technique for the psychological assessment of skills".

To support the proposal of "no-trial" observational learning as a mechanism for children's acquisition of imitative behaviours, Bandura (1962, 1965a, 1968) has claimed evidence of matching responses, even after delays, following observation of models' actions; there had been no apparent opportunity for the child to practice these imitations and therefore no extrinsic reinforcement contingent on these responses. However, as Berger (1966) has pointed out, rehearsal may be covert rather than overt; in addition, the absence of reinforcement as a condition is difficult to specify operationally with confidence (Berger and Lambert, 1968).

Gewirtz and Stingle (1968) and Aronfreed (1968) have questioned whether imitative learning of new behavioural responses occurs at all in studies used by Bandura to support his "observational learning" theory. In many, especially those dealing with imitation of aggressive actions (Bandura, 1965c; Bandura, Ross and Ross, 1961, 1963b), children showed aggressive behaviour similar to that of models. The mere presence of a target of aggression (an inflated doll) could, however, have provided an intrinsically pleasurable outlet for the children's aggressive tendencies; the behaviour observed may have been pre-potent in the child's repertoire and thus not newly learned but simply released by appropriate situational cues. Flanders (1968) has reviewed in detail studies relating to hypothesized "observational learning" phenomena.

While faulting instrumental conditioning theories of imitation (that require matching responses be performed and reinforced before acquisition), Bandura (1965c) has nonetheless noted that extrinsic reinforcement of imitation is "inevitable" during human social development. Gewirtz (1968) pointed out that "parents or others often deliberately set out to teach the child to imitate" (p.149). By progressive "fading" (gradual removal) of physical prompts for movement and applications of contingent positive reinforcement, Baer, Peterson and Sherman (1967) "shaped" (see p.26) a limited set of imitative behaviours in previously nonimitative subnormal children. After training, each child would, in addition, imitate new modelled actions without assistance. Garcia, Baer and Firestone (1971) successfully replicated the experiment, also with retarded subjects, and other authors (Lovaas, Berberich, Perloff and Schaeffer, 1966; Lovaas, Frietas, Nelson and Whalen, 1967; Metz, 1965) reported similar results with "autistic" children. While these studies differed in procedural details, all indicated the same conclusion, namely that instrumental training techniques using positive reinforcement are capable of developing, with relative rapidity, generalized imitative behavioural repertoires in previously non-imitative children.

The Control Exerted by Consequent Stimuli. Freely emitted responses may commonly be controlled by consequent stimulation; implications for therapeutic procedures have been outlined in Chapter 2, Section 4.

As indicated, manipulations including the presence or absence of positive or aversive contingent stimuli may be involved. Flanders (1968) summarised in the form of Table 1 possible reinforcement conditions that may operate within the imitation dyad.

TABLE 1

| | | Contingent Reinforcement to Model | |
|---|---|---|---|
| | | NO | YES |
| Contingent Reinforcement To Observer | NO | Non-Reinforcement | Vicarious Reinforcement |
| | YES | Direct Reinforcement | Double Reinforcement |

A convenient distinction may be made between studies confined to conditions of nonreinforcement or direct reinforcement of (imitative) behaviour emitted by the observer only and those involving reinforcement ("vicarious" or "double") to the model. Within the "generalized imitation" paradigm, experiments have been restricted to the former set of conditions only; such studies will now be considered before attention is drawn to those involving reinforcement of the model.

The selection of positive reinforcers used with a variety of subjects in "generalized imitation" studies is representative of the range to be found throughout the imitation literature; thus, praise ("good") (Baer and Sherman, 1964), food and praise (Metz, 1965), meal food and praise (Baer, Peterson and Sherman, 1967), sweets (Risley and Reynolds, 1970), beads exchangeable for toys (Steinman, 1970a), tokens exchangeable for toys or sweets (Schumacker and Sherman, 1970), smile, sweets and a tickle (Bandura and Barab, 1971), trinkets and praise (Bufford, 1971) and toys (Wilcox, Meddock and Steinman, 1973) have all been presented to child subjects, contingent upon imitative behaviour. Sherman (1965) used cigarettes in a similar capacity with initially mute adult psychotics.

In such experiments, trials involving particular "generalized imitations", executions of which are never reinforced, are interspersed among other, potentially reinforced, "imitations". Thus, intermittent reinforcement is central to these studies. In addition, schedules governing the availability of reinforcement for "imitations" may be either time-based "interval" schedules (the first appropriate response after X interval is reinforced) or indicate reinforcement for a proportion of correct responses ("ratio" schedules). The "discrete-trial" nature of generalized imitation experiments lends itself to the latter arrangement of reinforcement for "imitations", either on Fixed Ratio schedules ("FR Y"; correct imitation will be reinforced once every Y trials) or Variable Ratio schedules("VR Z"; correct imitation will be reinforced, on average, once every Z trials).

The least complicated schedule, that of continuous reinforcement (CRF) for every correct 'imitation' trial has, however, been used in the majority of generalized imitation studies (e.g. Baer and Sherman, 1964; Baer et al., 1967; Brigham and Sherman, 1968; Burgess, Burgess and Esveldt, 1970; Epstein, Peterson, Webster, Guanieri and Libby, 1973; Lovaas et al., 1967; Lutzker and Sherman, 1974; Martin, 1972; Peterson, Merwin, Moyer and Whitehurst, 1971) to maintain the imitative behaviour of different subject populations.

Others, for reasons of convenience or economy, have chosen to reinforce imitation trials by ratio schedule. Thus, having established responding on CRF, Metz (1965) then maintained the imitative behaviour of "autistic" children on an FR 3 schedule, while Bucher and Bowman (1974) and Garcia (1974), with subnormal subjects, used VR2 and VR3 schedules respectively for the same purpose. In a more sophisticated manner, Garcia, Baer and Firestone (1971), also with retardates, began reinforcing "imitation" trials on a CRF schedule, then progressed through FR2 and VR2 schedules to reach an end point of reinforcement on a VR3 schedule. The Partial Reinforcement Effect (e.g. Lewis, 1960), that maintenance of behaviour on such intermittent reinforcement schedules, rather than CRF, brings about increased resistance to extinction, has been demonstrated with imitative responses of undergraduate students (Lewis and Duncan, 1958) outwith the generalized imitation paradigm.

Despite the foregoing, various authors (Acker, Acker and Pearson, 1973; Baer and Sherman, 1964; Baer et al., 1967; Brigham and Sherman, 1968; Burgess et al., 1970; Lovaas et al., 1966; Lovaas et al., 1967; Martin, 1971; Metz, 1965; Peterson, 1968; Peterson and Whitehurst, 1971; Steinman, 1970a, b; Steinman and Boyce, 1971; Waxler and Yarrow, 1970) have questioned the importance of contingent positive reinforcement in the control of imitation. The role of such reinforcing stimuli in generalized imitation research has been assessed by use of three techniques, each of which will now be considered.

Firstly Metz (1965), Baer et al. (1967), Lovaas et al. (1967) and Peterson (1968) attempted to produce imitation in nonimitative subnormal and "autistic" children before reinforcement operations were instituted. These studies concur in that none of the subjects displayed any imitative behaviour under such conditions;

Baer and Sherman (1964) reported similar findings with young, normal children. As a second technique, reinforcement may be discontinued. Studies involving "autistic" (Lovaas et al., 1967) and retarded (Peterson, 1968) subjects found rapid loss of imitative and generalized imitative behaviours under such conditions. Similar studies with normal children are less conclusive; thus Baer and Sherman (1964) comment that the imitation of one subject "weakened considerably" and the other showed the same pattern but with "fewer apparent changes". Waxler and Yarrow (1970) also demonstrated loss of imitation under such conditions, but in contrast Peterson and Whitehurst (1971) found no decrement occurred.

Steinman (1970b) has, however, criticized "these procedures, although useful for determining the effect of having reinforcing stimuli in the situation, are not adequate for analysing the importance of contingent reinforcement. Comparisons between behaviour with reinforcement present versus reinforcement absent cannot distinguish between the various functional properties of reinforcing stimuli"(p.165). Thus, the third commonly practised procedures, those of noncontingent or delayed reinforcement for imitation of modelled actions would appear more appropriately used. A variety of such manipulations may be programmed for each investigation; for example, Steinman (1970a) and Steinman and Boyce (1971) delivered reinforcement under two delayed reinforcement conditions, either 15 or 30 seconds after correct emission of the imitative behaviour on which it was contingent. Again, these authors also included conditions where reinforcement was given to the subject immediately that the action was modelled, and also in which all reinforcers were given at once at the beginning of the experimental session.

There is little consensus about the effects of such procedures upon imitative behaviour, particularly from studies of 'normal' subjects. Acker et al. (1973) found that all children exposed to delayed reinforcement conditions ceased imitation, albeit after varying numbers of trials. Baer and Sherman (1964) reported that of two subjects, the imitative behaviour of one decreased to about half its previous frequency and for the other child the extent of the decrease was greater. Brigham and Sherman (1968) measured the accuracy of a child's imitations rather than frequency; when reinforcement was delayed or reinforcing stimuli delivered randomly and noncontingently throughout sessions, the accuracy dropped from 90% to 70%. Although the authors stress the importance of the 20% decrease in accuracy, the 70% retention is perhaps more striking. Others (Burgess et al., 1970; Peterson and Whitehurst, 1971; Steinman, 1970b; Steinman and Boyce, 1971; Waxler and Yarrow, 1970) found delayed or noncontingent reinforcement procedures had little or no effect on the imitative behaviour of normal children; almost every action continued to be imitated.

In contrast, studies involving subnormal subjects (Baer et al., 1967; Martin, 1971, 1972) show a rapid decline upon the introduction of delayed or noncontingent reinforcement procedures. Thus Baer et al. (1967) found delayed reinforcement for 30 seconds after correct imitation reduced the imitative behaviour of one child from its maximum to emission of no responses. A second child also decreased imitation once reinforcement was delivered immediately after an action had been demonstrated; delay of reinforcement for 30 and 60 seconds after correct imitation had no effect. A third child also decreased imitative behaviour, but to a lesser extent when delayed reinforcement procedures were applied. Lovaas et al. (1966) reported similar findings with "autistic" subjects, but the degree of decrease and procedures are left unspecified. Thus, the importance of contingent positive reinforcement to the observer within the "generalized imitation" paradigm is, at best, unclear. The studies indicate differences between subjects within discrete populations; also suggested, however, are differences between such subject groups. Contingent positive reinforcement may be more central to the maintenance of imitative behaviour in subnormal and "autistic" children than the normal child population.

Perhaps partly for ethical reasons, few studies have reported the effects of contingent punishment upon imitative behaviour. Acker et al. (1973) however, found that a verbal "no" and withdrawal of one previously earned sweet contingent upon imitations resulted in suppression of all imitative and generalized imitative behaviour in young normal children. Martin (1972) obtained the same effect with retardates solely by the experimenter verbally reprimanding imitation with a loud "no!". No studies, however, have been reported that attempted to analyse the importance of contingent punishment, rather than the effects of aversive stimuli in the imitation situation. It may be that delayed or non-contingent punishment procedures would be required in a manner similar to that described (p.48) previously to investigate the role of positive reinforcement with imitative behaviour. Several investigators (e.g. Mischel and Liebert, 1966, 1967) in the wider literature have combined contingent positive reinforcement of the observer for imitation and contingent reprimands for alternative responses. Flanders (1968) concludes that such is "an effective way to produce desired imitation" (p.319).

To this point, the effects of reinforcement to the observer only in the imitation dyad have been considered. Studies of "vicarious reinforcement" (the exposure of an observer to the procedure of presenting a reinforcing stimulus to the model) and "double reinforcement" (reinforcing stimuli presented to both observer and model) (see Table 1) within the "generalized imitation" paradigm have not been reported. The concept of vicarious reinforcement is, however, of particular relevance to Bandura's (1968) view of observational learning (see p.36); investigations (Bandura, 1965c; Bandura, Grusec and Menlove, 1967) have confirmed that increased imitation of a model by a normal child observer results from such a use of positive reinforcement for the model. Equally, Walters, Leat and Mezei (1963) demonstrated decrements in imitative behaviour of child subjects under vicarious punishment conditions (for the model). Various studies have combined vicarious positive reinforcement and vicarious punishment (both for the model); thus Bandura and Whalen (1966) and Mischel and Liebert (1966) produced imitation by exposing observers to models who took tokens and praised themselves for satisfactory performance but reprimanded themselves for unsatisfactory performances. Again, Flanders (1968) comments ".... (such combinations of procedures) effectively elicit subsequent imitation in a normal child observer" (p.320).

In summary, many combinations of reinforcement conditions are possible within the imitation dyad. While the results of these on imitative behaviour appear broadly as behavioural principles would predict, detailed effects, comparisons and interactions have been sparsely documented. Investigations within the "generalized imitation" paradigm have been limited to conditions of reinforcement (usually positive) to the observer only and even here results are inconclusive. Contingent reinforcement on various schedules is used to maintain imitative behaviour, but (insofar as reinforcement conditions may be considered the only variable operating in an experimental situation), the importance of such stimuli may vary between subject populations.

The Influence of Antecedent Setting Events. In addition to the control exerted by consequent reinforcement, antecedent setting variables may also influence the probability of response emission; such a variety of setting conditions have been found empirically to control the imitative behaviour of children. Although the effect of any variable may have been studied within either free response emission experimental situations or the discrete trial "generalized imitation" paradigm, setting conditions found to influence performance in one style of investigation may be equally relevant to the other. For convenience, however, distinction will be made between results from the two different experimental methods; those arising from the free response emission studies, which have all involved normal subjects, will be first considered.

Much interest has focussed on antecedent characteristics of both model and observer and the relationship between these individuals. Normal children show increased imitation of models who have controlled resources valuable to the child in the past (Hetherington and Frankie, 1967), do so at present (Bandura, Ross and Ross, 1963a) or will do so in the future (Mischel and Liebert, 1967). Removal of such future control of resources reduces imitation (Mischel and Liebert, 1967). It would appear that child observers imitate models who control resources. Similarly, models who are older, more skillful and higher in social status than observers are more readily imitated (Bandura and Walters, 1963). The effects of other model characteristics are less clear. Child rearing theorists (Sears, Rau and Alpert, 1965) have emphasised the importance to imitative learning of "nurturance" (the exchange of affection not contingent on certain behaviour); studies by Bandura and Huston (1961) and Hetherington and Frankie (1967) indeed suggest that nurturant models of either sex are imitated more than non-nurturant models by children of either sex. Aronfreed (1964), however, failed to find such a variation. Similarly, experimental manipulations of the sex of the model suggest few dependable effects (Bandura et al., 1963a; Bandura and Kupers, 1964).

The affective relationship between the members of the imitation dyad involves antecedent characteristics of both persons. Willis (1963) found the degree to which the observer liked the model was not related to any tendency to imitate that model; in contrast, Sampson and Insko (1964) reported that an observer's liking of a model increased imitative behaviour. Thus, at present, the effects of this complex variable are also undecided.

Various features individual to the observer do, however, appear to influence imitation. Studies involving some measure of aggression as the dependant variable have demonstrated that boys imitated more than girls (Bandura, 1965c; Bandura et al., 1963b, c). In most nonaggression studies (e.g. Bandura and Huston, 1961; Bandura and Whalen, 1966) results typically revealed no such differences between the sexes. Again, the state of the subject at the time of investigation may be relevant; Kimbrell and Blake (1958) found thirstier observers imitated more readily than others a model who violated a prohibition of drinking and Hanlon (1965) reported that after a period of isolation, girls imitate more readily than boys.

Thus it appears that, within the free response emission situation, some antecedent setting events are capable of influencing the occurrence of imitative behaviour. Such control may, however, in specific instances arise from interactions between discrete factors operational in the experimental situation at a given time.

Within the "discrete trial" generalized imitation paradigm, immediate setting conditions preceding each trial may be stringently controlled and, perhaps, the effects of programmed changes in these conditions more clearly monitored than within the "free response emission" design. Studies for which any identical setting conditions have concurrently preceded both "imitation" (potentially reinforced) and "generalized imitation" (nonreinforced) trials within the "discrete trial" paradigm will now be detailed.

Commonly, for subjects from various populations, each action modelled has been preceded by instructions "do this" or "say" (Baer et al., 1967; Bufford, 1971; Durrell and Weisberg, 1973; Lovaas et al., 1966; Lovaas et al., 1967; Martin, 1971, 1972; Peterson, 1968; Peterson et al., 1971; Peterson and Whitehurst, 1971; Steinman, 1970a, b; Steinman and Boyce, 1971). In some studies, however, (Acker et al., 1973; Baer and Sherman, 1964; Bandura and Barab, 1971; Bucher and Bowman, 1974; Waxler and Yarrow, 1970) these verbal imperatives have preceded only the first few trials that result in imitation; in other investigations (Brigham and Sherman, 1968; Burgess et al., 1970; Wilcox et al., 1973) the subjects have been told initially they will be reinforced if they do as the model does. Finally, Garcia, Guess and Byrnes (1973), Schumacker and Sherman (1970) and Metz (1965), all with retarded or "autistic" subjects only, and Epstein et al. (1973) with normal children, used no instructions of any kind. Each of these antecedent conditions, usually in combination with positive stimulation subsequent to "imitations" maintained the imitative behaviour of child subjects. Normal children, however, showed lowered rates of "imitation" and "generalized imitation" upon an alteration in such instructions (Waxler and Yarrow, 1970). The absence of the experimenter after an action had been modelled (Peterson et al., 1971; Peterson and Whitehurst, 1971) and a change of "activity context" (Waxler and Yarrow, 1970) had similar effects.

Clearly one variable which might affect imitation is the identity of the model. When a new model was exchanged for the standard one, Waxler and Yarrow (1970) found no change in the imitative behaviour of normal children; similarly Baer et al. (1967) reported little decrement in the performance of one subnormal subject subsequent to new male and female models. In contrast, the retarded subjects of Garcia (1974) showed little generalization to new models. Studies which provide differential reinforcement training for imitation of one model rather than another provide more consistent results for normal children (Durrell and Weisberg, 1973), retardates (Garcia et al., 1973) and both normal and subnormal subjects (Bandura and Barab, 1971); models who reinforced matching responses were imitated much more frequently than models who never rewarded the children for reproducing their behaviour. As Garcia et al. (1973) concluded "subjects copied the model for which positive consequences for imitation were provided" (p.309).

Thus, a variety of antecedent setting variables appear able to influence the emission of imitative responses, particularly when different specific instances of the variable have been associated with differential reinforcement of subsequent imitation. Those pre-setting conditions reported may be a small proportion of the total range with this capability. As previously indicated, however, conditions of reinforcement (see p.50) may also control imitative behaviour; comment upon the frequency of imitation and generalized imitation at a given instance must consider both antecedent and consequent stimulus events. Moreover, the relative influence exerted by both sets of variables may not be constant. The inconsistency of effects resulting from delayed and noncontingent reinforcement and nonreinforcement procedures that appear both within and between subject populations may reflect the control exerted by setting events, albeit with individual differences, upon the imitation of normal subjects and the relative importance of contingent reinforcement in the maintenance of behaviour of subnormal and "autistic" children. Two investigations which have directly compared the effects of both types of variable lend support to this view. Martin (1972), working with subnormal subjects, concluded "consequences rather than instructions controlled imitation" (p.467), while with young, normal children Epstein et al. (1973) found "the manipulation of antecedent variables to be the necessary condition for the control of imitation" (p.109).

In conclusion, while the natural development of imitation in normal children may be of an incremental nature, an imitative behavioural repertoire can be trained in previously nonimitative children by the use of contingent reinforcement. Once such behaviour has been established, through artificial means or otherwise, many authors have demonstrated that both specific antecedent setting events and reinforcement conditions may control the imitation shown by child subjects in laboratory situations. Differences between individuals and between subject populations are, however, suggested in the relative influence exerted by either set of variables. As Martin (1972) commented "there is a need to investigate variables present in imitation experiments and, further, to specify conditions in which imitative response classes are controlled by consequences, such as extrinsic reinforcement, and those in which they are controlled by antecedent variables" (p.468).

## 3. The Nature of Generalized Imitation

Sections 1 and 2 of this review have established the possibility that generalized imitation may offer promise as a training procedure for developmental retardates. Section 3 now reviews theories and research to establish its theoretical status in relation to the imitative behaviour of normal children, and also to analyse determinants of generalized imitation so that its potential for training subnormal children may be more precisely evaluated.

A child will copy novel and unreinforced actions demonstrated by a model when these actions are intermixed with others for which imitation is reinforced. This empirical finding has been replicated many times in laboratory studies (e.g. Bucher and Bowman, 1974; Bufford, 1971; Burgess et al., 1970; Steinman, 1970a) and emphasis has been laid on the durability of this "generalized imitation" phenomenon under typical experimental conditions. A combination of speculation and progressive research results has led to four hypothesized "explanations" of why such unreinforced imitations should occur. In chronological order of proposal, these are:-

1. The "conditioned reinforcement" explanation. Baer and Sherman (1964), Lovaas et al. (1966) and Baer et al. (1967) pointed out that the child is only reinforced when he performs in a manner similar to that of the model. Behavioural similarity frequently precedes the delivery of reinforcement and, therefore, may

become a discriminative "stimulus" for reinforcement. As stimuli which have developed discriminative properties may simultaneously develop conditioned reinforcing properties, "similarity in behaviour", acting as a stimulus may also become a conditioned reinforcer. Thus, "generalized imitation" may be maintained during continued differential reinforcement through the conditioned reinforcer, "similarity".

2. The "reinforcement schedule" explanation. Gewirtz and Stingle (1968) suggested that "imitative and generalized imitative behaviours be assumed to represent a functional response class containing a potentially unlimited number of instrumental responses, varied in content and matched to actions demonstrated by a single or many models. This class is acquired through extrinsic reinforcement of some member responses and subsequently maintained by an intermittent schedule that results from the reinforcement of "trained imitations" only" (p.374).

3. The "discrimination" explanation. As Steinman (1970a) commented, this might be more appropriately named the "failure to discriminate" explanation. Bandura (1968, 1969) has emphasised the complexity of the discrimination required in generalized imitation experiments. The subject is typically reinforced for imitation of a limited set of different modelled actions; randomly interspersed between these potentially reinforced trials, varied other actions are modelled imitation of which is never reinforced, despite possible similarities between individual actions across sets. Thus the child, being unable to discriminate reinforced from nonreinforced actions, simply imitates every modelled unit of behaviour.

4. The "social control" explanation. Steinman (1970a, b) suggested that two controlling systems may operate simultaneously

within generalized imitation procedures. One system involves the contingent differential reinforcement specifically manipulated by the experimenter; the second is a composite of social setting events derived from sources inherent in the experimental situation, including instructions. Such a system would be nondifferential in that it would operate concurrently on both reinforced and nonreinforced trials. Thus, Steinman (1970a) concluded "the generalized imitation of demonstrated actions may be largely a function of antecedent setting conditions typical of the particular procedures used to study the effect"(p.98).

To further complicate the issue, certain of these apparently discrete "explanations" have theoretical points in common. Apart from the "discrimination" hypothesis, the two earlier proposals (involving "conditioned reinforcement" and "reinforcement scheduling") also implicitly assumed that the subject does not discriminate reinforced from nonreinforced trials. The "conditioned reinforcement" "explanation" suggested that imitation becomes reinforcing because it frequently is reinforced. If, however, the child discriminates a particular modelled action as an occasion for nonreinforcement, imitation of that action should not be reinforcing. Indeed, stimuli (including demonstrated actions) that consistently precede non-reinforced responses should develop neutral or aversive, rather than positively reinforcing, properties (Terrace, 1966). Similarly, the "reinforcement schedule" "explanation" with emphasis on intermittent reinforcement may depend on a lack of discrimination between modelled actions (Steinman and Boyce, 1971). A variable ratio schedule can maintain consistent performance of nonreinforced responses, but only when no antecedent stimuli correlated with reinforcement and nonreinforcement are present. If external stimuli are explicitly correlated with particular reinforcement contingencies, as are specific actions in every generalized imitation study, a "multiple" rather than "variable ratio" schedule operates; hence differential responding should occur unless the child fails to discriminate reinforced from nonreinforced trials.

Thus, Bucher and Bowman (1974) have claimed that, essentially, only two "explanations" of generalized imitation have been advanced; firstly, that the effect may be the result of variables that control discrimination between reinforced and nonreinforced imitations, and secondly, that generalization arises from transfer or antecedent social setting effects common to both reinforced and nonreinforced trials. These authors then continued "such hypotheses are not contradictory and both emphasize the influence of present and past contingencies on discrimination performance" (p.23). This statement is representative of current thought and knowledge about the generalized imitation phenomenon. For historical perspective, the sequence of development to this point through theoretical and empirical considerations will now be traced.

The earliest "conditioned reinforcement" view has been criticized on numerous grounds. As Steinman (1970b) commented "logically it would be difficult to explain why differential reinforcement should be effective if this "explanation" of generalized imitation were true. Response-produced stimuli occur in every operant situation and are frequently followed by reinforcement. How can stimulus control be developed under these other conditions and yet not be developed in the generalized imitation situation?" (p.159) Further, Gewirtz and Stingle (1968) objected to this viewpoint on the grounds that an explanation which must be inferred from the behaviour itself, in terms of variables which cannot be measured, observed or controlled is not scientifically satisfactory.

By experiment, both Peterson (1968) and Martin (1971) found that the (nonreinforced) generalized imitations of retarded subjects were maintained when interspersed among reinforced nonimitations (e.g. complying with instructions "clap your hands", without demonstration). Similarly, nonreinforced nonimitative behaviours occurred when interspersed among (reinforced) "imitations". Both authors concluded that, although imitative behaviours may satisfy the criterion for a functional response class, (that topographically different responses have the same relationship to common controlling stimuli), they might be members of an even larger class of behaviours, which also includes nonimitations. If so, "similarity" could not function to link the behavioural class; Martin (1971) suggested the class might be defined by "following the instructions of adults". Thus, the "conditioned reinforcement" account of generalized imitation rapidly lost credibility.

On the proposal by Bandura (1968) of the "discrimination" viewpoint, Steinman and Boyce (1971) pointed out "to date, the only available data that can be used to support it are the very data the analysis is presumed to explain; that is, instances of generalized imitation. Obviously if this hypothesis is to become more than a tautological convenience, investigations demonstrating relationships between discrimination variables and generalized imitation are required. Simply to apply a discrimination analysis whenever nondifferential responding occurs is insufficient" (p.253).

A series of investigations followed which manipulated specific variables usually intrinsic to the generalized imitation paradigm; differences in performance rates between reinforced and nonreinforced imitations following such operations were held to indicate that "discrimination" had occurred. Such differential imitation was demonstrated by both normal and retarded subjects (Bandura and Barab, 1971; Garcia et al., 1971; Steinman and Boyce, 1971) to vary with the topographical differences between the reinforced and nonreinforced sets of modelled actions; Bucher (1973) obtained similar results from normal children for generalized "compliance with instructions". Peterson et al. (1971) produced "discrimination" by decreasing the number of actions demonstrated in both reinforced and nonreinforced sets. When a cue for discrimination was provided by two different models, each demonstrating either reinforced or nonreinforced actions only, Bandura and Barab (1971) found "models who reinforced matching responses were imitated much more frequently than models who never reinforced the children (normal and retarded) for reproducing their behaviour" (p.249). In contrast, Steinman (1970b) found such model cues did not promote "discrimination" in normal subjects. Preceding each nonreinforced imitation trial with an orange triangle signal in the subject's view produced differential imitation in retardates (Bucher and Bowman, 1974) as did a gradual lessening of the discrepancy in the behaviours of the model preceding demonstration of reinforced and nonreinforced actions (Epstein et al., 1973) with normal subjects.

Thus, manipulation of intrinsic variables or provision of extra "artificial" cues may bring about differential responding between "imitation" and "generalized imitation" trials; it would be tempting to conclude that the lack of such differentiation might be solely due to the complexity of the discrimination problem that is presented to the child. Another series of studies, however, suggest that the issue cannot be finally dismissed. Both normal subjects

(Steinman, 1970a, b) and retardates (Bucher and Bowman, 1974; Steinman and Boyce, 1971) show strong differential imitation on "choice trials" when reinforced and nonreinforced actions are modelled simultaneously but revert to generalized imitative responding upon return to the usual successive presentation mode. It appears that both groups of subjects are able to show discrimination of reinforced and nonreinforced actions when appropriate contingencies operate but still copy both in the typical generalized imitation paradigm. The "discrimination" hypothesis was not totally satisfactory and the question remained of why such nonreinforced imitations should occur.

Attention has been drawn in the previous section to the control exerted over imitative behaviour by antecedent setting conditions. Such findings led to speculation that social or environmental setting variables or prior experiences may be more important than discrimination difficulty and current reinforcement conditions in the maintenance of "generalized imitation" in laboratory settings. Burgess et al. (1970) pointed out that subtle "coincidental" cues from the experimenter such as eye contact, head movements or speech intonation may be common to the demonstration of reinforced and nonreinforced actions and thus control the imitation of both. Bufford (1971) stressed the importance in generalized imitation experiments of instructions, usually included "which function as setting events whose effects persist over extended periods even when not repeated" (p.49). Later, explicit contradictory instructions not to perform nonreinforced imitations (Bufford, 1971; Steinman, 1970a, b) or that imitation was not necessary (Waxler and Yarrow, 1970) brought about a decrease in the rate of "generalized imitations" in normal children. Similarly, the observation of a peer model performing differentially on an imitation task immediately eliminated generalized imitation (Burgess et al., 1970). Peterson and Whitehurst (1971) and Peterson et al. (1971) found that if the experimenter left the room directly after an action had been modelled, a rapid decrease in the emission of both reinforced and nonreinforced imitations resulted. In contrast, when children performed a (nonimitative) visual discrimination task incorporating a number of parameters of the generalized imitation paradigm, manipulation of the "experimenter absent" variable brought no change in response rate on either reinforced or nonreinforced trials (Wilcox et al., 1973). Thus, social setting events may control response rates in a situation with "social demand characteristics" such as imitation, where a subject directly copies a model, but exert little influence over nonsocial tasks.

These studies have demonstrated the control of particular environmental setting events over generalized imitative behaviour. Less specific social pressures may, however, also operate on the subject to imitate even though a particular trial has been discriminated on various bases as nonreinforced, and extinction or delayed or noncontingent reinforcement, conditions pertain even on potentially reinforced imitation trials. Bandura and Barab (1971) have forcefully summarized the argument for consideration of such social demand characteristics. "The discrete trial paradigm used to study generalized imitation typically includes a variety of extraneous rewards and coersive controls that can result in multiple confounding of the effects of reinforcement and setting variables upon imitative behaviour. When models bring children to and from experimental situations, as is typically the case in these studies, the social interactions that inevitably occur between the participants over a long series of sessions can significantly affect a child's level of imitativeness. Explicit demonstration of discrete actions in a trial by trial procedure by a model who also visibly records the child's performances are additional features which may compel imitative responding. To complicate matters further, each modelled action is generally preceded by a command to perform the demonstrated behaviour. When a subject does not respond, the model waits expectantly without saying anything for a relatively long time which can be upsetting; the strained silence can be terminated only by performing the required response. Escape from discomfort created by social demands could serve as a more powerful source of reinforcement maintaining imitative responding than the material reward dispersed by the model. These factors might account for why actions modelled under such conditions are often imitated regardless of reinforcement conditions deliberately arranged" (p.246).

The coercive and other social controlling features inherent in the generalized imitation paradigm are strongly emphasized; it may be that imitation is so determined by characteristics of the procedure itself that, unless many extraneous influences are removed, the effects of variables known commonly to exercise a high degree of behavioural control are obliterated. Steinman and Boyce (1971) commented "generalized imitation may be more the result of an inappropriate and confounded methodology than arising from discrimination difficulty, scheduling effects or the conditioned reinforcing properties that imitation may acquire" (p.254). Peterson et al. (1971) stated "generalized imitation only occurs because of the procedures used to study it" (p.126).

In part to balance such extreme views, Bucher and Bowman (1974) have claimed that the use of retarded subjects minimized social demands characteristics, a point previously pressed by Steinman (1970b) in an attempt to explain the relative efficiency of delayed and noncontingent reinforcement, and withdrawal of reinforcement procedures in diminishing the imitative behaviour of such children. The findings, however, of Bucher and Bowman (1974) that nonreinforced imitation varied with the degree to which reinforcement was available for other (nonimitative) activities and of Wilcox et al. (1973) indicating that a subject's pre-experimental history may be critical to the effectiveness of modelling procedures, call the generalized imitation paradigm into further question as an explanation of imitation in natural surroundings.

In conclusion, not one of the proposed "explanations" of the generalized imitation effect has been substantially and exclusively verified. Experimental and other arguments suggest that both discrimination variables and common social setting effects typically operate in such a situation dependent upon a subject's past experience and present contingencies operating for discrimination performance. Again, the possibility that a set of variables may exert considerably different control strength over discrete subject populations renders the generalization of results hazardous. Given that such variables operate, the extent to which "imitations" and "generalized imitations" may be legitimately regarded as a single functional response class for a discrete subject population (normal or retarded) is unclear. Various opinions have suggested that generalized imitation is an artefact of experimental methodology; if so, the extension of such a paradigm to account for the imitative behaviour of children in natural settings seems somewhat dubious. In general, however, antecedent setting events and contingent reinforcement (for 'imitations') seem to be important variables for training and maintenance of generalized imitation in subnormals; this supports earlier suggestions that generalized imitation might be a practically useful training procedure in a behaviour modification context. This possibility is explored in the next section.

## 4. Therapeutic Applications of Generalized Imitation

Despite the uncertain theoretical status of the "generalized imitation" phenomenon, that novel behaviour patterns can be reliably generated at will under certain conditions may provide field workers with a potentially economical method for the reduction of behavioural deficits (see Chapter 2, Section 4). The remark by Sherman and Baer (1969), previously quoted on page 27, pointing out the small number of such applications reported was, however, accurate when made and remains partially so.

The range of actions that might be modelled for imitation is virtually unlimited; primarily important to the developmentally retarded population for whom such methods are relevant may be the acquisition of varied self-help skills and communication patterns, including speech. As Bandura (1969) commented "although modelling variables play an important role in the development of most (social) behaviours, their position with respect to language is unique" (p.149).

Lovaas et al. (1966) demonstrated that nonverbal "autistic" children could acquire imitation of English words through prompting and contingent reinforcement, then maintain "generalized imitation" of intermixed Norwegian words. Baer et al. (1967) similarly gained generalized imitation of both verbal and manual behaviours in previously nonimitative retardates, then combined familiar and novel actions into more complex 'chains' (or sequences) of behaviour. They noted that one subject received only two hours of training on chains and at the end of this time would copy 50% of three action chains demonstrated to her and 80% of two action chains. It would appear that more than very simple behaviours might be taught through imitation. Lovaas et al. (1967) successfully extended such training to include "socially and intellectually useful behaviour" such as personal hygiene (e.g. teeth brushing), preschool games, elementary interpersonal skills and drawing and printing; control of the child's behaviour was gradually shifted from imitation of a model to verbal instructions (e.g. "draw me a picture"). These last authors claimed "by the use of imitation, we have been able to teach the children a number of behaviour patterns which seem virtually impossible to train otherwise. Such a procedure has the advantage that it works". (p.180)

Lovaas (1968) went on to develop in detail a programme, strongly based on shaping and imitation, for the establishment of speech in "psychotic" children. Since that time, modelling techniques have typically features in a progression of studies concerned with reduction of deficits in verbal behaviour. One series of investigations demonstrated that rules of grammar could be taught to severely and moderately retarded children through a training sequence that used techniques of imitation and differential reinforcement; the effects of training generalized to other examples of the grammatical rule that were not trained directly in the instance of plural nouns (Guess, 1969; Guess, Sailor, Rutherford and Baer, 1968; Sailor, 1971), verb word endings (Schumacker and Sherman, 1970) and adjectival word endings (Baer and Guess, 1971). This type of research implies that the eventual goal of any speech training programme must be to produce instances of verbal behaviour which have not been directly involved in the training context. As Garcia et al. (1973) pointed out, this should be achieved not only at labelling and grammatical levels but also include syntactical development. From a base of previously shaped imitative speech, it has been found (Garcia et al., 1973) that further imitation training of particular examples of syntax ("this is one —— ", "these are two —— ") leads to additional appropriate uses of similar syntax under conditions not specifically trained. Garcia (1974) then used imitation to produce a "conversational speech form" of three sequential verbal responses in retarded children. Lutzker and Sherman (1974) similarly trained subject-verb agreement in the description of pictures (singular picture subject requires verb "is", plural subjects verb "are") and concluded "imitation and reinforcement procedures appeared functional in producing generative sentence usage for both singular and plural sentences" (p.447).

These studies appear to substantiate a promise that techniques based on the generalized imitation paradigm will be capable of reducing speech behaviour deficits in the developmentally retarded. Despite, however, the enthusiasm of Flanders (1968) for the "undoubted" efficacy of imitation as a behaviour modification technique, and the success of Lovaas et al. (1967) no other authors have reported attempts to use the generalized imitation phenomenon in training a wider spectrum of behaviours. While such a state of affairs continues, it seems likely that a potentially valuable training tool for use with the developmentally retarded remains unexploited.

## 5. Summary

With particular emphasis on imitation as a possible training technique for retardates, this chapter has reviewed the field of imitation when defined as the immediate accurate reproduction by an observer of discrete behavioural acts explicitly demonstrated by a model.

Section 1 indicated that a variety of theoretical views have been proposed to account for imitative behaviour; of all these, however, the operant conditioning view associated with the 'generalized imitation' phenomenon seems to have most in common with, and hold most promise for, the rationale of behaviour modification procedures.

In particular, as seen in Section 2, generalized imitation can be trained in previously nonimitative children by a number of different methods all based on "shaping" techniques. Once established, generalized imitation, in common with imitative behaviours in other experimental paradigms, may be controlled by reinforcement and antecedent setting variables. It appears, however, that the effects of specific variables (e.g. presence or absence of contingent reinforcement, location or model identity) may not be consistent either between or within defined subject populations; equally, the effects of other important variables such as different reinforcement schedules have not been established.

Although various proposals have been advanced, the theoretical status of the generalized imitation phenomenon remains unclear; once again, however, as Section 3 suggested, determinants of generalized imitative responding may vary between individual subjects and specific populations. At present, the position is unclear and more information is required.

Section 4 has shown that, despite these difficulties, generalized imitation has been used successfully as a training procedure with developmental retardates, especially for the acquisition of speech. Various gaps indicated above remain, however, in information which would aid its efficient application with a specific population of young subnormal children.

# CHAPTER 4

## EXPERIMENTAL AIMS

A number of possible approaches to the behaviour of retardates have been reviewed in Chapter 2. Although in some cases biological causes can be identified, it was also established that environmental factors may be partly responsible for the limited or socially undesirable behavioural development of subnormal individuals. The scope for remediation through direct medical manipulation of biological conditions seems limited; the growth of behaviour modification techniques, however, suggests that much can be achieved in the training and education of retardates through methods based on operant conditioning principles.

Chapter 3 reviewed the possible relevance of imitation for training novel behaviour patterns, with particular emphasis on a subnormal child population. Of the various approaches to imitation examined, functional analyses of the phenomenon of 'generalized imitation' seemed to hold most promise for two reasons:-

1) functional analysis has many features in common with operant conditioning based behaviour modification techniques that have proved successful, and

2) training generalized imitative responding with contingent reinforcement appears a reliable method by which to teach initially nonimitative subnormal children to copy varied actions demonstrated by a model.

The relationship between the phenomenon of 'generalized imitation' and the natural development of imitative behaviour by normal children remained unclear. In addition, Chapter 3 also revealed that there was no generally accepted theoretical explanation of the generalized imitation phenomenon, and many of the variables that affect it had not been explored. To complicate matters further, it seemed that sets of variables such as contingent reinforcement, setting events and interval discrimination cues may exert grossly differing levels of control over the imitative behaviour (reinforced and nonreinforced) of discrete subject populations; particular differentiation appeared between normal and retarded/"autistic" children. Thus a strong possibility exists that any attempt to project experimental results gained within one subject population to another group may be unjustified and misleading. If the 'generalized imitation' phenomenon is to be systematically and optimally applied in a therapeutic role, the effects of various procedures and manipulations must be detailed for any defined subject population to whom such techniques appear relevant. Clearly, young, initially nonimitative subnormal children form one group to whose development behaviour acquisition through imitation might make a major contribution; few studies, however, have systematically investigated 'generalized imitative' phenomena in this population.

With emphasis on practical considerations, this thesis aims to investigate in detail the effects of a number of procedures and variables upon the training and maintenance of imitative behaviour within this specific group of children. It is intended to focus upon the gap in present knowledge that exists between the demonstration of generalized imitation as a laboratory phenomenon and its efficient application as a therapeutic technique with this defined subnormal population.

A review of the literature combined with clinical considerations suggested a number of aspects of generalized imitation about which further information might be helpful. These are listed below:-

1. As described in Chapter 2, many subnormal children may show no imitative behaviour. Generalized imitation can be established in such subjects, but details of training procedures have varied between reported studies. The first experiment attempted to compare the effectiveness of two different methods for training imitation in subnormal children.

2. Previous research with various (nonimitative) responses has suggested that maintenance by intermittent reinforcement rather than continuous reinforcement may commonly increase resistance to subsequent extinction (Jenkins and Stanley, 1950; Lewis, 1960). This has been termed the Partial Reinforcement Effect. A small number of generalized imitation studies have reinforced correct 'imitations' under ratio schedules, but have not investigated the Partial Reinforcement Effect. The second experiment examined implications, within the generalized imitation paradigm, of reinforcing 'imitations' on a ratio rather than continuous reinforcement schedule.

3. Antecedent setting conditions may control imitative behaviour. Typically in studies of the acquisition of generalized imitation, nonimitative children were trained to copy the behaviour of one model in a particular environment. For optimal use of modelling techniques as a therapeutic measure, however, it may be necessary for children to imitate a variety of models in many places. The third experiment examined the effects of model identity and experimental environment variables on 'imitative' and 'generalized imitative' responding.

4. Gewirtz and Stingle (1968) have proposed that

generalized imitative behaviour be considered as a single functional response class which can be established and thus defined by extrinsic reinforcement. This view implies that reinforced and generalized imitations should be influenced in closely similar ways by any given treatment. In applied settings it is important to know the degree to which such correspondence may occur empirically. This issue was the primary focus of the fourth experiment, with particular reference to stimulus control of 'imitations' and 'generalized imitations'.

5. Modelling techniques would probably not feature continuously in behaviour modification programmes with retarded children but rather be used periodically for the acquisition of specific behaviours; resulting intervals of nonpractice might lead to deterioration in imitative performance. The fifth experiment examined:-

a) retention of imitative responding after a period of no formal maintenance, and

b) the amount of subsequent retraining needed (if any) for each subject to recover a generalized imitative behavioural repertoire.

These issues formed the bases of the five experiments to be described in this thesis. In addition, however, the literature review suggested that considerable intersubject variability may show in the effects of specific procedures on imitative behaviour, even within a closely limited subject population. In the extention of generalized imitation into behaviour modification practice it is necessary to know the range of results that given procedures may produce between individual subjects. Previous studies of generalized imitation involving subnormal children have used few, or in the case of Peterson (1968) only a single subject. In these experiments, it was intended that sufficient subjects be investigated to allow examination of intersubject variability in the effects of main procedures.

Finally, the topics and variables for investigation were selected primarily for their relevance to practical issues, and experiments were carried out under conditions that might typically form part of a behaviour modification programme. Thus, generalized imitation was treated first and foremost as an empirical and potentially useful phenomenon. At the same time, however, the theoretical status of the paradigm remained unclear. Despite the specifically practical orientation of the investigations undertaken, it was hoped that the results derived might also allow comments on the relative merits and applicability, for this subject population, of the common hypothesized 'explanations' of 'generalized imitation' set out in Chapter 3, section 3.

Summary

This chapter indicates the main aims of five experiments which made up the practical work of this thesis. Generalized imitation is an empirical phenomenon with potential use to aid acquisition of novel behaviours in developmentally retarded individuals, but given procedures may affect the imitative behaviour of various subject populations in different ways. This series of studies, specifically with a group of young, retarded and initially non-imitative children, examined five topics important to the practical use of the generalized imitation phenomenon:-

1) the relative efficiency of possible procedures for training generalized imitative behaviours in

previously nonimitative subjects;

2) effects on 'imitative' and 'generalized imitative' responses, of an intermittent reinforcement schedule for trained 'imitations';

3) effects of location and model variables on 'imitations' and 'generalized imitations';

4) stimulus control of 'imitations' and 'generalized imitations';

5) retention and recovery of 'imitative' and 'generalized imitative' behaviours after a period of no formal practice.

It was also hoped that these studies might provide evidence bearing on the various 'explanations' of the generalized imitation phenomenon.

# CHAPTER 5

## GENERAL METHOD

1. Subjects
2. Experimental Setting and Apparatus
3. Reinforcers
4. Procedure
5. Data Collection
6. Experimental Design
7. Summary.

The series of studies to be described in this thesis, although investigating different aspects of the generalized imitation phenomenon in a subnormal child population, have, as elements of an integrated research programme, many features of method in common. For economy and to provide an introductory overview of procedures used, these features will now be described; variations that arise will be noted in the 'Method' section of the relevant experiment.

1. Subjects

The Royal Scottish National Hospital at Larbert, Stirlingshire, provides, as an institution for the mentally retarded, long term care for a total of 1325 residents of all ages. Until recently, these patients were drawn from a catchment area of all Scotland, excluding the Strathclyde and Argyll Regions. Subjects for the present research were selected from the occupants of four wards within the hospital given over exclusively to the care of juvenile patients. Each ward housed thirty children. Qualified nursing staff were semi-permanently attached to particular wards with between four and seven nurses on duty in a ward for each of two daytime shifts; a skeleton staff only was present at night.

The population of the four wards, totalling 120 children aged between 1 and 14 years, exhibited varying degrees of developmental retardation and a variety of physical handicaps. For some of the children, diagnoses had been formulated on conventional biological or medical grounds, while for others no such labels were available beyond an acknowledged and observable lack of social and intellectual development. The majority of ward occupants were incontinent of urine and faeces by day and night; the administration of medication was common to control a range of conditions, including "grand mal" and "petit mal" seizures to which some children were subject. A Junior Occupation Centre in the hospital was attended by 36 of the children daily, but the remainder stayed either in bed or in a day room attached to each ward. An estimate by the nursing staff suggested that 111 out of these 120 children required continuous adult supervision for their safety. All, however, had in common a lack of competence necessary for social independence combined with the need for more or less constant nursing care.

From this population 14 children were chosen to form an experimental subject pool. Selection was made on the basis of three concurrent criteria, namely that each child show:

a) gross developmental retardation,

b) neither obvious impairment of visual or auditory capacity, nor gross spasticity of the upper limbs, and

c) no imitative behaviour.

Details of chosen children at a point just prior to their first experimental participation are summarised in Table 2. To preserve anonymity, each individual has been assigned a number from 1 to 14 by which he or she will be identified throughout this report.

The group will now be examined in terms of the criteria for inclusion indicated above.

A. <u>Gross Developmental Retardation</u>

Table 2 shows that the subjects in this group had a mean chronological age of 8 yrs 2 months on first experimental participation.

TABLE 2. SUBJECTS

| Subject (Number) | Chronological Age at First Experiment | Sex | Percentage of Life-Span in Institution | Diagnosis | C.N.S. Seizures | Current Medication |
|---|---|---|---|---|---|---|
| 1 | 3yrs 8mths | Male | 84% | Mongol | No | None |
| 2 | 3yrs 11mths | Male | 98% | Mongol | No | None |
| 3 | 5yrs 1mth | Male | 15% | Not known | No | 1) Thioridazine<br>2) Diazepam |
| 4 | 5yrs 11mths | Female | 54% | Mongol | No | None |
| 5 | 6yrs 8mths | Male | 43% | Microcephaly | No | None |
| 6 | 8yrs 4mths | Male | 25% | Post-Encephalitis "Brain damage" | No | None |
| 7 | 8yrs 7mths | Male | 60% | Not known | No | Chloropromazine |
| 8 | 8yrs 9mths | Male | 23% | "Brain damage" | Yes | 1) Phenobarbitone<br>2) Diazepam |
| 9 | 8yrs 10mths | Female | 77% | Mongol | No | None |
| 10 | 9yrs 2mths | Male | 58% | Mongol | No | None |
| 11 | 10yrs 10mths | Male | 60% | Mongol | Yes | Phenobarbitone |
| 12 | 11yrs 0mths | Male | 71% | "Brain damage" | No | 1) Thioridazine<br>2) Diazepam |
| 13 | 11yrs 3 mths | Male | 66% | "Brain damage" | Yes | Phenobarbitone |
| 14 | 12yrs 7mths | Female | 60% | "Post-inoculation Brain damage" | Yes | Phenobarbitone |
| MEAN: | 8yrs 2mths | | 57% | | | |

As an illustration of their developmental levels at that point, none had any useful speech or, indeed, any words at all; none could feed themselves with a spoon, all were totally incontinent and only eight could walk independent of support. Although with considerable variation between individuals, the group had spent a mean of over half (57%) of their lives in an institution for the mentally retarded. Six of the children had been firmly diagnosed as examples of "mongolism" (Down's Syndrome) and others as suffering from less well defined, but inferred, disorders of the central nervous system; for two children, no statement about the 'cause' of their retardation had been recorded. Four individuals (Subjects 8, 11, 13 and 14) were currently receiving anti-convulsant medication to control "petit mal" and "grand mal" seizures. In addition, four (Subjects 3, 7, 8 and 12) were tranquillized to reduce their levels of activity; the placement of Subject 3 and Subject 8 on the latter drugs represented an attempt to minimize frequently emitted harmful stereotyped behaviour, that of hitting their own faces with a strength that resulted in considerable bruising.

B. <u>No Impairment of Visual or Auditory Capacity, nor Gross Spasticity of Upper Limbs</u>.

Both visual and auditory stimuli were to be important factors in the experimental situation; it was therefore necessary to exclude children with obvious impairment in either sensory modality. Formal vision and hearing tests had never been carried out on this population and therefore, for present purposes, a rough-and-ready assessment was attempted of each possible candidate. All children selected as subjects could follow an object with their eyes and react to sounds behind the head; general observation of their behaviour suggested an awareness of events in their immediate environment. It should however, be noted that such "techniques" may well have left undetected handicaps like colourblindness or high tone deafness.

Similarly, as the experiments would require controlled movements of the upper limbs, children with gross motor disabilities were excluded. All of these selected had competent muscular control of the upper limbs, although subject 12 demonstrated a mild degree of athetosis with fluctuating tone.

C. No Imitative Behaviour

The first experiment in this thesis concerned the training of imitation in previously nonimitative children; thus it was necessary at the outset that none of the subjects show any evidence of an imitative behavioural repertoire. This criterion of selection had also an additional application; later assessment of the control exerted by selected independent variables over such experimentally acquired behaviours was unlikely to be complicated by previous unrecorded learning.

It was, however, difficult to assert with complete confidence that every subject selected had an initial absence of imitation. Previous studies (e.g. Baer et al., 1967; Metz, 1965) have defined this condition operationally in terms of a child showing no imitation of several simple demonstrated actions, even when requested to do so. Before the present investigation began, three steps were taken to determine whether each potential subject would copy or not. These were:-

1) the behaviour of each child was discussed with nursing staff who knew the individual well;

2) the behaviour of each child in a ward setting was

unobtrusively observed over two separate 15 minute sessions, and

3) both the experimenter and a familiar member of staff demonstrated simple actions to the child with instructions to copy the behaviour.

If, by the end of these separate stages, no evidence of imitative behaviour was forthcoming, the child was held to be "nonimitative" for the purposes of this investigation.

## 2. Experimental Setting and Apparatus

Most previously cited studies of the "generalized imitation" phenomenon (see Chapter 3) have involved notably uncomplicated experimental settings and apparatus; the present series of investigations was no exception.

Unless otherwise stated, all experiments were conducted in a single, barely furnished treatment room off one of the juvenile wards. This room measured 2.3 by 3.1 metres and contained a table and two chairs, one of which was comfortably padded with a high back and hollow side arms.

Also permanently placed in the room were a Sony 3420 CE "Videocorder" camera and a Sony 3620 videotape recorder loaded with ½ inch, high density tape; this latter could be connected to a 24 inch screen, 625 line television monitor. Such a system was chosen to provide optimal contrast and detailed definition of recordings made with normal lighting.

A large faced clock with full sweep second hand was visible to the experimenter and various consumable items were kept within his reach; (see Section on "Reinforcers" for details). Also to hand was a uniformly coloured red ball of 30 centimetres diameter which could be hidden at will from the subject behind a screen. Additional simple properties available included a toy "teddy bear", two dessert size spoons, a plastic cup, 6-inch sided squares of tissue paper and nine multi-coloured cubes of side measurement 1 inch.

## 3. Reinforcers

The variety of reinforcing stimuli that were presented consequent on correct "imitations" in previous studies of generalized imitation has been described in the literature review (see p.46 ). For the majority of such experiments, reinforcement conditions were restricted to manipulations of positive reinforcing stimuli only, either as a main independent variable or more subordinate factor of methodology. The present series of investigations conformed to the above pattern in that reinforcers delivered to every child were restricted to positive stimuli only; accordingly, prior to experimentation, an effective positive reinforcer was sought for each subject.

Nawas and Braun (1970 b) pointed out "with retardates, especially in their typically barren institutional settings, the range of reinforcers which have been found of practical use is limited" (p.18) . Bijou and Sturges (1959) suggested five categories of potential reinforcers for such children. These were:

1) consumables, those items which are either edible or drinkable;
2) manipulatables, including toys, trinkets and hobby materials;

3) visual and auditory stimuli, particularly films and music;

4) social stimuli, such as praise, hugging or attention; and lastly,

5) tokens or any other object which acquires a reinforcing property through repeated association with a primary reinforcer (such as food, drink or other survival needs) or with anything that the individual cherishes highly.

Preliminary discussion with nursing staff who knew the individual subjects well, and first-hand observation by the experimenter, suggested that for each of the children selected, praise and specific consumables might be effective reinforcers. Such stimuli have advantages over some of the other possible reinforcers outlined above. Praise ("good boy!" or "good girl!") may be delivered contingent upon appropriate behaviour with minimal delay; food and drink are convenient and economical to obtain, easily administered to the subject in small portions to delay satiation and rapidly consumed, thus avoiding long delays between deliveries. The edible solids used were chocolate pieces, chocolate beans ('Smarties'), crisps, sweet hospital pudding and jam, while liquids administered included syrup ('Delrosa'), milk and orange juice.

An effective (consumable) reinforcer was identified for each child during early contact. An item eagerly sought by the subject, and the withdrawal of which resulted in distressed emotional behaviour, was retained for use; substances refused by a child were replaced with others as necessary. The subjects for whom each reinforcer was selected are indicated in Table 3.

Table 3. Subjects receiving each consumable reinforcer.

| Reinforcer | Subject Number |
|---|---|
| Chocolate pieces | 3, 14 |
| Chocolate beans | 6, 10 |
| Crisps | 11 |
| Sweet pudding | 8, 12 |
| Jam | 5, 9 |
| Syrup | 1, 2, 7 |
| Milk | 4 |
| Orange Juice | 13 |

Methods for administration of these items varied. Chocolate pieces and beans were delivered directly by the experimenter to the subjects' mouths, as were small portions of pudding and jam on the end of a spoon; in contrast, subject 11 would only accept crisps placed in his hand. Orange juice was delivered to subject 13 from a cup with a spout feeder, but at first the efficient administration of liquid reinforcers to the remaining subjects presented difficulty. Fuller (1949) delivered milk to a "vegetative idiot" through the mouth of a syringe; Nawas and Braun (1970 b), however, pointed out "this is not a typical procedure and may be aversive in many cases" (P.19) . Such a technique was tried with the plastic cylinder (without needle) of a disposable syringe, this cartridge containing

5 $cm^3$ of either syrup or milk as appropriate. Despite the doubt expressed by Nawas and Braun (1970 b), the syringe rapidly lost any aversive properties such objects might have acquired for the subjects; without exception, all soon became "magazine trained" to the extent of immediately turning towards the experimenter with open mouth upon possible occasions for reinforcement. 1 $cm^3$ of liquid was then delivered directly into the subject's mouth as appropriate.

In summary, reinforcements contingent upon appropriate behaviour consisted of immediate praise ("good boy!" or "good girl!"), followed as soon as possible by a consumable reinforcer chosen for each child.

## 4. Procedure

The experiments undertaken all followed the "discrete trial" paradigm common to studies of the "generalized imitation" phenomenon. On any given trial, the action demonstrated by the model for imitation was selected from two sets of behaviours, either:

1) "training" actions, accurate reproductions of which by the subject (termed "imitations") were, depending on experimental conditions, contingently reinforced, or

2) "test" actions, subdivided into two groups of "standard" and "comprehensive" test actions, reproductions of which (named "generalised imitations") were never reinforced.

To aid distinction, these sets will consistently be termed "training" or "test" actions; the specific behaviours in each are listed in Table 4.

Table 4. Modelled Actions

| Training | | Standard test | |
|---|---|---|---|
| 1 | pat cheek | 8 | touch nose |
| 2 | nod head | 9 | cover eye |
| 3 | pat table | 10 | pat chair arm |
| 4 | pat crown of head | 11 | pat wall |
| 5 | pat chair back | 12 | wave hand |
| 6 | pat table leg | | |
| 7 | pat chest | | |

Comprehensive Test

| Body movements | | Vocal | | Object Manipulations | |
|---|---|---|---|---|---|
| 13 | clap hand | 18 | say 'aaa' | 23 | pat teddy |
| 14 | stick out tongue | 19 | say 'b' | 24 | bang spoon on table |
| 15 | pat foot | 20 | cough | 25 | put cube in cup |
| 16 | point | 21 | say 'da da' | 26 | crumple paper |
| 17 | kick heels | 22 | say 'mmm' | 27 | throw cube |

These actions were typical of those used in "generalized imitation" experiments (see, for example, the list proposed by Baer et al., 1967); all were principally chosen as clearly defined behavioural units probably within the abilities of retarded child subjects. The "training" and "standard test" actions had in common that both were limited to either body movements or patting objects constantly within reach of the subject. In contrast, the "comprehensive test" actions, while including some body movements only, also covered a wider topographical range of behaviours extending to vocalizations and simple manipulations of common objects.

As a general strategy, experimental operations with each subject were carried out over repeated trials of five selected actions from the "training" set only. At various infrequent but preordained points (either after a certain number of trials or following a criterion of performance) the five "standard test" actions were modelled for one trial each, alternated with "training" action trials. This latter step, similar to procedures in previous studies, monitored the occurrence of nontrained, nonreinforced "generalized imitations". The "comprehensive test" actions, modelled less frequently but under identical conditions, similarly probed "generalized imitation" of experimentally less familiar and more widely varying behaviours.

Experimental runs were divided into a series of consecutive sessions undertaken with each child singly. Prior to each session, the experimenter escorted the subject from his or her ward to the room that contained the equipment previously described (see this Chapter, sections 2 and 3). The child sat in the padded chair with his legs under one of the hollow side arms, thus mildly restrained, but still allowed maximal movement of the upper limbs and trunk. Throughout all experiments, subject and model sat close together in chairs, facing each other with a table close by the side, as illustrated in Figure 1. Except where otherwise indicated, the experimenter, an adult male dressed in casual clothes, acted as model.

Evidence has been presented (see Chapter 3) which suggests that antecedent setting events prior to each trial may influence the probability of imitation. Less specifically, Zeaman and House (1963) indicated the need for distinctive cues to assist the severely retarded to attend to relevant aspects of the environment in learning situations. The instructions "do this" or "say" which have preceded each trial in most "generalized imitation" experiments might act as a suitable cue. Such events, however, last a very limited time before each action is modelled and thus may be easily missed, particularly by subnormal subjects. In addition, Bijou and Baer (1966) have pointed out that wide variations may occur between children in the control that overt verbal instructions exert over their behaviour. Because of such uncertainties, except where otherwise indicated no verbal instructions preceded either sessions or individual trials throughout the experiments undertaken. Instead, except under specific conditions, a large and obvious red ball of 30 cms. diameter served as a distinctive cue throughout the demonstration of each action for imitation.

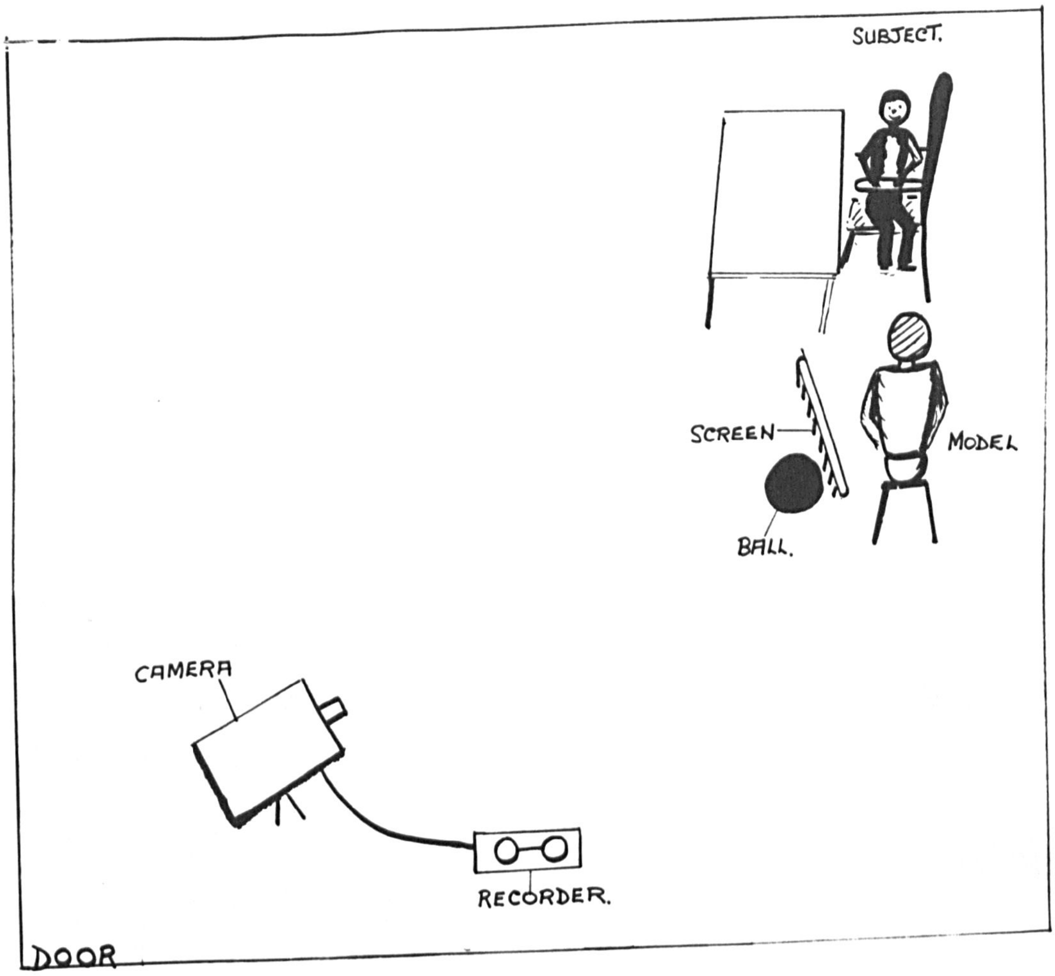
At the beginning of each trial, the model brought the red ball from behind the screen and placed it on his knees in full view of the subject. The model then demonstrated a selected action in a standard, unemphatic manner for up to a maximum of ten seconds. If appropriate under experimental conditions, similar behaviour by the subject during the ten second trial period was reinforced immediately (see Figure 2); that trial then ceased and the ball was placed behind the screen, outwith the subject's vision. Trials for which no consequences were programmed continued for the full ten seconds' duration

FIGURE 1.

Diagrammatic representation showing:

UPPER Relative positions of model, subject and apparatus (between trials) in the experimental setting; and

LOWER Detail of how each subject sat in the padded chair with his legs under one of the hollow side arms.


SUBJECT.
SCREEN
MODEL
BALL.
CAMERA
RECORDER.
DOOR

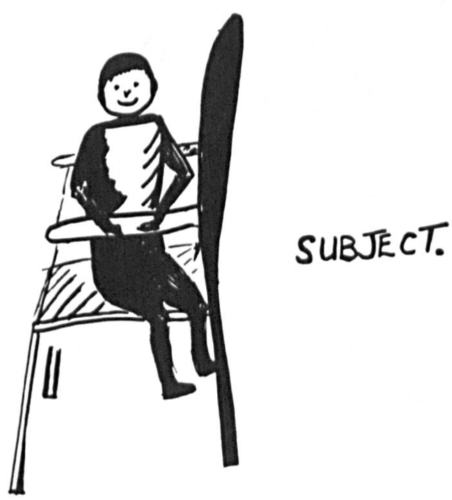

SUBJECT.

FIGURE 2.

Reinforcement of a correct 'imitation'.

Subject 2 correctly reproduces the 'training' action 'pat cheek' demonstrated by the model; the child has just been praised and is about to receive the consumable reinforcer, in this case 1 $cm.^3$ of syrup, delivered to the subject's mouth by the model from a syringe cylinder. The red ball of 30 cms. diameter used to indicate each trial rests on the model's knees.

despite any behaviour emitted by the subject in that time. A constant period of 10 seconds always elapsed between trials, and during such intertrial intervals the model sat passively with eyes averted from the subject. Care was taken that all reinforcers and their means of delivery were kept from the subject's view except upon administration.

Depending on the child's condition from day to day, each session contained on average 30 trials and lasted about 10 minutes; upon occasions when a subject appeared excited, upset or otherwise uncooperative, the session was terminated at the experimenter's discretion. Sessions were carried out daily, including weekends, at random times throughout the day. If a subject became unwell, experimentation was discontinued until the child had fully recovered.

Each session was recorded on videotape and played back later through the monitor for analysis.

## 5. Data Collection

Throughout the present study, data were systematically drawn from two areas, namely the general developmental levels of subjects and their behaviour, imitative and otherwise, during experimental sessions.

Prior to every experiment, the current capabilities of each participating subject were assessed by means of:-

1) the Vineland Scale of Social Maturity (Doll, 1953), which provided a "social age" (S.A.) equivalent based on the social development of "normal" children. From the combination of this measure with the chronological age (C.A.) of the child was derived a "social quotient" (S.Q.) of development, where S.Q. = $\frac{\text{S.A.}}{\text{C.A.}}$ X 100. Both "social

age" and "social quotient" were used as descriptive measures of each subject.

2) the Primary Progress Assessment Chart (Gunzburg, 1969), a checklist of various categorised behaviours likely to be of value to the subnormal individual and arranged within categories in common sequence of acquisition. For present purposes, a "raw score" comprising the total number of such behaviours shown by each child was used as a measure of developmental level for that individual.

Such "assessment techniques" have drawbacks, previously discussed (see p.11 ), and in the present investigations were intended to provide a coarse indication only about the development of each child at the time when applied. Both scales are, however, in widespread clinical use throughout Britain with subnormal populations and their inclusion may facilitate comparison between the present subjects and other similar groups.

The second and major focus for data collection was the behaviour of subjects during experiments. Upon the playback of each session recording, the experimenter analysed the performance of the subject by means of three standard measures. These were:-

1) on any given trial, the degree to which the subject accurately reproduced an action demonstrated by the model;
2) the time that elapsed within each trial between the demonstration of an action and its imitation by the subject ("latency"), and
3) the emission by the subject of "intertrial" behaviours, identical to those previously modelled for imitation

but outwith the confines of a trial on which the behaviour had been demonstrated.

Each measure will now be examined in detail.

1. Occurrence of Imitative Behaviour on Each Trial. On trials involving the frequently modelled "training" actions, the performance of the subject was judged to fall into one of two categories, either "imitation" or "nonimitation", which resulted in a score of 1 or 0 respectively. The restriction to two categories only reflected the need upon occasion for the experimenter to decide whether a given performance reached criterion for reinforcement or not.

In contrast, on trials where the less frequently demonstrated "standard test" and "comprehensive test" actions were modelled, the subject's (nonreinforced) behaviour was judged to fall into one of three categories:-

a) a competent, accurate reproduction of the behaviour modelled (scored 1);

b) a "poor" imitative response, comprising an attempted execution but in which reproduction was incomplete. Thus, for example, following demonstration of the "standard test" actions and body movement subset of the "comprehensive test" actions, the subject's hand might move definitely towards the body part or furniture item to be patted, but never complete the behavioural unit. In the subset of vocal actions, any sound emitted by the subject, even if not a close approximation to the behaviour modelled was judged to fall into this category; similarly, in trials involving the manipulation of objects, that the subject touched the relevant object without completing the required movement was judged a "poor" imitation. (All responses in this category were scored ½.)

c) no imitative response (scored 0).

Lateral preferences, crossed laterality or alteration of laterality between trials in the limbs used for imitative responses were not penalized in the scoring of each trial. The reproduction of a behavioural unit with concurrent identical colateral movement (e.g. subject pats left cheek with left hand and right cheek with right hand concurrently in imitation of 'training' action 'pat cheek' demonstrated by model) was, however, always judged as "nonimitation" and consequently scored 0 for each trial upon which such behaviour occurred.

The sum of the scores obtained by each subject for all "training" action trials in a session, expressed as a percentage of the total number of such trials in the session, provided a measure of imitative performance, "percentage imitation" of "training" actions. In a similar manner, the emission of nonreinforced "generalized imitations" was computed when appropriate. These measures have been commonly used in "discrete trial presentation" studies of imitation as indices of imitative responding and similarly featured in the present investigation.

2. Latency of Response. Within a "discrete trial" paradigm, the latency (or 'reaction') time that elapses between the start of a trial and response emission by the subject is a well established measure of response strength (Deese, 1958). Under present experimental conditions, each trial had a maximum duration of 10 seconds during which the subject might imitate the model. The latencies of such responses were timed to

the nearest second, with a minimum possible of one second. Clearly, upon trials where no imitative behaviour occurred, no latency time could be recorded. It is interesting to note that such a measure has not been used in previously reported generalized imitation studies.

3. Occurrence of Intertrial Responses. For present purposes, behaviour emitted by a subject which was similar to that previously demonstrated by a model and which occurred within a time limit, albeit arbitrary, of 10 seconds following the demonstration has been termed "imitation". Metz (1965), however, pointed out that specific imitative behaviours which were appropriate and reinforced in a particular situation were often repeated by "autistic" subjects inappropriately; similarly, Waxler and Yarrow (1970) noted the necessity to be "alert to any appearance of the experimental responses emitted by subjects at points not directly following the experimenter's demonstration"(p.127). All such occurrences were noted of behaviours demonstrated for imitation during a given session, but emitted by the subject outwith a trial on which they were specifically modelled. Again, such data have not been commonly used in generalized imitation research.

Thus, among the measures of imitative performance, taken, only one ("occurrence of imitation on each trial") has consistently featured in previous descriptions of generalized imitative behaviour. All three may, however, be relevant to a detailed account of the phenomenon. In addition, other behavioural incidents of interest were noted as appropriate.

It has been common practice in such studies that the reliability of data collected by the experimenter be regularly checked by other independent observers. For the present investigation, various checks on the scoring of the "occurrence of imitation" variable were carried out both by members of the hospital nursing staff and other adults skilled in the observation of child behaviour. A measure of inter-scorer reliability for each checked subject session was then calculated in a manner suggested by Bijou, Peterson, Harris, Allen and Johnston (1969); that is:-

$$\text{Interscorer reliability} = \frac{\text{number of trials where experimenter and check scorer agree}}{\text{number of agreements} + \text{number of disagreements}}$$

The measure of reliability so obtained was directly comparable with figures quoted in previously reported studies.

## 6. Experimental Design

Two major types of design for experiments are at present found within the behavioural sciences, namely "within subject" and "between group" designs. Each will now be described.

1) "Within subject" designs. This type of design aims to determine operations that relate functionally to the performance of behaviour. The effect of a variable either antecedent to or consequent on behaviour is demonstrated by the consecutive presentation, removal and representation of the variable to a subject. Control over a behaviour is demonstrated if response rates or other measures can be altered at will by varying the experimental operations; typically the effects of the experimental variable may be immediately observed. The generality of such effects may then be demonstrated through experimental replication with other subjects. Such a strategy has been predominantly used in the studies of generalized imitative behaviour cited in Chapter 3.

2) "Between group" designs. This approach seeks to demonstrate differences between groups of subjects after the manipulation

of independent variables. In the simplest form, an experimental and a control group are selected, both groups being initially equal in all important respects. An independent variable condition is then administered to the experimental group, after which both groups are again compared on relevant parameters. The resulting data are statistically analysed, the inclusion of the control group permitting, a clear-cut evaluation of independent variable effects; mean differences between groups are considered rather than the behaviour of individual subjects.

Both types of design have advantages and disadvantages which dictate useful areas of application for each; details and relative merits of both design modes have been extensively discussed by Bijou et al. (1969), Kazdin (1973) and Edgar and Billingsley (1974). Briefly, the "within subject" design bypasses variability due to intersubject differences which is included in the design of "between group" experiments. Such an exclusion may be desirable from several viewpoints. Firstly, intersubject variability is not part of the behavioural processes of the individual subject but is an effect due to the method of study. Secondly, in evaluating experimental findings from group designs, intersubject variability serves as a base for statistical evaluation of the results. Because of this, as Sidman (1960) noted, it is possible that lawful effects of variables may be obscured. A similar problem is that averages from group data may have no equivalent in representing the behavioural processes of individuals. Equally, the form or shape of the function obtained with group data may not represent the behaviour change processes of the individual; indeed, exceptional subjects in the group may be affected totally differently by the experimental manipulation. The avoidance of such difficulties renders the "within subject" style of design particularly strong for the study of functional behavioural control.

In turn, however, experimental situations arise for which the "within subject" design is not appropriate and the use of a "between group" design carries distinct advantages; a major example of such a situation concerns reversability of treatments and comparison of effects from different experimental conditions on the same subject. After a subject has experienced one treatment, the loss of naivety or experience gained may carry over to contaminate the effects of another successive and contrasting experimental condition. As Kazdin (1973) commented about research in applied settings "there is now .... emphasis on finding effective treatments and these cannot easily be evaluated in single subject or single group designs. This has led to refinement and extension of procedures evaluated (statistically) as treatments and compared with a control group"(p.520).

In the present study, a set of retarded children served consistently as subjects through a prescribed succession of experiments, with the exception of three children who also took part in an additional investigation. Thus the total experimental histories of subjects were, with exceptions, comparable at any given point. Both "within subject" and "between group" designs were employed for individual experiments as appropriate. Clearly in a comparison of methods for training imitation in previously nonimitative children, reversability of treatments would be impractical once training was complete; similarly with comparison of continuous or ratio schedule reinforcement maintenance of imitative behaviour, previous experience could potentially contaminate treatment effects upon reversal of experimental conditions. Thus for both experiments "between groups" designs were used and results were statistically analysed. Subject groups were, however, small and it is emphasised that for practical purposes appreciable differences only in treatment effects were sought between groups. On such occasions, when group mean measures have been used, the performance of selected individual subjects will also be noted.

For the remainder of experiments to be reported, which concern the effects of various conditions (e.g. change of model, change of experimental setting) on the imitative behaviour of individual children, "within subject" designs have been employed. When, however, a relatively large number of subjects have been involved in identical treatments, the effects of such experimental manipulations will be summarized as group data; selected individual performances will also, however, again be demonstrated as appropriate.

## 7. SUMMARY

This chapter outlines points of method common to all five experiments of this thesis. Six main headings were used:-

1. Subjects. A total of fourteen young, institutionalized, subnormal children, all of whom were initially nonimitative.

2. Experimental Setting and Apparatus. A barely furnished hospital treatment room, containing two chairs, a table, a small screen, recording apparatus and television monitor. Also available were a clock, a red ball of 30 cms. diameter, a 'teddy' bear, two spoons, a plastic cup, squares of tissue paper and multicoloured blocks.

3. Reinforcers. For each child, on each occasion for reinforcement, praise ('good boy' or 'good girl') was followed as soon as possible by delivery of a consumable item.

4. Procedure. Experimental sessions were carried out with each subject singly. Within a 'discrete trial' paradigm, the model

demonstrated one action on each trial. These actions were drawn from two sets, either 'training' actions, 'imitations' of which by the subject might be reinforced, and 'test' actions, 'generalized imitations' of which were never reinforced. Each session was recorded on videotape and played back later for analysis.

5. Data Collection. Before each experiment, every participating subject was assessed by means of the Vineland Social Maturity Scale and Primary Progress Assessment Chart, the former providing a 'Social Age Equivalent' and 'Social Quotient', the latter number of items passed. Imitation performance in each session was recorded by means of:-

a) the incidence of imitative behaviour on each trial. Reproductions of 'training' actions were scored as falling into one of two categories ('imitation'/no 'imitation') and those of 'test' actions into three possible categories (competent 'generalized imitation', poor 'generalized imitation', no response);

b) latency of each response;

c) incidence of similar responses between trials;

When some sessions were rated by more than one scorer, a measure of interscorer reliability of marking was derived.

6. Experimental Design. Both 'within subject' and 'between group' designs were used, as appropriate.

# CHAPTER 6

# THE EXPERIMENTS

# EXPERIMENT 1

## Training generalized imitative behaviour:

## a comparison of procedures.

# INTRODUCTION

As previously described (see p.68) imitation may be used to develop novel behaviour patterns in subnormal children. Such retardates, however, commonly show no inclination to copy the actions of adult or peer group models; thus, as a preliminary step prior to the use of such techniques it may be necessary to train imitative responding in each prospective child candidate. The acquisition of (potentially reinforced) imitative and (nonreinforced) generalized imitative behaviours by developmentally retarded subjects under laboratory conditions are well documented phenomena (Baer et al., 1967; Garcia et al., 1971; Lovaas et al., 1966; Lovaas et al., 1967; Metz, 1965). Typically, an initially nonimitative child was taught by "shaping" with positive reinforcement (see p.26) and "fading" (see p.45 ) to copy a limited set of demonstrated "training" actions, each to a standard criterion performance; at prearranged points in the training procedure novel "test" actions were also modelled, correct generalized imitations of which were never reinforced. Formal training of different "imitations" continued until the subject reproduced accurately any novel action demonstrated by the model in a context of continued reinforcement for previously trained imitations.

Although subjects in all relevant studies attained a final common criterion performance of generalized imitative behaviour, there were differences in the details of procedure used for each investigation. One of the main points of variation was the sequence in which separate "training" actions were programmed for demonstration to the subject in the period before generalized imitation had been achieved; three such arrangements have been reported. Firstly, Baer et al. (1967) and Lovaas et al. (1967) taught imitation of each successive "training" action in turn to criterion in isolation; once a given action was reliably imitated, it was discarded in favour of the next scheduled for training. Secondly, Lovaas et al. (1966), when shaping verbal imitation, also trained subjects to copy successive sounds and words in turn; during ongoing teaching of any specific imitation, however, random trials were also intermixed upon which previously trained sounds were modelled and correct imitation reinforced. Thirdly, Metz (1965) and Garcia et al. (1971) used procedures that combined features of both previously described. These authors trained two imitations concurrently, each action being individually modelled on alternate trials in a training session; when the subject imitated both demonstrated actions to criterion, the pair were discarded and replaced by two more behaviours, a process which continued until generalized imitative responding was complete.

From these descriptions, two distinct forms of training procedure may be abstracted:-

1) those that involved a potential alteration between "training"actions demonstrated on successive trials; thus actions, imitation of which had been previously trained were demonstrated on separate interspersed trials during acquisition of a particular "imitative" response. For this study, such a method has been dubbed the 'Cumulative' training method.

2) those in which each 'imitation' was trained to criterion in isolation, without interspersed trials involving demonstrations of previous actions, reproduction of which had already been trained. This method will be labelled the 'Serial' training method.

Although both types of procedure have been shown competent to train generalized imitative behaviour in retarded child subjects, the efficient use of resources in clinical settings dictates that such training be completed as rapidly, over as few trials, as possible. The question thus arose whether either form of training method carried distinct economic advantages.

The present experiment attempted to establish the relative efficiency of these procedural forms by comparing the performances of two groups of initially nonimitative retarded children during training of generalized imitation, one group by the 'Cumulative' method and the other by the 'Serial' method.

It was anticipated that all subjects would eventually attain a generalized imitative behavioural repertoire, regardless of the method by which each was trained. In the absence of further relevant information and with the essentially empirical nature of this investigation in mind, however, no further specific predictions were attempted about the outcome of comparisons between groups trained by the contrasting methods indicated.

## METHOD

### Subjects

Twelve retarded children, all initially nonimitative within the operational definition previously described (see p.84 ), served as subjects for this experiment. These children, Subjects 3-14 in Table 2, were randomly assigned to form two groups both of six individuals; one group was to be trained to imitate by the 'Cumulative' method and the other by the 'Serial' method. The subjects in each group are summarized, with developmental data, in Table 5.

| 'CUMULATIVE' TRAINING METHOD GROUP | | | | |
|---|---|---|---|---|
| Subject (Number) | Age | Primary P.A.C. Items Passed | Vineland Social Age | Vineland Social Quotient |
| 4 | 5yrs 11mths | 39 | 0.7yrs | 12 |
| 5 | 6yrs 8mths | 38 | 0.7yrs | 10 |
| 6 | 8yrs 4mths | 38 | 1.0yrs | 12 |
| 10 | 9yrs 2mths | 36 | 1.4yrs | 15 |
| 13 | 11yrs 3mths | 38 | 1.2yrs | 11 |
| 14 | 12yrs 7mths | 29 | 0.6yrs | 5 |
| Mean: | 9yrs 0mths | 36 | 0.9yrs | 11 |

| 'SERIAL' TRAINING METHOD GROUP | | | | |
|---|---|---|---|---|
| Subject (Number) | Age | Primary P.A.C. Items Passed | Vineland Social Age | Vineland Social Quotient |
| 3 | 5yrs 1mth | 41 | 0.7yrs | 12 |
| 7 | 8yrs 7mths | 54 | 1.3 yrs | 15 |
| 8 | 8yrs 9mths | 29½ | 0.9yrs | 11 |
| 9 | 8yrs 10mths | 45 | 1.1yrs | 13 |
| 11 | 10yrs 10mths | 28 | 0.9yrs | 8 |
| 12 | 11yrs 0mths | 57 | 1.6yrs | 15 |
| Mean: | 8yrs 10mths | 42 | 1.1yrs | 12 |

Table 5. Subjects Comprising 'Cumulative' and 'Serial' Training Method Groups.

The resulting groups had similar mean chronological ages and social quotients; the mean number of items passed on the Primary P.A.C. and mean social age equivalent on the Vineland Scale of Social Maturity were, however, marginally higher for subjects to be trained by the 'Serial' method.

Experimental Setting, Apparatus and Reinforcers

The experimental setting, apparatus and specific reinforcers administered to individual subjects were as described in the relevant sections of Chapter 5 (General Method).

Procedure

Each child was trained individually over successive daily sessions as indicated in Chapter 5 (General Method; see p.91 ). A maximum of three children only were trained during any given time period and the training method used was alternated with consecutive sets of three subjects.

Each child was given up to six sessions, each of 10 minutes, to adapt to the experimental situation. Before imitation training began, all five "standard test" actions (see Table 4) were modelled to each subject both by the experimenter and a uniformed nurse familiar to the child; each action was presented twice by each model, preceded by the instruction "do this" and again without instructions.

Each subject was then taught to imitate successive actions from the 'training' set in an order corresponding to position of the behavioural units in Table 4; thus imitation of Action 1 (patting cheek) was first trained, then imitation of Action 2 (nodding head) and so on. Exception was made only for Subject 3 and Subject 8, both of whom consistently displayed a behaviour pattern of hitting their own cheeks; to avoid confusion during training or data collection, Action 7 (patting chest) was substituted for Action 1 as the first "imitation" taught to both these subjects, after which the order reverted to that of Table 4.

Once the first imitation had been established, two different methods were used to complete subsequent training, each applied solely to one of the two subject groups. These methods were:-

1) The 'Cumulative' method. During the training of a particular "imitation", trials were randomly interspersed when any action, imitation of which had been previously established, might be demonstrated and correct reproduction contingently reinforced. Thus, for example, while training imitation of Action 3 (patting table), on random trials the model demonstrated either Action 1 or Action 2 instead and the subject was reinforced for appropriate subsequent imitative behaviour.

2) The 'Serial' method. Imitation of each successive "training" action was taught to completion in isolation without any trials interspersed involving demonstrated actions whose reproduction had been previously trained. Thus, during imitation training of Action 2, no trials involved demonstration of Action 1; similarly, imitation of Action 3 was established with neither Action 1 nor Action 2 modelled on any intervening trial.

Two procedures, "shaping" (Skinner, 1953) and "fading" (Baer et al., 1967) were used concurrently, depending on the subject's behaviour within and between trials, to train imitation of each action. Although these procedures have been briefly mentioned previously (p.26 and p.45 respectively), each will be described in detail with particular reference to training imitation of Action 1 (patting cheek) for illustration.

During initial trials, the model placed the red ball of 30 cms. diameter on his knees in full view of the child, instructed "do this" and demonstrated the action of patting his cheek for a maximum of 10 seconds. Any response by the subject during the trial that involved an element of the modelled action (e.g. moving a hand) was reinforced, whereupon the trial ended and the ball was removed from the child's view. A further constant interval of 10 seconds then elapsed before the next trial. At early stages in training of each imitative response, behaviour was also reinforced that bore some relation to the imitation desired, even if emitted during this intertrial interval. Gradually, the subject's behaviour both within and between trials was shaped by "successive approximations" (see p.27); that is, the criterion behaviour for reinforcement progressively approximated the final desired performance. Thus, after Action 1 (patting cheek) had been demonstrated, firstly any hand movement was reinforced, then similar movements of increasing amplitude only, next hand movements progressively closer to the face and, lastly, fingers touching the subject's cheek. If any such shift in criterion behaviour for reinforcement resulted in a notable decrement in the quality of the subject's responses, the criterion in operation reverted to a less demanding level for some trials. Finally, when the subject had achieved a high rate of cheek patting behaviour, responses emitted during trials only were reinforced.

If by the end of any trial, the subject had displayed no attempt to reproduce the demonstrated action, the model took the child's hand and physically prompted it through the desired behaviour; thus, when Action 1 had been demonstrated, the subject's hand was guided to touch his cheek, whereupon reinforcement followed. On subsequent similar trials, the model "faded" the prompt by gradually removing his active participation in the child's response. For example, he lifted the subject's hand part way to the cheek only; the child was then reinforced upon successful completion of the movement. On later trials the model only touched the subject's hand, then pointed to it and finally gave no physical cue at all apart from the trial demonstration. Again, any change in the level of prompt that resulted in a marked performance decrement was temporarily discontinued.

If during early training, a subject resisted guidance through a response, for example pulled his arm down when the model attempted to raise it, the model waited and tried again until the arm could be at least partially raised without great resistance. The (prompted) response was then reinforced. Once an "imitative" response had been reliably established during trials only, the experimenter also 'faded' the verbal instruction cues by speaking in a progressively softer voice on successive trials until no verbal prompts occurred on any trial.

Training of each imitation continued by a combination of 'shaping' and 'fading' until the subject accurately reproduced the current training action on 10 consecutive presented trials in the presence of the red ball, without verbal instructions and without the emission of similar responses between these trials.

When training of each imitation was completed, tests for generalized imitation were carried out. The 'standard test' actions (see Table 4) were demonstrated under identical conditions for one trial each, but correct (generalized) imitations of the "test" actions were never reinforced. Each "test" action trial was terminated after 10 seconds irrespective of the subject's behaviour.

Imitation training by 'Cumulative' or 'Serial' methods continued with each successive action from Table 4 until the subject achieved a score of at least 90% for generalized imitation during one presentation of all the 'standard test' actions; this represented, at least, accurate reproduction of four'test'actions and 'poor' imitation of one, as described in the appropriate section (p.96 ) of Chapter 5.

At this point, over three sessions, a further test for generalized imitation was given with a wide variety of novel actions (the 'comprehensive test' actions of Table 4). Test trials were carried out as before with interspersed retraining trials in which actions, all previously trained for any given subject were demonstrated and imitation reinforced.

Each session was recorded on videotape and played back later for analysis. Data were collected in the forms described in Chapter 5 (General Method); at a number of points throughout the study, independent observers checked the reliability of the experimenter's scoring of the subjects' behaviour.

## RESULTS

Observer agreement on scoring of trials always exceeded .93.

Before training began, none of the subjects imitated any of the five 'standard test' actions when demonstrated by either the experimenter or a familiar uniformed nurse, whether or not the actions were preceded by instructions.

During training of the first imitative response, the frequency of emotional or disruptive behaviour (e.g. crying, then vacating chair and walking away) shown by all subjects rapidly decreased. Although behaving in many different ways (e.g. twisting in chair) during intertrial intervals, all the children, with the exception of Subjects 11 and 14, soon learnt to sit still and observe the model upon the introductory cues for each trial. Subsequently, individual subjects were restless during isolated sessions only.

Five out of six subjects in each group, that is Subjects 4, 5, 6, 10 and 13 trained by the 'Cumulative' method and Subjects 3, 7, 8, 9 and 12 trained by the 'Serial' method acquired generalized imitative behavioural repertoires. The number of training trials taken by these children to achieve the generalized imitation criterion level are shown in Table 6; as indicated, differences occurred between groups in the patterns of training trials required to reach this point. Despite a considerable range of individual results, all ultimately successful subjects in the 'Cumulative' method group required more trials to reach criterion imitation of the first"training"action than subjects in the 'Serial' method group. Assessed by a Mann-Whitney 'U' test (Siegel, 1956) this difference between groups reached significance ($p < .01$). Again with appreciable intersubject variation there was, however, no significant difference (Mann-Whitney; $p > .05$) between groups in the number of trials then taken to complete training of all necessary subsequent"imitations". In this latter phase, for the 'Cumulative' method group trials on which previously trained actions were demonstrated occurred in a ratio of approximately 1:3 with those involving current"training"actions.

Table 7 indicates the number of correct"imitations"emitted by subjects in each training group prior to gaining criterion performance of generalized imitation. Once again there was a wide range of results; the differences between training method groups

Table 6. Number of Training Trials to Reach Generalized Imitation Criterion.

| | Group Trained By 'Cumulative' Method (N=5)* | | | Group Trained By 'Serial' Method (N=5)† | | | |
|---|---|---|---|---|---|---|---|
| | Mean Number of Trials per Subject | Range | | Mean Number of Trials per Subject | Range | | Mann-Whitney 'U' test, (2 tail) |
| | | Min | Max | | Min | Max | |
| Training of First Imitation | 307 | 209 | 372 | 118.4 | 99 | 142 | $p < .01$ |
| Training of all Subsequent Imitations | 309.4 | 148 | 569 | 425 | 173 | 709 | $p > .05$ |
| Total | 616.4 | | | 543.4 | | | |

* Subject 11 Excluded

† Subject 14 Excluded

Table 7. Number of Correct Imitative Responses to Reach Generalized Imitation Criterion.

| | Group Trained By 'Cumulative' Method (N=5)* | | | Group Trained By 'Serial' Method (N=5)† | | | |
|---|---|---|---|---|---|---|---|
| | Mean Correct Imitative Responses Per Subject | Range | | Mean Correct Imitative Responses Per Subject | Range | | Mann-Whitney 'U' test (2 tail) |
| | | Min | Max | | Min | Max | |
| Training of First Imitation | 103 | 43 | 203 | 68 | 19 | 113 | p > .05 |
| Training of all Subsquent Imitations | 186.6 | 105 | 227 | 269.2 | 153 | 358 | p > .05 |
| TOTAL | 289.6 | | | 337.2 | | | |

* Subject 11 Excluded

† Subject 14 Excluded

were not significant (Mann-Whitney; $p > .05$) either in acquisition of the first "imitative" response or all subsequent responses. The ratios of correct "imitations" to total training trials in the latter training phase ('Cumulative' group; .60:1; 'Serial' Group; .63:1) were clearly similar for children in both groups.

The number of intertrial responses emitted by successful subjects is shown in Table 8; all such responses were similar to previously trained 'imitations' only. With wide intersubject variations, there was no significant difference (Mann-Whitney; $p > .05$) between the subject groups trained by either 'Cumulative' or 'Serial' methods during both stages of imitation training.

"Imitations" of between a minimum of 3 and maximum of 7 separate "training" actions were taught to each individual who acquired generalized imitation, and the mean training time of these children was 5 hours 20 minutes.

The behaviour patterns shown by all successful subjects were in many respects similar irrespective of the training method used; the performances of Subject 5 and Subject 9 contain all important features and have thus been selected for illustrative purposes as representative of the behaviour from all participants who reached generalized imitation criterion. Figure 3 indicates that as more actions for imitation were shaped, the number of sessions needed to reach criterion for each action tended to decrease markedly; for subjects in the 'Cumulative' method group, the introduction of a new action for imitation training resulted in some decrement in reproduction of previously trained actions, which then rapidly reverted to previous levels. The percentage score for generalized imitations progressively rose on each presentation of the 'standard test' actions,

Table 8. Number of Intertrial Responses Before Reaching Generalized Imitation Criterion.

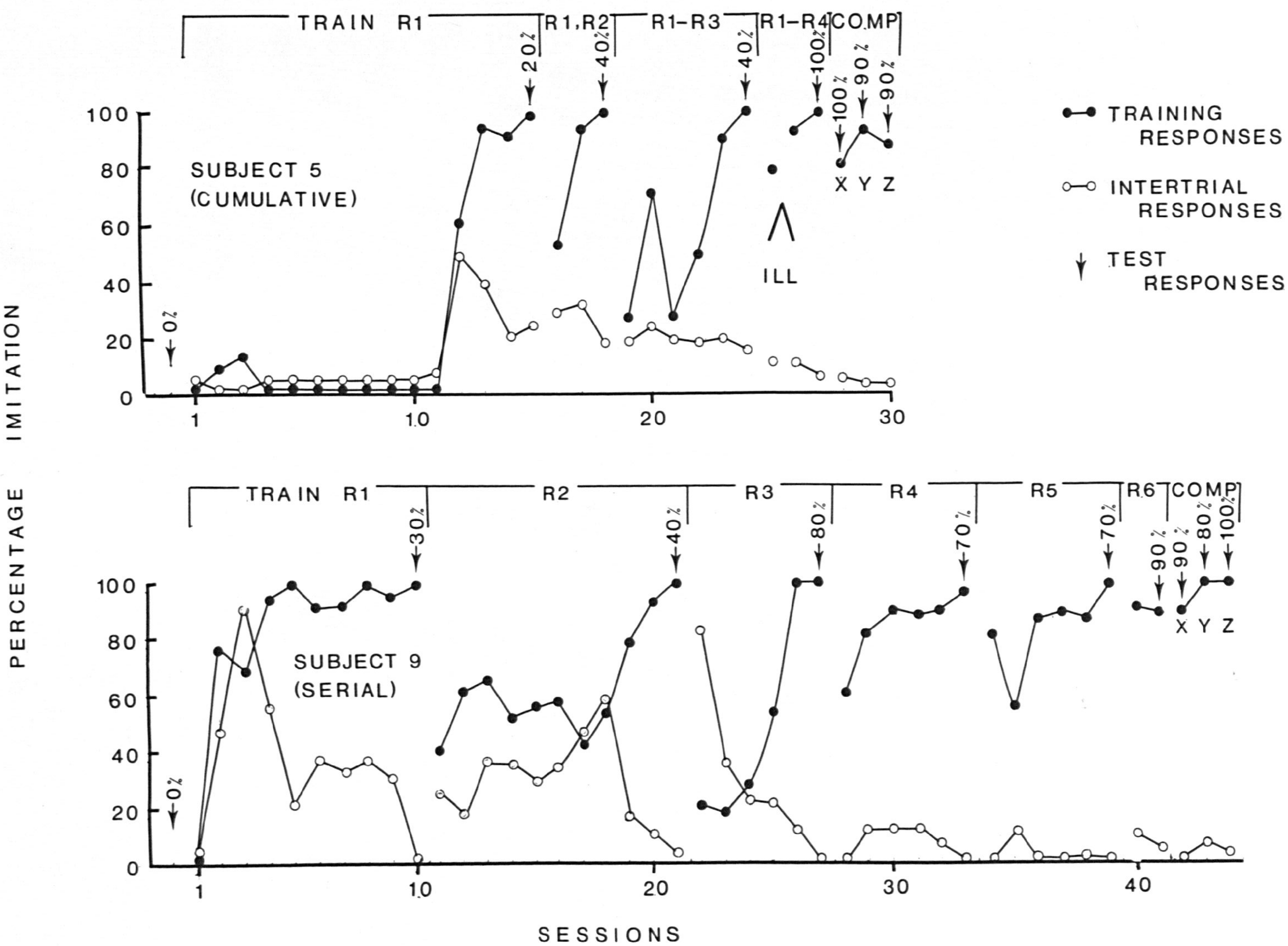
| | Group Trained By 'Cumulative' Method (N=5)* | | | Group Trained By 'Serial' Method (N=5)† | | | |
|---|---|---|---|---|---|---|---|
| | Mean Intertrial Responses Per Subject | Range | | Mean Intertrial Responses Per Subject | Range | | Mann-Whitney 'U' Test (2 Tail) |
| | | Min | Max | | Min | Max | |
| During Training of First Imitation | 27.2 | 17 | 57 | 24.4 | 5 | 54 | $p > .05$ |
| During Training of All Subsequent Imitations | 58 | 46 | 84 | 52.6 | 21 | 70 | $p > .05$ |
| TOTAL | 85.2 | | | 77 | | | |

* Subject 11 Excluded

† Subject 14 Excluded

FIGURE 3

Traing performances of Subject 5 ('Cumulative') and Subject 9 ('Serial'). Percentage of demonstrations imitated (training responses, filled circles) and the occurrence of similar responses between trials also expressed as a percentage of the number of demonstrations (intertrial responses, open circles). The training of successive responses is mapped at the top of each graph and vertical arrows indicate tests for generalized imitation. With the standard test of five actions, the generalized imitation score obtained on each occasion is shown as a percentage; scores on the three parts of the comprehensive imitation test, given at points X, Y and Z are similarly indicated.


TRAIN R1
R1,R2
R1-R3
R1-R4
COMP
SUBJECT 5
(CUMULATIVE)
ILL
X Y Z
TRAIN R1
R2
R3
R4
R5
R6
COMP
SUBJECT 9
(SERIAL)
X Y Z
PERCENTAGE IMITATION
SESSIONS
TRAINING RESPONSES
INTERTRIAL RESPONSES
TEST RESPONSES

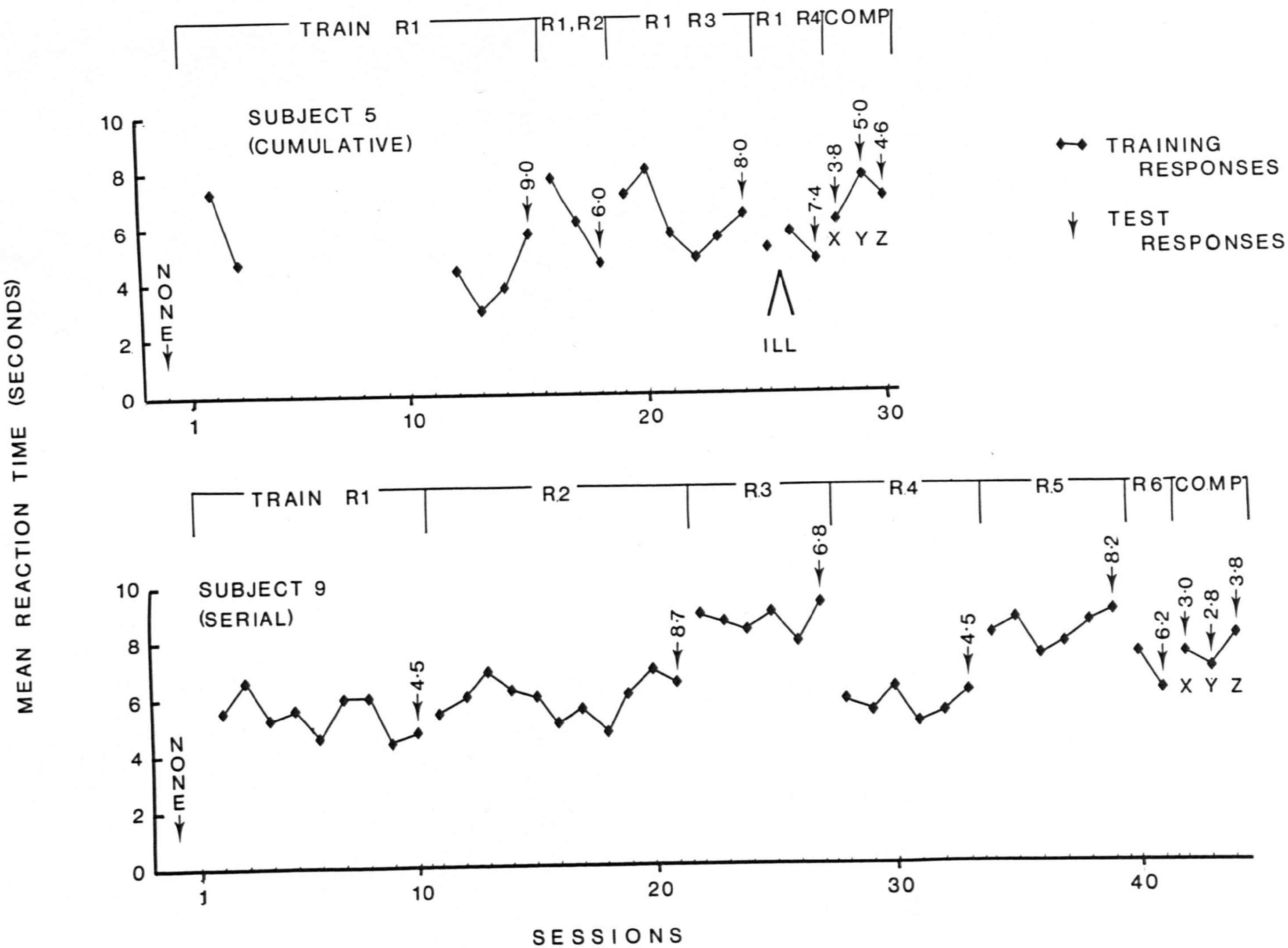
although different actions might be reproduced on each demonstration series. The frequency of intertrial responses tended to decrease as training continued, despite a periodic increase coinciding with the introduction of a new"training"action. The training of Subject 5 was interrupted by an illness of 18 days' duration but there was no apparent decrement in performance after this interval.

Figure 4 shows mean reaction times of correct"imitations"of "training"actions emitted each session by Subject 5 and Subject 9; differences occurred between individuals in the patterns of reaction times displayed. Subject 5 (and also Subjects 3, 4, 6 and 12) showed a rapid decrease in mean latencies over initial successful"imitations" of the first"training"action while, in contrast, Subject 9 (with Subjects 7, 8, 10 and 13) maintained a fairly stable level of reaction time throughout the phase. The means of reaction times shown over adjacent sessions varied considerably both within and between subjects. Results from the 'Serial' group, exemplified by Subject 9, show that this variation between latency means from adjacent sessions also differed both within subjects for separate specific imitative responses and between subjects for the same response. Mean reaction times over sessions for a given response tended towards relatively stable but different levels that typified the individual"imitation"for any one subject. As subjects reproduced different 'standard test' actions upon successive presentations during training, no comment is made about the reaction times of such generalized imitations.

Once the criterion of generalized imitative responding had been reached, continuous reinforcement maintained imitation of the trained actions at a high level over the last three sessions while components of the comprehensive imitation test were demonstrated (points X, Y and Z of Figure 3). The mean rates of generalized

FIGURE 4.

Mean reaction times (filled diamonds) of correct'imitations'of 'training' actions emitted by Subject 5 ('Cumulative' method) and Subject 9 ('Serial' method) on each session. The specific responses involved in each session are indicated at the top of each graph.


TRAIN R1
R1,R2
R1 R3
R1 R4
COMP
SUBJECT 5
(CUMULATIVE)
NONE
9·0
6·0
8·0
7·4
3·8
5·0
4·6
X Y Z
ILL
TRAINING RESPONSES
TEST RESPONSES
TRAIN R1
R2
R3
R4
R5
R6
COMP
SUBJECT 9
(SERIAL)
NONE
4·5
8·7
6·8
4·5
8·2
6·2
3·0
2·8
3·8
X Y Z
MEAN REACTION TIME (SECONDS)
SESSIONS

imitation and mean reaction time of responses emitted by both subject groups on separate parts of the comprehensive imitation test are shown in Figure 5. There was little difference shown between training method groups on either sets of measures; rather, all children achieved a high level of generalized imitation of novel actions, especially body movements and object manipulations. Many subjects were less successful in the articulation of novel vocal imitations but attempted a sound of some kind following almost every trial demonstration. The mean reaction times of vocal generalized imitations were shorter than responses to actions in the body movement and object manipulation categories.

Subject 11 and Subject 14, from the 'Cumulative' and 'Serial' method training groups respectively failed to reach the criterion of generalized imitative performance; indeed, neither achieved competent imitation of even the first action (cheek patting) and training was discontinued after 60 sessions in each case. The performances of both subjects were essentially similar, and that of Subject 11 is shown in Figure 6. After an initial increased frequency of cheek patting behaviour, the rate at which such responses occurred within and outside trials varied considerably between sessions; intertrial responses were usually emitted at a high rate that never fell to a level necessary for criterion imitation performance on any session. Similarly, there was considerable variation in the mean reaction times of responses emitted in each session. At the end of this training period, neither subject showed any generalized imitation of the 'standard test' actions.

## DISCUSSION

In the present experiment, all the subjects' imitative

<u>FIGURE 5</u>.

Performances of successfully trained subjects on three parts of comprehensive imitation test given at points X, Y and Z at end of imitation training. Subject 11 ('Cumulative' method group) and Subject 14 ('Serial' method group) not included as neither reached this point in training.

A. Mean percentage generalized imitation score obtained by subjects in both groups (shaded bars, 'cumulative' method group; open bars, 'serial' method group) on separate parts of comprehensive imitation test.

B. Mean reaction times of all generalized imitative responses emitted by subjects in both groups (filled square, 'cumulative' method group; open square, 'serial' method group) on separate parts of comprehensive imitation test.

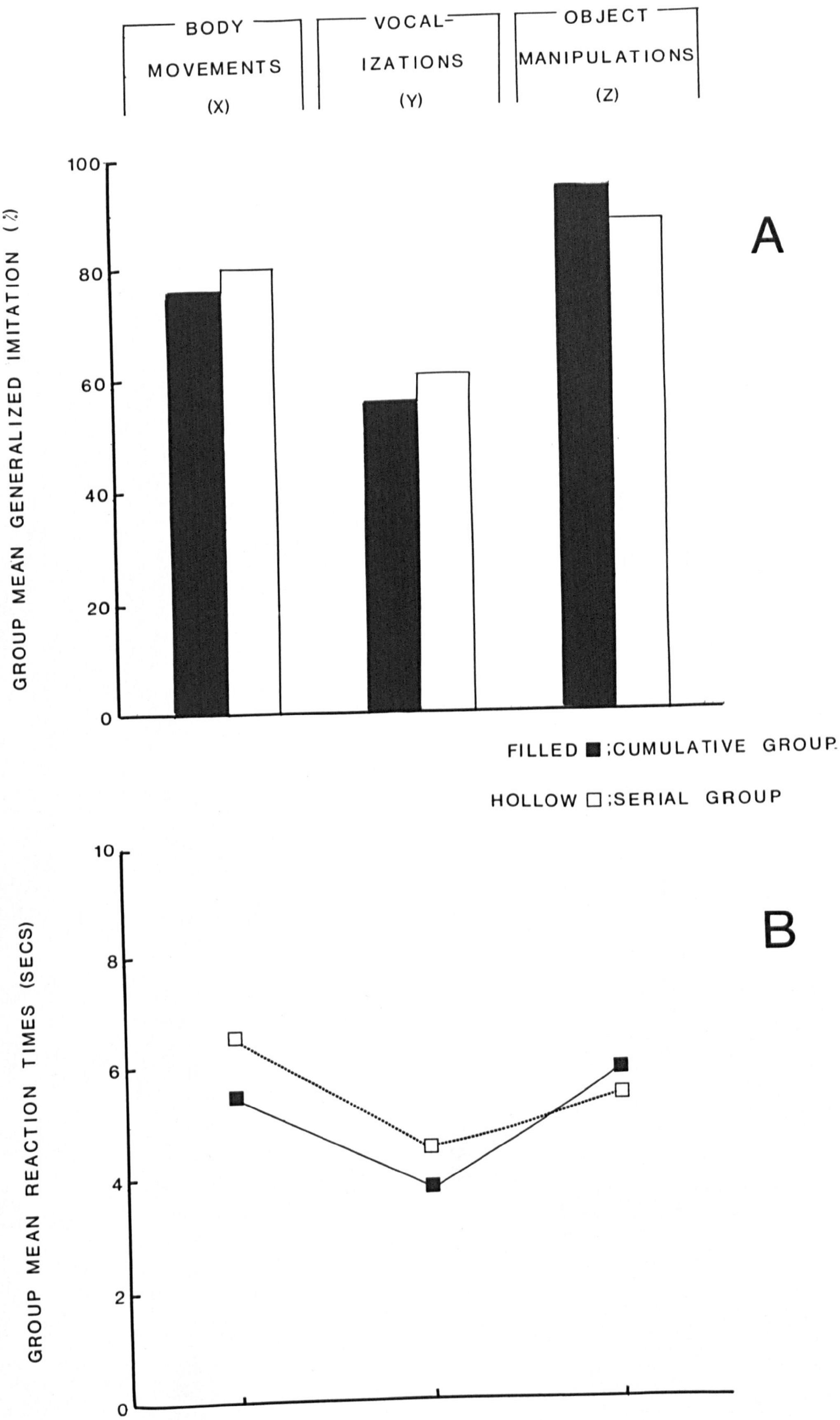
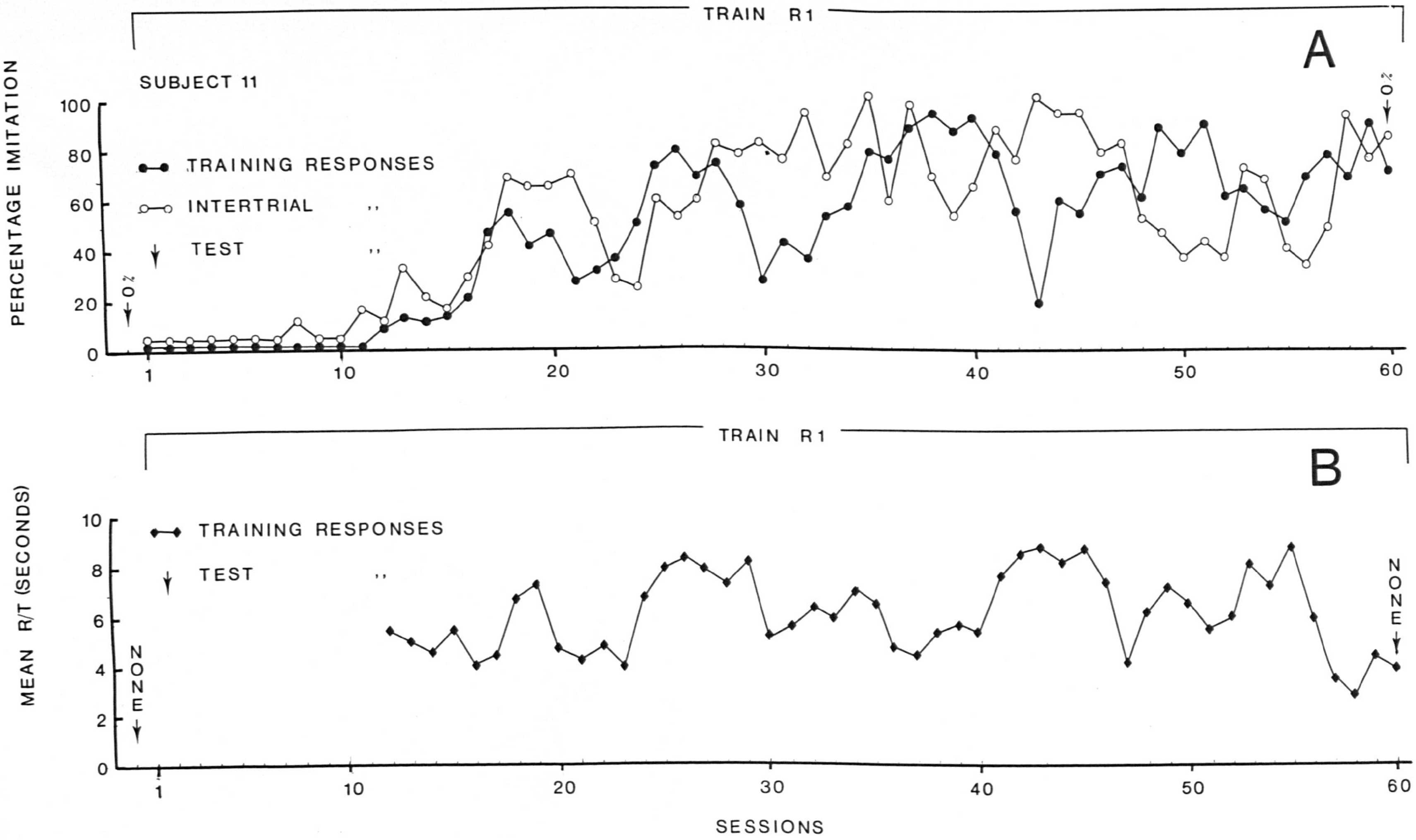

BODY MOVEMENTS (X)
VOCAL- IZATIONS (Y)
OBJECT MANIPULATIONS (Z)
GROUP MEAN GENERALIZED IMITATION (%)
100
80
60
40
20
0
A
FILLED ■ ;CUMULATIVE GROUP
HOLLOW □ ;SERIAL GROUP
GROUP MEAN REACTION TIMES (SECS)
10
8
6
4
2
0
B

FIGURE 6.

Performance of Subject 11:-

A. Percentage of demonstrations imitated (training responses, filled circles) and the occurrence of similar responses between trials, also expressed as a percentage of the number of demonstrations (intertrial responses, open circles). Vertical arrows indicate tests for generalized imitation with the 'standard test' actions; the generalized imitation score obtained on each occasion is shown as a percentage.

B. Mean reaction times of correct imitations of'training'action 1 (shown by filled diamonds) emitted in each session.


TRAIN R1
A
SUBJECT 11
PERCENTAGE IMITATION
TRAINING RESPONSES
INTERTRIAL ,,
TEST ,,
0%
TRAIN R1
B
MEAN R/T (SECONDS)
TRAINING RESPONSES
TEST ,,
NONE
SESSIONS

behaviour was, for the most part, readily scored and the interjudge reliability of scoring (.93) compares well with figures quoted by other authors (Brigham and Sherman, 1968; Bufford, 1971; Garcia et al., 1971; Steinman, 1970a; Steinman and Boyce, 1971).

The only prediction attempted proved substantially correct in that the majority of subjects developed generalized imitative behavioural repertoires whether trained by 'Cumulative' or 'Serial' methods. Thus results from this discrete population of young, institutionalized retarded children supported a finding consistently derived from various subject groups; that is, a combination of 'fading' and 'shaping' techniques are commonly sufficient to generate generalized imitation in previously nonimitative persons. The consistent patterns, albeit with individual differences, in imitative and generalized imitative behaviour which emerged over training were similar to those described by previous authors (e.g. Baer et al., 1967; Garcia et al., 1971). The wide differences between subjects in the number of trials needed to learn both first and subsequent 'imitations' also concur with findings from other studies; as Lovaas et al. (1967), for example, commented "the amount of time required to teach generalized imitation varied enormously from one child to another"(p.174).

In a direct comparison of the two training methods used, it would have been helpful to assume, as suggested by developmental data, that the two subject groups involved were approximately equal before training began. During teaching of the first 'imitation', however, when the treatment of all subjects was similar, children in the 'Cumulative' group required more trials to reach the criterion imitative behaviour than other subjects. Thus, in terms of the main performance measure for this experiment ("number of trials to learn"), it appeared the two subject groups were not in fact initially equal; rather, the children to be trained by the 'Cumulative' method were empirically at a disadvantage. This experiment, however, provides no strong evidence about the causes of this inequality. Clearly there are many possibilities, including differing attention spans, incidence of alternative or disruptive behaviours, strengths of individual reinforcers and levels of 'ability'; limited evidence of this last is perhaps provided by the differences between groups shown in developmental data. Such difficulties might have been overcome by training all subjects in a similar manner to imitate the first action and then selecting children into groups on the basis of their performance to that point. In practical terms, however, it was not possible to train twelve subjects concurrently nor, indeed, with the intersubject variation shown, to arrange individual starting points so that all subjects would complete training of the first action simultaneously.

Nevertheless, no further discrepancy (of whatever cause) corresponding to that between the two method groups in training of the first 'imitation' was found in the training of all subsequent 'imitative' responses. Thus, it appears the 'Cumulative' method had enabled initially less promising subjects not only to reach a similar level of generalized imitation as those trained by the 'Serial' method but also to do so in a similar number of trials. This result suggests that, to teach generalized imitation in a laboratory setting, procedures involving potential alteration of the"training"actions modelled during acquisition of a particular"imitation"were likely to prove more efficient than those without such alterations.

A number of further factors are of relevance to this conclusion:-

1) The number of subjects used was very small. To have trained more children would have required considerably more effort and involved many practical difficulties; that an initial significant differences found between groups containing such small numbers of subjects should have been later nullified does, however, add credibility to the final conclusion.

2) An experimenter's skills of behaviour shaping depend largely on rapid decisions, about the suitability of reinforcement or changes in reinforcement criteria, taken after a subject's potentially varied responses on any trial. As it is impossible under such circumstances to organize and apply a detailed regime for all subjects, some variation between subjects may have come about through unnecessary or wasted use of training trials. The alternate training of sets of subjects from either group represented an attempt to distribute any systematic effects of experimenter variation (e.g. increasing shaping skill, or boredom) equally between groups. Consistent use of the same experimenter may also have helped to keep such variation minimal.

3) The random demonstration to the 'Cumulative' method group of previously taught actions during imitation training of a new action was at the experimenter's discretion rather than according to any predetermined schedule. Though this arrangement produced generalized imitation, it might have been possible to insert fewer such trials and still reach the same criterion performance; to cut down the total training trials for this group would again enhance the overall experimental conclusion.

One possible explanation of the apparent different efficiencies of the training procedure forms that the 'Cumulative' and 'Serial' methods represent is suggested in a comment by Metz (1965);

"discrimination between two or more possible actions for imitation was more difficult to achieve than the simple performance of one task after massed practice" (p.394). At least two sets of antecedent events may influence a subject's behaviour during any trial. These are:-

1) all cues that regularly occur prior to any trial (e.g. red ball, instructions (if given) and experimenter's preparatory movements including possible renewed eye contact with subject), and

2) the specific topography of the action demonstrated on that trial.

To attain generalized imitation as defined in this study, it was necessary for the subject's behaviour to be controlled by both sets of cues. To obtain regular reinforcement, a subject under training by the 'Cumulative' method had not only to recognize a trial period as such but also to discriminate which of a progressively increasing range of possible actions had been demonstrated. In contrast, subjects being trained by the 'Serial' method, having once reached a high emission rate of a specific taught response (e.g. patting cheek) had only to distinguish when the operant would or would not result in reinforcement over massed similar trials. The gradual decrease in intertrial responses over successive sessions suggests they learned to do this, which would be possible by attending to a minimum of the trial introduction cues only. Correspondence between the demonstrated action and subject's response need only be significant for this group at a point where the modelled action changed, a relatively infrequent event. Thus a training method that integrated the use of both sets of cues at an early stage might well train generalized imitation in fewer trials than one that did not.

Both subjects who did not gain generalized imitation failed even to form the trial/no trial discrimination, showing a similar rate of cheek patting responses in both periods; it is possible that, as suggested by Zeaman and House (1963), the differentiating cues provided were not distinctive enough for these children. One of these unsuccessful children (S11) was a mongol, as were also another three of the initially nonimitative subjects. This is perhaps surprising if the views summarized by Belmont (1971) are true that "(many authors) have remarked on what they consider the mongoloid's remarkable capacity for mimicry or imitation" (p.37). Sherlock (1911), however, suggested that such behaviour only occurred in mongols who were sufficiently "intelligent". Further to this point, the number of subjects of varied diagnoses in the present experiment was not enough to investigate possible relationships between available measures of "ability" and performance during training. It is perhaps though worthy of note that both unsuccessful children (Subject 11 and Subject 14) had, of all participants, gained the lowest social quotients on the Vineland Social Maturity Scale, scoring below 10 in both cases; such a measure, for all its limitations, may provide an empirical indication of levels below which such imitation training becomes unviable.

Most of the forms of data collected in this experiment concerning imitative behaviour proved helpful. The incidence of "imitations"showed systematic effects and the percentage score of generalized imitation of 'standard test' and 'comprehensive test' actions likewise. The inclusion of a 'poor' response scoring category for reproduction of test actions was realistic and it is interesting to note the high correspondence between generalized imitation rates of 'standard test' actions and 'comprehensive test' actions. This latter implies that to test for generalized imitation during experiments, it would be adequate to demonstrate the 'standard test' actions only. The incidence of intertrial responses showed systematic effects and provided useful information. The gathering of reaction time data seemed to serve less useful purpose, at least at a time when the incidence of imitative behaviours is low or intermittent, or the proportion of different training actions in a session unstandardized, making the systematic plotting of continuous performance on this measure impossible.

At a clinical level, ten of the twelve subjects acquired a generalized imitative behavioural repertoire, in a mean time of 5 hours 20 minutes irrespective of training method; indeed, this figure which represents something over half a conventional nursing shift might have been shorter had all subjects been trained by the 'Cumulative' method. At the end of this mean time interval, these children were ready to acquire varied skills in a manner described by Lovaas et al. (1967) from a basis of imitation. The only exception may have been some subjects who showed poor vocal imitation; it would be necessary to improve the articulation of these individuals before starting to train verbal skills through imitation techniques. Finally, these children also formed a group of subjects for possible experimental work who had generalized imitative behavioural repertoires but also whose total histories of imitative behaviour were largely known.

## SUMMARY

Twelve young, initially nonimitative children were randomly assigned to form two groups, each comprising six individuals. 'Fading' of prompts and positive reinforcement of responses were then used in an attempt to establish 'imitative' and 'generalized imitative' responding

in each child singly. One group were trained by a 'Cumulative' method whereby 'training' actions, (reinforced) 'imitations' of which had been previously established, were demonstrated on separate,interspersed trials during acquisition of the current 'imitation' under training. The remaining six children were taught to reproduce a model's actions by an alternative 'Serial' method, where each 'imitation' was trained to criterion without interspersed trials involving demonstration of previously trained actions. Five children in each group reached a level of imitative performance where they exhibited (nonreinforced) 'generalized imitations' of varied novel 'test' actions in a context of continued reinforcement for correct 'imitations' of 'training' actions.

Although requiring a significantly larger mean number of training trials to acquire the first 'imitation', the five successful subjects in the 'Cumulative' method group then needed only a mean number of subsequent trials similar to that of the successful 'Serial' group to reach the generalized imitation performance criterion. In that the 'Cumulative' form of training procedure had enabled initially less promising subjects to exhibit later training performances similar to the group trained by the 'Serial' procedure form, it was suggested that the 'Cumulative' form of training might provide a relatively more efficient and economical method to train generalized imitation in previously nonimitative retarded children.

## EXPERIMENT 2

Some effects on 'imitative' and 'generalized imitative' responses of an intermittent reinforcement schedule for trained 'imitations'.

INTRODUCTION

Once generalized imitative responding has been established in an experimental situation, it is common practice to continue reinforcement of trained 'imitations' during extended periods of maintenance. Previous studies (e.g. Baer et al., 1967; Burgess et al., 1970) suggest such contingent reinforcement may be more necessary for some subject populations than others to sustain imitative behaviour at high, stable levels; it seems likely (see p.50 ) that developmentally retarded children are one such group for whom reinforcement of 'imitations' is necessary for maintaining imitative and generalized imitative behaviours.

Types of simple reinforcement schedule and their use within the generalized imitation paradigm have been reviewed in Chapter 3 (p.47 to p.48); with developmentally retarded subjects, such reinforcement has been delivered for correct 'imitations' on a continuous reinforcement (CRF) schedule (e.g. Baer et al., 1967) and on both fixed ratio (FR3) (Metz, 1965) and variable ratio (VR2) (Bucher and Bowman, 1974) intermittent schedules. Under all three conditions, 'imitations' and 'generalized imitations' were typically emitted at high stable rates.

Previous investigations involving a wide range of nonimitative behaviours suggest that reinforcement of responses on an intermittent rather than CRF schedule may influence the performances of both animal and human subjects under at least two sets of conditions; these are:-

1) while a given reinforcement schedule is in operation, and
2) when all reinforcement of the relevant behaviour is subsequently discontinued.

Ferster and Skinner (1957) reinforced key pecking behaviour by pigeons on fixed interval (FI), variable interval (VI), FR and VR schedules and found that each resulted in characteristic response rates and patterns; the reinforcement of retarded children for bulb pressing (Orlando and Bijou, 1960) and pulling a plunger out of a panel (Ellis, Barnett and Pryor, 1960) produced largely similar results. With both kinds of subject, ratio schedules generated rapid and many responses while interval schedules elicited responses at a low steady rate increasing in bursts if motivation was high or the time for reinforcement approached. Studies concerning the use of various reinforcement schedules with children have been reviewed by Bijou and Baer (1966) and those specifically with retardates by Spradlin and Girardeau (1966).

Following a period of delivery according to either CRF or intermittent schedules, reinforcement for a given response may be subsequently discontinued. After an exhaustive review of experimental work with animals, Jenkins and Stanley (1950) stated "all other factors being equal, resistance to extinction after intermittent reinforcement is greater than that after continuous reinforcement when behaviour strength is measured in terms of single responses"(p.222) . A similar conclusion was reached by Lewis (1960) in a later survey of discrete trial studies with nonhuman subjects. Bijou (1957) demonstrated with young normal children that reinforcement of a simple tapping response on a VR schedule resulted in many more responses before extinction when reinforcement was subsequently withdrawn than CRF schedule training. The present author can find no report of any empirical attempt to demonstrate a similar finding with subnormal children; Nawas and Braun (1970b), however, commented "research to date suggests that findings concerning the reinforcement of behaviour on intermittent schedules hold as well for the retardate as they do with normal humans and lower animals alike"(p.22). If so, it is likely that intermittent rather than continuous reinforcement of a response emitted by a subnormal child would also result in increased resistance to subsequent extinction.

For clinical or experimental purposes, once retarded child subjects have acquired a generalized imitative behavioural repertoire, it is usually desirable that emission of 'imitations' and 'generalized imitations' should be both maintained at a high level and be as resistant to (unintentional) extinction as possible. The findings described above suggest that such a combination of performance characteristics might result from intermittent reinforcement of training 'imitations'. The discrete trial nature of the generalized imitation paradigm favours the use of ratio rather than interval schedules for this purpose; on the further choice between FR and VR schedules, Nawas and Braun (1970b) pointed out that, in general, "a VR schedule produces a higher rate of responding and the behaviour is more resistant to extinction than in FR reinforcement"(p.22).

Despite its previous use (Bucher and Bowman, 1974; Metz, 1965) and possible advantages the effects of intermittent rather than continuous reinforcement of 'imitations' within the generalized imitation paradigm have not been empirically established. To this end, in the present investigation the imitative and generalized imitative performances of two groups of retarded children were compared over three consecutive experimental phases:-

Phase 1. 'Maintenance'. Precedents from previous studies, combined with clinical considerations, suggested that a schedule which programmed reinforcement of correct 'imitations' for, on average, one on every four trials, would serve to maintain effective imitative responding.

Thus, the 'imitations' of one subject group (hereafter termed the 'VR4 group') were reinforced intermittently, on a VR4 schedule, while those of the other subjects (the 'CRF group') were reinforced on a CRF schedule. It was predicted that all subjects in both groups would emit 'imitations' and 'generalized imitations' at high stable rates throughout.

Phase 2. 'Withdrawal of Reinforcement'. Reinforcement of 'imitations' was then discontinued for all subjects. It was anticipated that all the children would eventually cease to emit 'imitations' and 'generalized imitations' of demonstrated actions; in addition, it was predicted that the 'imitations' of subjects in the VR4 group would require more trials to extinguish than those of the group previously reinforced on the CRF schedule.

Phase 3. 'Reinstatement of Reinforcement'. Reinforcement of 'imitations' was then reinstated on a CRF schedule for subjects in both groups. It was predicted that under this condition the emission of imitative and generalized imitative responses by all children would recover to their previous high rates.

In an absence of relevant information, no predictions were attempted about possible systematic effects of these experimental conditions on reaction times of responses or the emission of intertrial responses; rather empirical evidence was sought on these aspects of performance.

## METHOD

### Subjects

The ten children who had successfully completed training of generalized imitation during Experiment 1 served as subjects for this investigation. In addition two other children, Subject 1 and Subject 2, were also included; although initially nonimitative, they had also acquired generalized imitative behavioural repertoires but in a pilot study that used a variation of the 'Cumulative' method described in Experiment 1. After training, these twelve retarded children had in common that they would emit 'generalized imitations' in a context of continued reinforcement for 'imitations' when all actions were demonstrated without instructions in the presence of a red ball of 30 cms. diameter. These subjects were divided into two groups, both of six individuals; the 'imitations' of one group were to be reinforced on a VR4 schedule and those of the other on a CRF schedule. Subject 1 and Subject 2, being very similar in age, background, diagnosis and experimental experience were deliberately placed one in each group and the remaining children were randomly assigned to either. The subjects in each group are summarized with developmental data in Table 9.

The resulting groups had similar mean chronological ages and social quotients; the mean number of items passed on the Primary P.A.C. and mean social age equivalent on the Vineland Scale of Social Maturity were, however, marginally higher for the VR4 group.

Experimental Setting, Apparatus and Reinforcers

The experimental setting, apparatus and specific reinforcers administered to individual subjects were as described in the relevant sections of Chapter 5 (General Method).

Procedure

Sessions were conducted daily with each child individually, as indicated in Chapter 5 (General Method; see p.91 ). A maximum of three children only served as subjects during any given time period.

Subjects for whom 'imitations' reinforced on VR4 schedule during experimental Phase 1 ('Maintenance')

| Subject (Number) | Age | Primary P.A.C. Items Passed | Vineland Social Age | Vineland Social Quotient |
|---|---|---|---|---|
| 2 | 5yrs 4mths | 93 | 1.7yrs | 32 |
| 3 | 5yrs 7mths | 51 | 1.2yrs | 22 |
| 5 | 7yrs 3mths | 48 | 1.1yrs | 15 |
| 9 | 9yrs 5mths | 50 | 1.3yrs | 14 |
| 10 | 9yrs 4mths | 37 | 1.4yrs | 15 |
| 12 | 11yrs 2mths | 57 | 1.6yrs | 14 |
| Mean: | 8yrs 0mths | 56 | 1.4yrs | 19 |

Subjects for whom 'imitations' reinforced on CRF schedule during experimental Phase 1 ('Maintenance')

| Subject (Number) | Age | Primary P.A.C. Items Passed | Vineland Social Age | Vineland Social Quotient |
|---|---|---|---|---|
| 1 | 5yrs 0mths | 91 | 1.7yrs | 34 |
| 4 | 6yrs 6mths | 45 | 1.1yrs | 17 |
| 6 | 8yrs 11mths | 54 | 1.4yrs | 16 |
| 7 | 8yrs 9mths | 54 | 1.4yrs | 16 |
| 8 | 8yrs 10mths | 30½ | 0.9yrs | 10 |
| 13 | 11yrs 4mths | 39 | 1.2yrs | 11 |
| Mean: | 8yrs 3mths | 52 | 1.3yrs | 17 |

TABLE 9. Subjects Comprising 'VR4' and 'CRF' Groups.

Preliminary Retraining. Prior to this investigation, varying periods of time had elapsed for each subject without formal training of 'imitations' in the experimental setting. Thus as a preliminary step, all subjects were retrained as necessary to a common criterion performance by reinforcement of correct 'imitations' of a limited set of five demonstrated actions. For all children except two, these were "training"actions 1-5 from Table 4; the exceptions were Subject 3 and Subject 8 with whom, for reasons previously described in Experiment 1 (p.111),"training"action 7 (patting chest) was substituted for "training"action 1. These actions were demonstrated to the children in order 1 (or 7) to 5, each action once during every five consecutive trials, always without instructions but in the presence of the 30 cms. diameter red ball. Each action was demonstrated over a maximum of 10 seconds for any trial; the subject was reinforced for a competent 'imitation' during that time, whereupon the trial ended and the red ball was removed from the child's sight. A constant period of 10 seconds always elapsed between trials. Where necessary, 'shaping' and 'fading' were used, as described in Experiment 1, to retrain imitation of any "training"action. A maximum of thirty trials occurred in any one session.

This process continued until the child correctly imitated each of the"training"actions 1 (or 7) to 5 twice over ten consecutive trials and emitted no similar intertrial responses over that time. At this point, each of the five 'standard test' actions (Table 4) were demonstrated under similar presentation conditions for one trial only; there were no programmed consequences for correct 'generalized imitations' and each trial lasted for 10 seconds regardless of the subject's behaviour. Retraining of each subject through"training" actions 1 (or 7) to 5 ceased when the child achieved a score of at least 90% for generalized imitation (see Chapter 5 for scoring method) during one presentation of all the"standard test"actions.

Phase 1. 'Maintenance'. "Training"actions 1 (or 7) to 5 were then demonstrated, one on each trial, to every subject over a total of 180 trials, again with the red ball showing, without instructions and with a standard 10 second interval between trials. This total number of trials constituted a set sequence of 60"training"actions (shown in Table 10) presented in three successive cycles. Within the sequence, each of the five separate"training"actions 1 (or 7) to 5 occurred on twelve trials. Thirty"training"actions were demonstrated in each session to every child. For each group of subjects previously described, correct 'imitations' of these"training"actions were then reinforced according to one of two schedules:-

Either: A. VR4 reinforcement schedule. Correct 'imitations' emitted on an average of one in every four consecutive trials were reinforced. During the sequence of 60 trials, reinforcement was programmed for three out of the twelve trials on which each of the "training"actions 1 (or 7) to 5 were demonstrated; that is, during 60 trials, correct 'imitations' were reinforced on 15 predetermined trials. The trials on which reinforcement was potentially available are indicated in Table 10. Following correct imitation and reinforcement, or an uncopied demonstration of 10 seconds such a trial ended and the red ball was removed from view. For the remainder of trials there were no planned consequences and the"training"action was modelled for 10 seconds regardless of the subject's behaviour during that time.

Or: B. CRF reinforcement schedule. "Training"actions 1 (or 7) to 5 were demonstrated one on each trial in the order shown in Table 10; each action was demonstrated for a maximum of 10 seconds and the subject

| Trial | Training Action Demonstrated | | Trial | Training Action Demonstrated | | Trial | Training Action Demonstrated | | Trial | Training Action Demonstrated | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | R | 16 | 2 | | 31 | 3 | | 46 | 5 | |
| 2 | 1* | | 17 | 4 | | 32 | 1* | | 47 | 1* | R |
| 3 | 5 | | 18 | 1* | R | 33 | 5 | | 48 | 5 | |
| 4 | 4 | | 19 | 4 | | 34 | 3 | R | 49 | 3 | |
| 5 | 3 | | 20 | 1* | | 35 | 2 | | 50 | 4 | |
| 6 | 2 | | 21 | 1* | | 36 | 1* | | 51 | 1* | R |
| 7 | 2 | R | 22 | 3 | | 37 | 3 | | 52 | 4 | |
| 8 | 1* | | 23 | 5 | R | 38 | 3 | | 53 | 2 | |
| 9 | 5 | | 24 | 1* | | 39 | 5 | R | 54 | 2 | |
| 10 | 4 | R | 25 | 3 | R | 40 | 4 | | 55 | 4 | |
| 11 | 5 | | 26 | 3 | | 41 | 2 | | 56 | 5 | |
| 12 | 3 | | 27 | 4 | R | 42 | 5 | R | 57 | 2 | |
| 13 | 3 | R | 28 | 1* | | 43 | 5 | | 58 | 4 | R |
| 14 | 1* | | 29 | 2 | | 44 | 4 | | 59 | 4 | |
| 15 | 2 | R | 30 | 3 | | 45 | 2 | | 60 | 5 | |

* For Subject 3 and Subject 8,"training"action 7 substituted for"training"action 1.

R During maintenance on VR4 reinforcement schedule, reinforcement programmed for correct 'imitations' on these trials only.

Table 10. Training Actions Demonstrated in Sequence of Sixty Consecutive Trials.

was reinforced for a correct 'imitation' within that time, whereupon the trial ended and the red ball was removed. Similarly, 'training' action trials on which the subject emitted no 'imitative' response ended after 10 seconds.

After the completion of 60, 120 and 180"training"action trials by each subject in both groups, tests for generalized imitation were carried out by demonstration of each of the 'standard test' actions over five consecutive trials. The model exhibited each 'standard test' action without instructions and in the presence of the red ball; demonstrations continued for 10 seconds irrespective of the subject's behaviour and correct ('generalized imitative') reproductions of these actions were never reinforced. Again, a standard interval of 10 seconds elapsed between 'standard test' action trials. Thus, during the experimental phase 'training' and 'standard test' actions were demonstrated over a total of 195 trials to each subject. For each child this phase lasted for 6 sequential sessions, with each session always containing 30 'training action trials'.

Phase 2. 'Withdrawal of Reinforcement'. "Training"actions 1 (or 7) to 5 were then demonstrated to every subject in both groups again in the order shown by Table 10. Each action was modelled without instructions and in the presence of the red ball, each session containing thirty trials. In this phase, there were no programmed consequences for any behaviour, including correct 'imitations', emitted by subjects and 'training' actions were always demonstrated for a standard period of 10 seconds on each trial; after this time, the red ball was removed from the subject's sight and a further interval of 10 seconds passed before the next trial. Demonstrations of the 'training' actions continued in the sequence shown by Table 10 through successive cycles, as necessary, until the subject showed no correct 'imitations' over 10 consecutive trials and concurrently emitted no similar intertrial responses.

The model then exhibited all the 'standard test' actions, one each on five consecutive trials under conditions identical to those described above for the 'training' action trials in this phase. Once again, each session contained a maximum of 30 'training action' trials.

Phase 3. 'Reinstatement of Reinforcement'. Finally, reinforcement for 'imitations' of 'training' actions 1 (or 7) to 5 was reinstated on a CRF schedule for all subjects exactly as previously described in the Preliminary Retraining section. 'Shaping' and 'fading' of prompts were again used to aid imitative responding when necessary. Retraining of each child finished when the criterion imitative performance of 'training' and 'standard test' actions had been reached; that is, when the subject showed correct 'imitations' on 10 consecutive 'training' action trials, emitted no concurrent intertrial responses and subsequently gained a score of 90% 'generalized imitation' of the 'standard test' actions.

Each session was recorded on videotape and played back later for analysis. Data were collected in the forms described in Chapter 5 (General Method). At a number of points throughout the study, independent observers checked the reliability of the experimenter's scoring of the subject's behaviour.

## RESULTS

Observer agreement on scoring of trials always exceeded .96.

During preliminary retraining, all subjects at once, or very rapidly, reached criterion level performance for 'imitations' and 'generalized imitations' of the 'training' and 'standard test' actions.

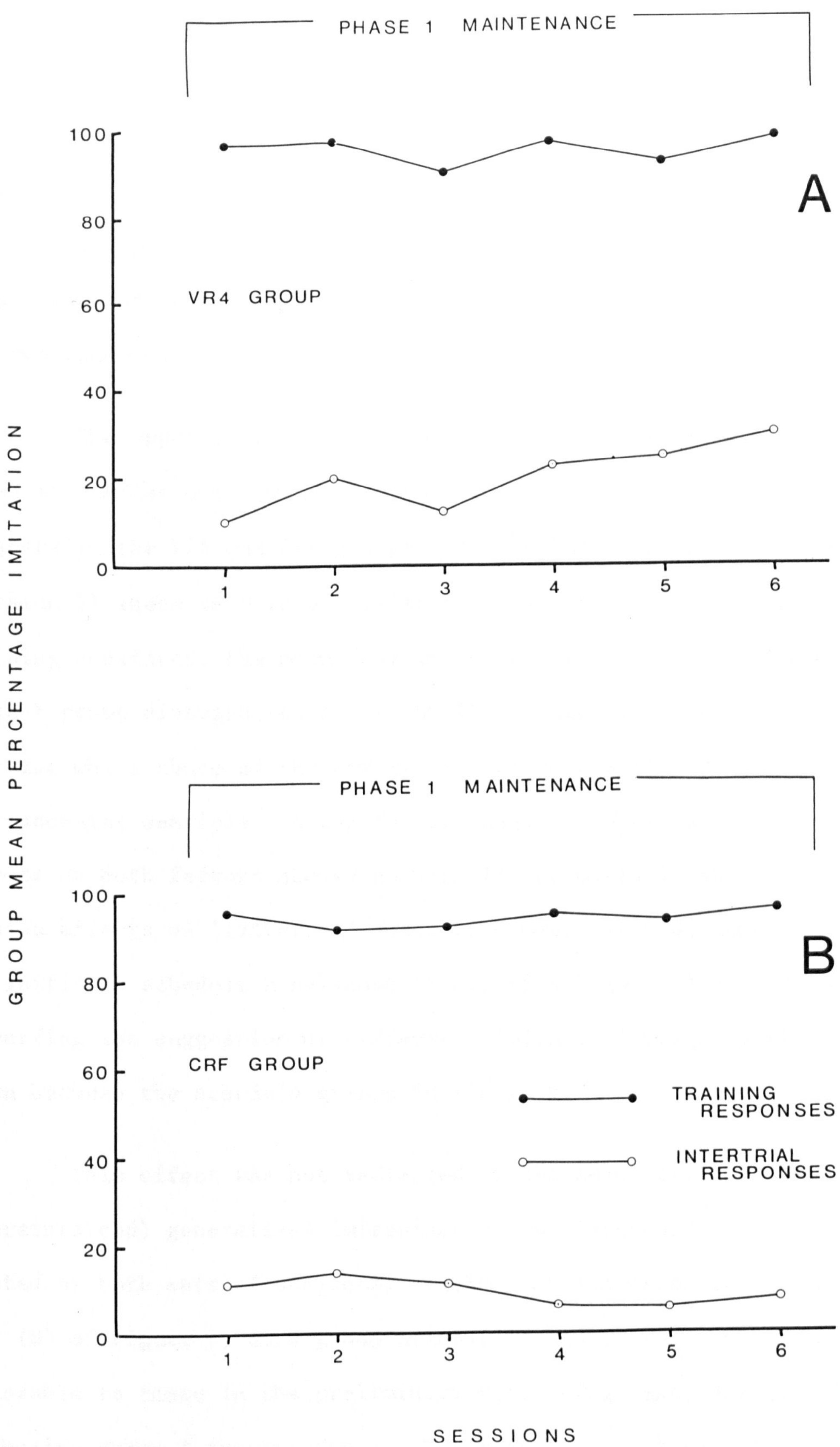
Phase 1. 'Maintenance'. All subjects emitted 'imitations' of "training"actions at high rates while reinforcement was available on either VR4 or CRF schedules. As indicated in both parts of Figure 7, the mean response rates of 'imitations' for each group were high and stable over all six maintenance sessions; indeed, the mean 'imitation' emission rates for both groups (VR4 group, 167.7; CRF group, 166.5 out of a possible maximum of 180) were very similar. Subjects in the VR4 group did not receive reinforcement on a total of 17 trials for which it had been programmed on the intermittent schedule (see Table 10), a mean of approximately 3 for each child. A two factor analysis of variance with fixed effects on both factors showed no significant schedule or sessions effects on 'imitation' response rates, nor did the schedule x sessions interaction approach significance.

All intertrial responses emitted by subjects in each group were similar to 'training' actions only. As shown again in both parts of Figure 7, the mean rates of intertrial responding were similar for groups on both schedules during the first 'maintenance' session; after that, however, the rate of the CRF group dropped slightly while that for the VR4 group tended to increase over successive sessions. A two factor analysis of variance with fixed effects on both factors indicated no overall schedule or session effects on emission rates of intertrial responses; it did, however, yield a significant schedule x session interaction, $F\ (5, 50) = 4.66$; $p < .01$, confirming the different intertrial response emission trends shown between the two schedule groups in Figure 7.

Generalized imitation scores for the 'standard test' action trials during the preliminary 'retraining' test and each test during

FIGURE 7.

Mean emission rates of 'imitations' and intertrial responses by all subjects in (A) VR4 group and (B) CRF group over successive sessions in Phase 1 'Maintenance' of Experiment 2. Mean percentage of demonstrations imitated (training responses; closed circles) and mean occurrence of similar responses between trials also expressed as a percentage of the total number of demonstrations (intertrial responses; open circles).


PHASE 1 MAINTENANCE
A
VR4 GROUP
GROUP MEAN PERCENTAGE IMITATION
PHASE 1 MAINTENANCE
B
CRF GROUP
TRAINING RESPONSES
INTERTRIAL RESPONSES
SESSIONS

Phase 1 were, albeit with minor variations, uniformly high for all children. As Figure 8 shows, the mean percentage generalized imitation scores obtained by all subjects in both groups on each test were very similar. A two factor analysis of variance with fixed effects on both factors yielded neither significant main schedule or session effects on generalized imitation scores, nor a significant interaction between the two factors.

The upper part (A) of Figure 9 indicates the mean reaction times of 'imitations' emitted in successive 'maintenance' sessions by subjects in the VR4 and CRF groups. At the beginning of this phase (Session 1) these were very similar for both sets of children. As training continued, the mean 'imitation' reaction times of the separate subject group diverged, those of the VR4 reinforced group tending to increase while those of the CRF group decreased slightly over corresponding sessions. A two factor analysis of variance with fixed effects on both factors showed no significant overall schedule or session effects on 'imitation' reaction times; it did, however, yield a significant schedule x sessions interaction $F\ (5,\ 50) = 3.75;\ p < .01$, supporting the suggestion of different 'imitation' reaction time trends shown between the schedule groups in Figure 9.

This effect was not reflected in the mean reaction times of (nonreinforced) generalized imitations of the 'standard test' action emitted by both sets of subjects; rather, as indicated in the lower part (B) of Figure 9, each group maintained stable reaction time levels, comparable to those in the preliminary retraining test, during successive Phase 1 presentations. The mean 'generalized imitation' reaction times of the VR4 group tended to be longer than those of the CRF group. A two factor analysis of variance with fixed effects on both

FIGURE 8.

Mean percentage generalized imitation scores obtained by all subjects in VR4 group (open blocks) and CRF group (closed blocks) during separate tests for generalized imitation after preliminary retraining and during Phase 1 ('Maintenance') of Experiment 2.

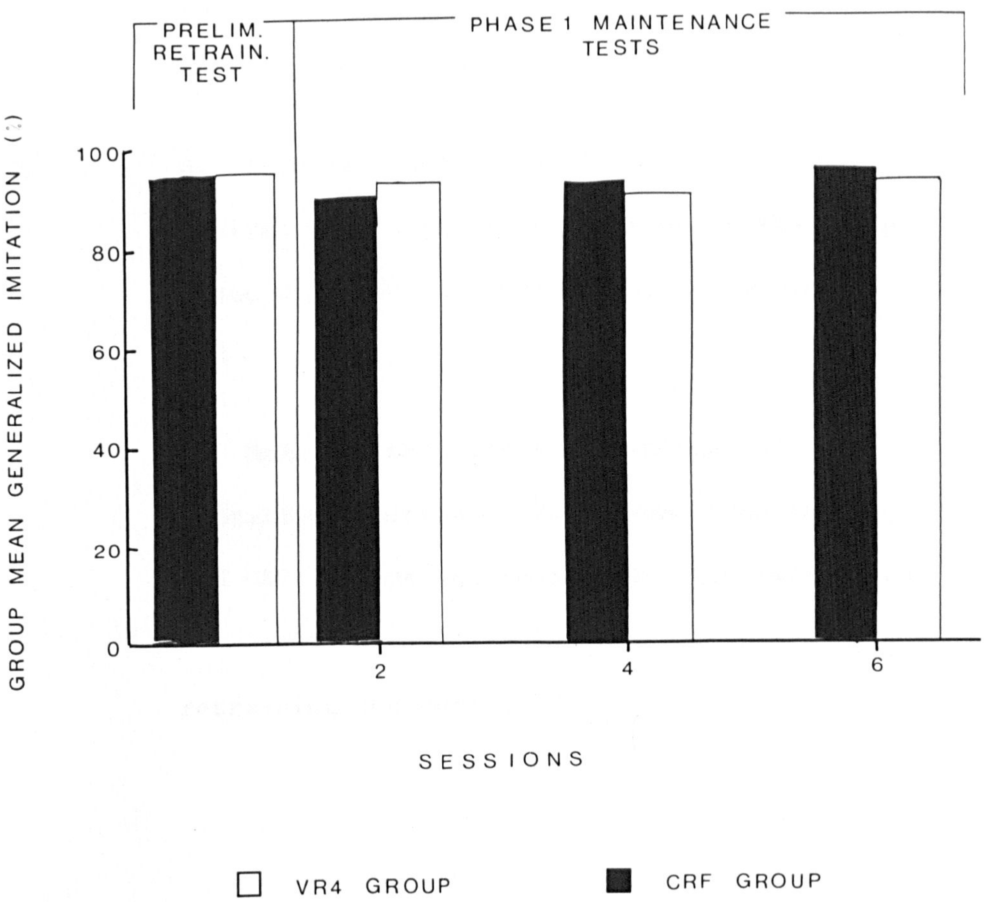
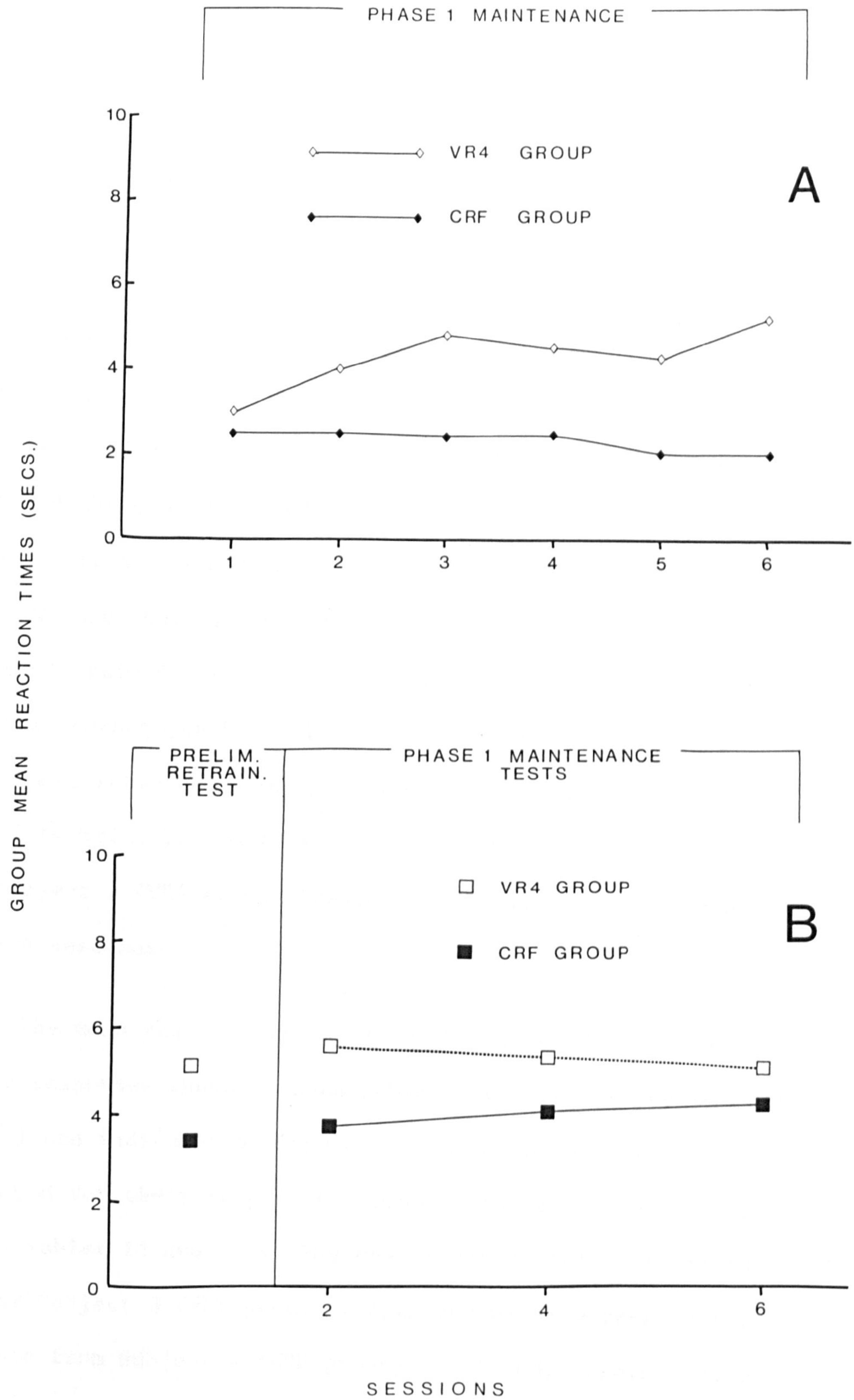

PRELIM. RETRAIN. TEST
PHASE 1 MAINTENANCE TESTS
GROUP MEAN GENERALIZED IMITATION (%)
100
80
60
40
20
0
2
4
6
SESSIONS
VR4 GROUP
CRF GROUP

FIGURE 9.

Mean reaction times of imitative behaviours exhibited by separate subject groups during Phase 1 ('Maintenance') of Experiment 2:-

A. Mean reaction times of all 'imitations' emitted over successive sessions by VR4 group (open diamonds) and CRF (closed diamonds), and

B. Mean reaction times of'generalized imitations'emitted by VR4 group (open squares) and CRF (closed squares) during separate tests for generalized imitation after preliminary retraining and during Phase 1.



PHASE 1 MAINTENANCE
VR4 GROUP
CRF GROUP
A
10
8
6
4
2
0
1
2
3
4
5
6
GROUP MEAN REACTION TIMES (SECS.)
PRELIM. RETRAIN. TEST
PHASE 1 MAINTENANCE TESTS
VR4 GROUP
CRF GROUP
B
10
8
6
4
2
0
2
4
6
SESSIONS

factors, however, indicated no significant schedule or session effects on this measure, nor significant factor interaction.

Despite these trends with mean reaction times of all 'imitations' or 'generalized imitations' emitted during sessions, such systematic effects were not so clearly shown over time in the reproduction of different discrete modelled actions.

During this experimental phase, the results shown by all individuals in each group were, albeit with detailed differences, essentially similar. The performances of Subject 3 and Subject 4, from the VR4 and CRF groups respectively, are presented for illustrative purposes as each demonstrate typical behavioural features shown by all children within their group. As indicated in Figure 10, both subjects maintained high levels of 'imitations' and 'generalized imitations' throughout Phase 1, despite the use of different reinforcement schedules; while, however, Subject 4 (CRF group) emitted intertrial responses at a steady low rate throughout this phase, Subject 4 (VR4 group) tended to emit an increasing number on successive sessions.

The mean reaction times of imitative and generalized imitative responses shown by both subjects over corresponding sessions in Phase 1 are indicated by Figure 11. Both children followed the trends noted for their respective group in the comparison of total group data (see Tables 13 and 14). The mean reaction times of 'imitations' emitted by Subject 3 (VR4 group) lengthened with successive sessions while those from Subject 4 (CRF group) shortened; again, the mean reaction times of 'generalized imitations' emitted by both children remained roughly steady over this phase.

Finally, as this 'maintenance' phase proceeded, subjects in the

FIGURE 10.

Imitative performances of Subject 3 (VR4 group) and Subject 4 (CRF group) during separate phases of Experiment 2. Percentage of demonstrations imitated (training responses; filled circles) and the occurrence of similar responses between trials also expressed as a percentage of the number of demonstrations (intertrial responses; open circles). The durations of successive experimental phases are mapped at the top of each graph and vertical arrows indicate tests for generalized imitation. The generalized imitation score obtained on each presentation of the 'standard test' actions is shown as a percentage.

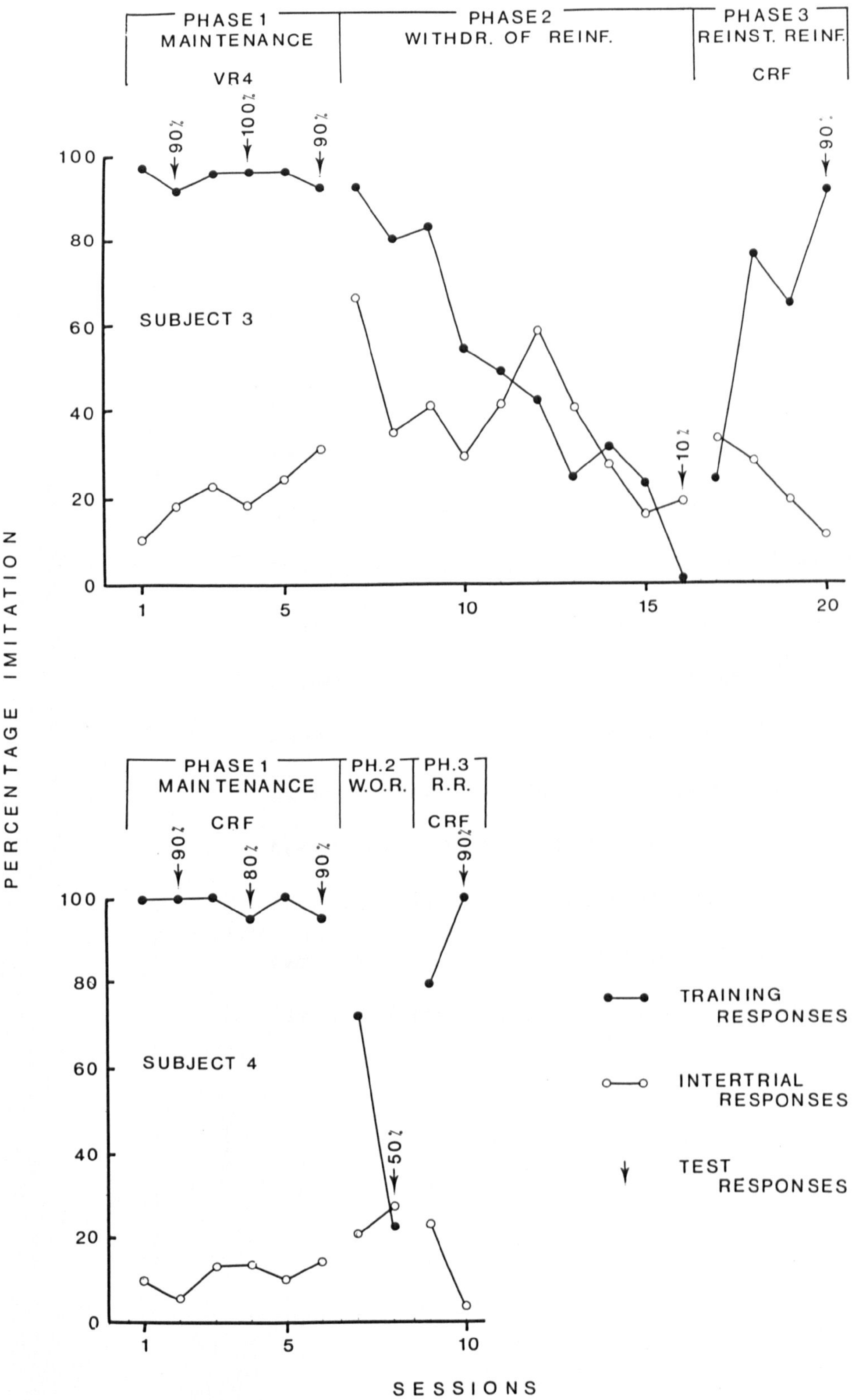
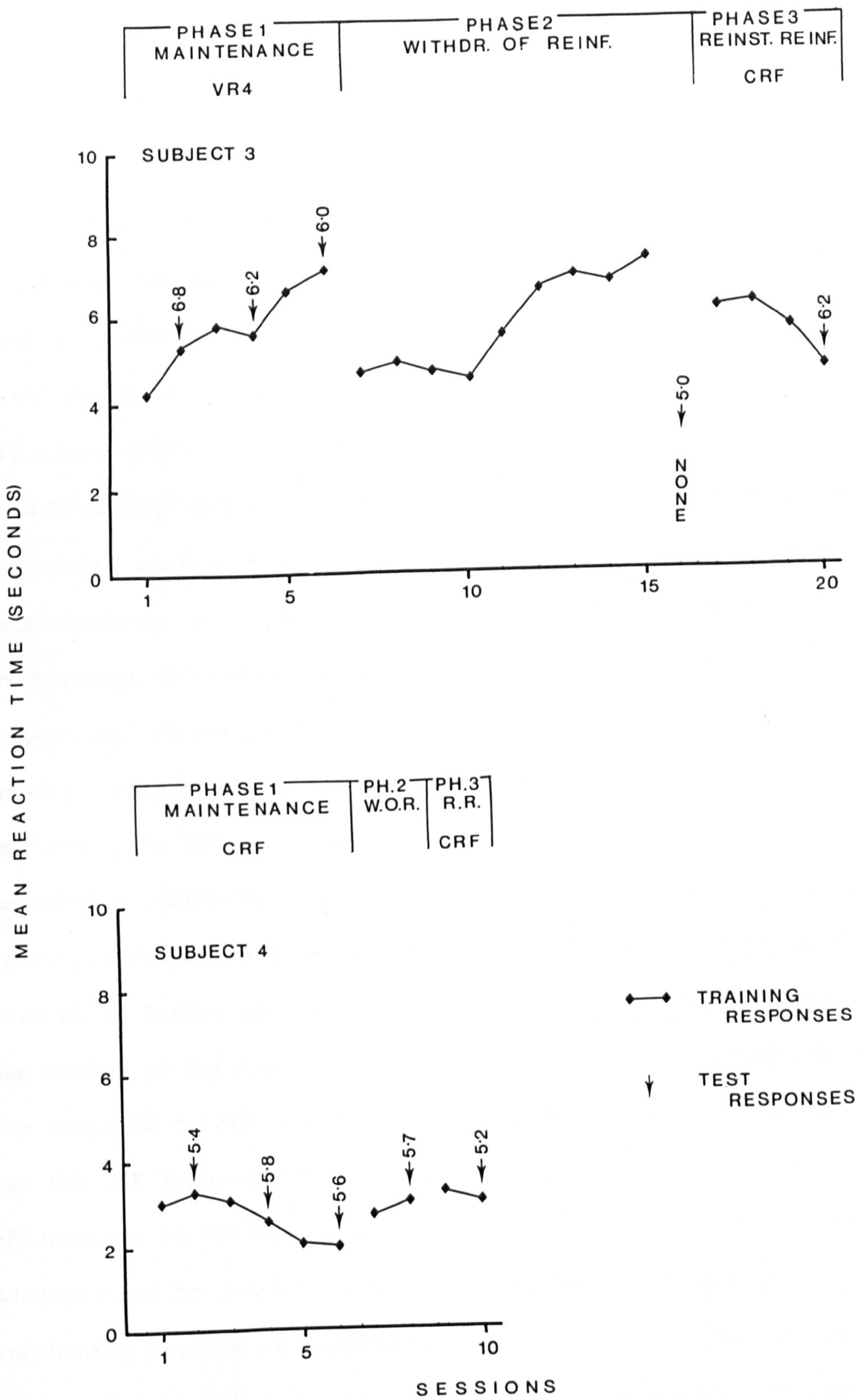

PHASE 1
MAINTENANCE
VR4
PHASE 2
WITHDR. OF REINF.
PHASE 3
REINST. REINF.
CRF
90%
100%
90%
90%
10%
SUBJECT 3
PERCENTAGE IMITATION
PHASE 1
MAINTENANCE
CRF
PH.2
W.O.R.
PH.3
R.R.
CRF
90%
80%
90%
90%
50%
SUBJECT 4
TRAINING RESPONSES
INTERTRIAL RESPONSES
TEST RESPONSES
SESSIONS

FIGURE 11.

Mean reaction times of imitative behaviours exhibited by Subject 3 (VR4 group) and Subject 4 (CRF group) over separate phases of Experiment 2. Mean reaction times shown for 'imitations' during each session (filled diamonds). The durations of successive experimental phases are mapped at the top of each graph and vertical arrows indicate tests for generalized imitation. The mean reaction time of generalized imitative responses on each presentation of the 'standard test' action is marked in seconds.


PHASE1
MAINTENANCE
VR4
PHASE2
WITHDR. OF REINF.
PHASE3
REINST. REINF.
CRF
SUBJECT 3
6·8
6·2
6·0
5·0
NONE
6·2
MEAN REACTION TIME (SECONDS)
PHASE1
MAINTENANCE
CRF
PH.2
W.O.R.
PH.3
R.R.
CRF
SUBJECT 4
5·4
5·8
5·6
5·7
5·2
TRAINING RESPONSES
TEST RESPONSES
SESSIONS

CRF reinforced group remained attentive and cooperative; in contrast, children in the VR4 group were increasingly distracted by random irrelevant external stimuli and showed a high rate of extraneous and emotional behaviours.

Phase 2. 'Withdrawal of Reinforcement'. When reinforcement of correct 'imitations' was discontinued, all children in both groups eventually ceased reproduction of 'training' actions and reached the experimental criterion of extinction. Even with allowance for individual variation, marked differences emerged between the performances shown by each subject group in this phase. As Table 11 indicates, the group previously reinforced on the VR4 schedule required significantly more (Mann-Whitney; $p < .05$) 'training action' trials than the previously continuously reinforced group to reach the operational criterion of extinction; indeed, the former group continued to respond for a mean number of trials over twice that shown by the latter set of subjects. Similarly, the VR4 group emitted a mean of over twice as many correct 'imitations' (Mann-Whitney; $p < .02$) and over three times as many intertrial responses (Mann-Whitney; $p < .03$) during this phase; once again these latter were similar to the 'training' actions only. The mean number of intertrial responses, expressed as a proportion of the mean total of trials was considerably higher (.28) for the VR4 group than the CRF group (.16). Under this experimental condition, the performances of subjects previously reinforced on the VR4 schedule were characterized by sporadic bursts of responses interspaced with lengthening periods of nonresponding; response patterns shown by children in the CRF group were more varied. Typically, however, even when emission of 'imitations' had reached a low level, all subjects would respond on the initial trials of each session.

The mean 'generalized imitation' score achieved by children in

Table 11. Performance of Former VR4 and CRF groups prior to 'Imitation' Extinction Criterion during Phase 2 (Withdrawal of Reinforcement).

| | Former VR4 Group (N=6) | | | Former CRF Group (N=6) | | | |
|---|---|---|---|---|---|---|---|
| | Mean | Range | | Mean | Range | | Mann-Whitney 'U' Test (2-Tail) |
| | | Min | Max | | Min | Max | |
| Trials to Extinction Criterion | 180 | 101 | 255 | 89 | 46 | 200 | $p < .05$ |
| Correct 'Imitations' to Extinction Criterion | 106 | 54 | 126 | 46.5 | 21 | 100 | $p < .02$ |
| Intertrial Responses to Extinction Criterion | 50.3 | 15 | 93 | 14.2 | 4 | 34 | $p < .03$ |

each group after the extinction criterion of 'imitations' had been reached are indicated in Table 12. All subjects showed a decrement in performance from their levels during the previous 'maintenance' phase. Although the difference between groups at this point was not significant (Mann-Whitney; $p > .05$), while the VR4 group showed a large and consistent fall across all subjects in rates of generalized imitation, the CRF subjects exhibited less of an overall decrement combined with a wide range of intersubject differences. For example, Subject 6 in this latter group, although having reached the extinction criterion for emission of 'imitations', still obtained an 80% 'generalized imitation' score immediately afterwards at the end of this phase.

As previously indicated, there was considerable variation between subjects in the number of correct 'imitations' emitted on 'training action' trials before extinction was reached. Thus, to establish trends in the reaction times of these responses within and between group with some degree of uniformity, the mean reaction times of the first 10 and last 10 correct 'imitations' only emitted by each child have been considered, with the results shown in Table 13. Although the differences between group did not reach significance (Mann-Whitney; $p > .05$) at either point, as in the previous experimental phase, the VR4 group tended to show longer reaction times than the CRF group. Both groups, however, showed a trend to longer 'imitation' reaction times just prior to the extinction criterion.

As there was also considerable variation between children in the 'generalized imitation' scores obtained (see Table 12) and the specific 'standard test' actions reproduced in their presentation after the extinction criterion, no group analysis of the reaction times of these responses has been attempted.

Table 12. Percentage Generalized Imitation Scores obtained by Former VR4 and CRF Groups on Presentation of 'Standard Test' Actions after 'Imitation' Extinction Criterion in Phase 2 (Withdrawal of Reinforcement).

| | Former VR4 Group (N=6) | | | Former CRF Group (N=6) | | | |
|---|---|---|---|---|---|---|---|
| | Mean | Range | | Mean | Range | | Mann-Whitney 'U' Test (2-Tail) |
| | | Min | Max | | Min | Max | |
| 'Generalized Imitation' Score | 10% | 0% | 20% | 28.3% | 0% | 80% | $p > .05$ |

Table 13. Mean Reaction Times of First and Last Ten 'Imitations' emitted by Subjects in Former VR4 and CRF Groups during Phase 2 (Withdrawal of Reinforcement).

| | Former VR4 Group (N=6) | | | Former CRF Group (N=6) | | | |
|---|---|---|---|---|---|---|---|
| | Mean | Range | | Mean | Range | | Mann-Whitney 'U' test (2-Tail) |
| | | Min | Max | | Min | Max | |
| First 10 'Imitations' in Phase | 4.6 secs | 1.1 secs | 7.7 secs | 2.5 secs | 1.0 secs | 4.3 secs | $p > .05$ |
| Last 10 'Imitations' in Phase | 5.1 secs | 1.2 secs | 9.1 secs | 3.4 secs | 1.0 secs | 7.2 secs | $p > .05$ |

Once again, the individual performances of Subject 3 and Subject 4 over this phase are representative of those shown by children in each group. As Figure 10 indicates, the 'imitations' of Subject 3 (VR4 group) tended gradually to diminish over many sessions with an initial high emission rate of intertrial responses which also decreased over time; once the extinction criterion had been reached, a low 'generalized imitation' score was obtained. In contrast, Subject 4 (CRF group) showed rapid extinction of 'imitations' with little increase in intertrial responding and a relatively high rate of 'generalized imitations' still when tested after the criterion performance point. During this phase, the mean reaction times of 'imitations' emitted by Subject 3 (VR4 group) rose slightly over sessions as did those of Subject 4 (VR4 group) (See Figure 11).

Under this experimental condition, the frequency of irrelevant and emotional behaviours shown by all subjects increased markedly; indeed, some children left the setting on their own initiative while others indicated unwillingness to continue sessions.

Phase 3. 'Reinstatement of Reinforcement'. Upon the reintroduction of continuous reinforcement for correct 'imitations', all subjects in both groups again reproduced demonstrated actions and, after varying numbers of trials, eventually reached the criterion, retraining performances of 'imitations' and 'generalized imitations'. The behaviour patterns of each subject group during this period are compared in Table 14. The group of subjects who had been previously reinforced on the VR4 schedule required a mean of nearly three times the number of retraining trials to criterion that was needed by the previously CRF schedule reinforced group; this differences proved significant (Mann-Whitney; $p < .05$). A similar trend was found in

Table 14. Performance of Former VR4 and CRF Groups Prior to Retraining Criterion during Phase 3 (Reinstatement of Reinforcement)

| | Former VR4 Group (N=6) | | | Former CRF Group (N=6) | | | |
|---|---|---|---|---|---|---|---|
| | Mean | Range Min | Range Max | Mean | Range Min | Range Max | Mann-Whitney 'U' Test (2-Tail) |
| Training Action Trials to Retraining Criterion | 48.5 | 18 | 131 | 17.2 | 10 | 40 | $p < .05$ |
| Correct 'Imitations' to Retraining Criterion | 34.3 | 15 | 89 | 15 | 10 | 30 | $p > .05$ |
| Intertrial Responses to Retraining | 11 | 3 | 25 | 2.2 | 0 | 5 | $p < .05$ |

the emission of intertrial responses (all of which were similar to 'training' actions) in that the VR4 group exhibited a mean of five times as many as the CRF group (Mann-Whitney; $p < .05$) in this period. Although the difference between groups in the number of correct (reinforced) 'imitations' shown did not reach significance (Mann-Whitney; $p > .05$) again the previously VR4-reinforced group required more 'imitations' than the CRF group to reach criterion performance.

On subsequent presentation of the 'standard test' actions, as can be seen in Table 15, all subjects showed high rates of (nonreinforced) 'generalized imitations' with no significant difference (Mann-Whitney; $p > .05$) between groups.

As in the previous (Phase 2) section, there was considerable variation between subjects in the number of correct 'imitations' emitted before the retraining criterion was reached, the lowest number being 10 by any child, as required by the set criterion. Thus, once again, in group comparisons, the mean reaction times of the last 10 correct (reinforced) 'imitations' by each subject only were considered; these are indicated, with the mean reaction times of subsequent 'generalized imitations', in Table 16. The results are consistent with those from previous phases in that the mean reaction times for each set of responses are higher for the previously VR4 reinforced group than the CRF group; for neither response set, however, does the difference between groups reach significance (Mann-Whitney; $p > .05$).

Once again, the performances of Subject 3 and Subject 4 reflect those of all children in each group during this phase. As shown in the final parts of Figure 10, the rates of 'imitations' increased over sessions and the emission of intertrial responses decreased until criterion retraining performance was reached, after which each child

Table 15. Percentage Generalized Imitation Scores obtained by Former VR4 and CRF Groups on Presentation of 'Standard Test' Actions after 'Imitation' Retraining Criterion in Phase 3 (Reinstatement of Reinforcement).

| | Former VR4 Group (N=6) | | | Former CRF Group (N=6) | | | |
|---|---|---|---|---|---|---|---|
| | Mean | Range | | Mean | Range | | Mann-Whitney 'U' Test (2-Tail) |
| | | Min | Max | | Min | Max | |
| 'Generalized Imitation' Score | 96.7% | 90% | 100% | 95% | 90% | 100% | $p > .05$ |

Table 16. Mean Reaction Times of 'Imitations' and 'Generalized Imitations' emitted by Former VR4 and CRF Groups at Retraining Criterion during Phase 3 (Reinstatement of Reinforcement).

| | Former VR4 Group (N=6) | | | Former CRF Group (N=6) | | | |
|---|---|---|---|---|---|---|---|
| | Mean | Range | | Mean | Range | | Mann-Whitney 'U' Test (2-Tail) |
| | | Min | Max | | Min | Max | |
| Final 10 Correct 'Imitations' to Retraining | 4.5 secs | 1.0 secs | 7.9 secs | 3.1 secs | 1.0 secs | 6.9 secs | $p > .05$ |
| 'Generalized Imitations' at Retraining Criterion | 5.2 secs | 1.4 | 7.6 | 4.8 | 1.4 | 6.8 | $p > .05$ |

showed a high rate of 'generalized imitations' upon presentation of the 'standard test' actions. Over the corresponding sessions in Figure 11, the mean reaction time of imitative responses emitted in each session tended to fall as retraining progressed.

In general, children who had been reinforced on the CRF schedule during Phase 1 (Maintenance) required very few or no prompts by the model to re-establish imitative responding; rather, after the delivery of the first reinforcing stimulus in this phase, they immediately attended to the behaviour of the model again. In contrast, many of the subjects who had been previously reinforced on the VR4 schedule required prompting and shaping with reinforcement over many trials in this present phase before their attendance to the model and imitative behaviours recovered to previous high levels.

## DISCUSSION

All the subjects' imitative behaviour was readily scored and the interjudge reliability of scoring (.96) compares well with figures quoted by other authors (e.g. Steinman, 1970a).

Specific predictions about the immediate or subsequent effects of each experimental condition proved substantially correct. Firstly, the present results replicated those from previous studies of generalized imitation (e.g. Lovaas et al., 1967; Peterson, 1968) with developmentally retarded children in which experimental conditions of reinforcement available/not available for correct 'imitations' have been systematically reversed. It appears necessary to have reinforcing stimuli present in a given situation to maintain the imitative and generalized imitative behaviours of this specific retardate population. Secondly, should such stimuli be totally removed, the 'imitations' of children previously reinforced on a variable ratio schedule will be less prone to extinction than those of subjects whose every correct 'imitation' had been reinforced. Thus what Jenkins and Stanley (1950) called the 'Partial Reinforcement Effect' has been demonstrated with one type of intermittent reinforcement schedule to hold true for the imitative responses of a subnormal child population.

The first of these conclusions was based on evidence of similar changes within the behaviour of each individual child following systematic alterations in experimental conditions. The second finding, however, arose from differential effects of a treatment on two independent subject groups; thus its reliability depends on justification of assumptions about the initial equality of these groups. Developmental data indicated both groups as essentially similar, but Experiment 1 suggested such information to have limited value as a basis of comparison; rather, more valid selection of subjects might have resulted from examining individual performances of the responses for later investigation. Such a step would have involved several 'pre-experimental' sessions under similar conditions (e.g. continuous reinforcement of 'imitations') for all subjects to gain 'baseline' performance samples for each child. From the characteristics of these, subjects might be matched and allocated to alternate treatment groups. Such a procedure was, however, impractical as only three children served as subjects over any given period and so not all subjects were simultaneously available for matching. Thus, assertions of initial group equality can be made at gross levels only, on the bases of developmental data similarity combined with a given criterion of performance reached by all subjects before the first experimental phase. Each experimental phase will now be considered in turn.

Phase 1. 'Maintenance'. The two groups were maintained over similar numbers of trials, and thus the CRF subjects could potentially have received four times as many reinforcements during this phase as those in the VR4 group. The alternative method, namely to arrange correspondence between groups in the number of potentially reinforced trials would, however, have both entailed the VR4 group spending considerably longer in the experimental situation and made less direct any comparison of group performances. Further support for the procedure used has been provided by Ellis (1962) who found no significant connection between the amount of reinforcement dispensed to retardates during a maintenance phase and the number of responses emitted during a subsequent extinction phase.

Within the confines of the 'discrete trial' paradigm, the use of a VR reinforcement schedule with young retardates resulted in response patterns similar to those typically found with other categories of human and infra-human subjects under this condition. The finding parallels that of Spradlin, Girardeau and Corte (1965) who noted similar general correspondence between the performances of subnormals and other subjects on both FR and FI reinforcement schedules, albeit with clearly defined single classes of responses. Taken together, these sets of results suggest that conclusions from studies of reinforcement schedules with varied populations might be justifiably extended to include the subnormal child population.

Apart from overall response rates, however, the VR4 schedule appeared to lead to some deterioration of performance characteristics, suggesting that frequent reinforcement may be necessary to maintain the trial/no trial distinction. Also, it remains uncertain whether the progressively lengthening 'imitation' reaction times of the VR4 group would have eventually exceeded the 10 second time limit of each trial and hence no longer qualified for reinforcement at all.

The ratio of reinforcement for, on average, one in every four imitation trials on the VR schedule was an arbitrary figure chosen from clinical judgement and the precedents set by previous studies; within this situation, the ratio proved sufficient to maintain response emission in all subjects over 180 trials. Ferster and Skinner (1957), considering key pecking behaviour, warned "(the pigeon) will stop responding altogether if the average number of responses required goes beyond a certain value" (p.391). Ellis et al. (1960) showed that as the ratio on which retardates were reinforced increased, subjects with higher 'Mental' and 'Chronological' ages performed at higher overall rates, while those of lower developmental levels showed more erratic behaviour patterns with split runs. Thus, within a given retardate population there may well be large differences between individuals in tolerance of ratio stretching before performances deteriorate.

Phase 2. 'Withdrawal of Reinforcement'. The behaviour patterns shown by all children, particularly those previously reinforced on the intermittent schedule, were again essentially similar to results obtained under comparable circumstances with varied subjects including animals. Thus, 'spontaneous recovery' of lever pressing by rats at the beginning of successive extinction sessions had been noted by Ellson (1938). Again, Ferster and Skinner (1957) described the key pecking performances of a pigeon, once reinforcement on a VR schedule had ceased, as follows: "the early part of the extinction curve consisted of sustained responding in short bursts separated by short pauses. The decline in overall rate as extinction proceeded followed from the increasing length of pause separating these bursts of responding" (p.411). Although derived from a free response emission situation, this description has much in common with the performance of 'imitations' in this phase by previously intermittently reinforced subjects of the present study. The procedure did not, however, allow similar comment on emission of 'generalized imitations'; regular, frequent demonstrations of the 'standard test' actions would have resulted in very large differences between subjects in the number of presentations and consequent practice effects with resulting complication of group comparisons.

Attention has been previously drawn (see Chapter 3) to the comment by Steinman (1970b) that although decrement in imitative responding may follow a total withdrawal of reinforcement, this procedure is not adequate to analyse the importance of contingent reinforcement in the maintenance of generalized imitation; rather, it indicates the effect of having reinforcing stimuli in the situation at all. For the present, institutionalized subnormal population, however, for whom effective reinforcers are limited (Nawas and Braun, 1970b) and delivery situations sparse, the reversal of reinforcer present/absent experimental conditions probably has more basis in reality than intricate noncontingent and delayed reinforcement procedures.

Phase 3. 'Reinstatement of Reinforcement'. Following an extinction phase for plunger pulling by moderately retarded adolescents Spradlin et al. (1966) noted a dramatic, immediate response recovery as soon as reinforcers were again apparent in the situation; these authors commented "there can be little doubt that the reinforcement itself had stimulus properties when delivered after the extinction of a response" (p.378). A similar explanation may account for the rapid recovery of imitative and generalized imitative by some subjects in this study, particularly the former CRF group upon reintroduction of contingent reinforcement for 'imitations'. In contrast, the majority of the former VR4 group showed no such immediate recovery, suggesting that after extended responding under the previous (no reinforcement) condition, extinction was more complete.

A direct comparison of present results with those from other reinforcement schedule studies assumes that the 'explanation' of generalized imitation proposed by Gewirtz and Stingle (1968) (see Chapter 3) is valid; that is, 'imitations' and 'generalized imitations' may be regarded as a single functional response class in a manner similar to bar pressing and other discrete behaviours. This view implies that both sets of responses should be influenced in closely similar ways by any given treatment. Parallel response emission rates for some individuals over all experimental phases support this assumption, although for others there are marked differences, particularly after the extinction criterion in Phase 2, between absolute rates of imitation and generalized imitation. This latter distinction may, however, have reflected the arbitrary nature of the pre-determined criterion performance of extinction and all subjects have reached very low emission rates of both response sets had the phase been prolonged. In contrast, however, group reaction time data did not exhibit congruent trends for 'imitations' and 'generalized imitations' suggesting the 'single response class' 'explanation' may be limited in application to particular kinds of performance measures.

Similar contradictions occur when an alternative 'discrimination' (Bandura, 1968) 'explanation' (see also Chapter 3) is considered. This view hypothesizes that subjects exhibit generalized imitation because they are unable to discriminate between (reinforced) imitative and (nonreinforced) generalized imitative behaviours; different rates of emission of the two response sets are commonly held as evidence of such 'discrimination'. During the 'maintenance' phase, no such differentiation was shown in response rates, but appeared systematically in the reaction time measure. Later, however, when reinforcement of 'imitations' was discontinued, some children (especially Subject 6) did show differential emission rates of the two response sets. Because of these contradictions, no general assessment of the usefulness of various hypotheses about the nature of 'generalized imitation' will be attempted at this stage. Rather, the contrasting results of different forms of data and suggestions of different possible mechanisms for each child under separate experimental conditions are noted.

All the measures of imitative performance taken in this experiment, including the previously unreported use of a 'reaction time' index showed systematic effects. During the latter two phases, lengthening reaction times of frequently occurring 'imitations' coincided with deteriorating performances indicated by falling imitative and rising intertrial response emission rates; conversely shortening reaction times were associated with recovery of 'imitations' and falling intertrial response rates. Such a correlation of performance characteristics suggests that mean reaction times of, at least, 'imitations' indeed provides a useful measure of relative imitative performance strength.

Guilford (1965), among many others, has described the main assumptions concerning distribution and variance characteristics of data that underlie the use of analysis of variance techniques in statistical consideration of experimental results. At the same time, it is pointed out that, while the extent to which any body of data meets these assumptions cannot be readily tested, the limits of tolerance of conditions under which analysis of variance procedures may justifiably be used are wide. The 'F' measure, for example, is held to be 'rather insensitive' (p.301) to variations in the shape of data distributions. When, however, all the necessary assumptions have not been met, the probability levels associated with given 'F' ratios may vary somewhat. Although in the present study, the applicability of the assumptions necessary for analysis of variance were not tested, effects were shown at such high levels of significance that some variations in the probabilities involved would not materially alter confidence in the nature of the conclusions.

Finally, these experimental results have immediate relevance to the use of generalized imitation in clinical settings with developmentally retarded children. Increased resistance to extinction for imitative responses may be programmed by reinforcement on a VR schedule, but by doing so, finer points of immediate performance in terms of response immediacy and occurrence of intertrial responses may be sacrificed. Hence, the therapist has to decide the schedule for use on the basis of necessary priorities of performance characteristics, and these may depend on the type of responses being taught by imitation; in the acquisition of vocal responses, (e.g. Lovaas et al., 1966) as rapid imitation as possible by the subject may be important, while in the acquisition of manipulative skills (Lovaas et al., 1967) longer delays are not critical.

## SUMMARY

Twelve young, subnormal children, having previously acquired generalized imitative repertoires under specific laboratory conditions, were randomly assigned to form two groups of six subjects each. Although correct 'imitations' of one group were reinforced on a

continuous reinforcement schedule (CRF) and those of the other group on a variable ratio (VR4) schedule over the same total number of trials, all subjects maintained high stable levels of 'imitative' and 'generalized imitative' responding; the VR4 group, however, exhibited increased rates of intertrial responses and progressive lengthening of mean 'imitation' reaction times during this phase. Next, reinforcement for correct 'imitations' was discontinued for all subjects; subsequently, every child showed a marked decrease in the frequency of 'imitative' responses, but the former VR4 group required significantly more trials to reach an 'extinction of imitations' criterion than the former CRF schedule group. All subjects showed varying concurrent decreases in levels of 'generalized imitation'. Finally, upon reinstatement of contingent reinforcement for 'imitations' on a CRF schedule, all subjects rapidly recovered former high levels of'imitative' and 'generalized imitative' responding.

It was concluded that:-

1) the Partial Reinforcement Effect appeared to hold for the imitative behaviour of this subject population,

and

2) it is necessary to have reinforcing stimuli in the experimental situation to maintain emission of 'imitations' and 'generalized imitations' by such subjects.

EXPERIMENT 3

Some effects of location and model variables on 'imitations' and 'generalized imitations'.

## INTRODUCTION

On the clinical use of behaviour modification procedures, Stokes, Baer and Jackson (1974) commented: "the usual need for generalization of therapeutic behaviour change across locations and personnel is widely accepted; it is not, however, always realized that generalization does not automatically occur simply because a behaviour change has been accomplished. Thus, the need to programme each generalization rather than expect it requires both emphasis and effective techniques" (p.599).

This caution has been firmly upheld by studies investigating two main aspects of such possible generalization in child subjects. Firstly, children of 'average intellectual ability' treated for "deviant" behaviour patterns (Wahler, 1969; Walker and Buckley, 1972), retardates taught a greeting response (Stokes et al., 1974) and "autistic" subjects who gained assorted skills (Lovaas, Koegel, Simmons and Stevens-Long, 1973; Rincover and Koegel, 1975), all in one location showed little spontaneous transfer of treatment gains to other locations. Rather, to achieve this desired generalization, special intervention, usually reinforcement or other training of the target behaviour, was necessary in the novel location. Secondly, after training to reduce self-destructive behaviours in 'autistic' children (Lovaas and Simmons, 1969) and acquisition of a 'conversational speech form' (Garcia, 1974) and greeting response (Stokes et al., 1974) by retardates in the presence of a single experimenter, these subjects again showed little generalization of behaviour change to new personnel. In each study, similar training with at least one other experimenter was needed before the children exhibited any generalization of treatment gains in the presence of other such "extra-therapy personnel".

In a similar manner, the optimal use of modelling techniques as a therapeutic measure may also demand that children imitate a variety of models in many different places. Once again, however, in the acquisition of generalized imitation, previously nonimitative developmentally retarded children are typically trained to copy the behaviour of one model in a particular location. Changes in various environmental setting stimuli including instructions (e.g. Waxler and Yarrow, 1970), absence of the experimenter after an action has been modelled (Peterson et al., 1971; Peterson and Whitehurst, 1971) and "activity context" (Waxler and Yarrow, 1970) have been shown to result in lower rates of 'imitations' and 'generalized imitations' by normal children. When, however, a new model was exchanged for the standard one, Waxler and Yarrow (1970) found no change in the imitative behaviour of their normal subjects; similarly, Baer et al., (1967) reported little decrement in the performance of one subnormal child after the introduction of new male and female models. In contrast, Garcia (1974) using mimicry in part of his 'conversational speech form' training programme with retardate subjects, found little spontaneous transfer of the imitative behaviours to new models. Despite the inconsistency of the above findings, it seems that spontaneous generalization of imitative behaviours by subnormal children to new locations and models cannot be taken for granted and that there may be marked differences between individuals in the transfer shown under given stimulus changes.

Rincover and Koegel (1975) have suggested that children who initially fail to show such transfer to novel locations or persons may be responding selectively to another incidental stimulus in the original treatment situation; hence, to bring about the transfer of treatment gains for such individuals, it is necessary that the stimulus controlling responding in the original situation should also be present under the novel conditions to which generalization is desired.

The earlier studies in this thesis provided retarded child subjects who, so far as was known, had only been reinforced for imitative behaviour (except in early training) under one set of stimulus conditions; that is, for reproducing the actions of one male model in a single location in the presence of a red ball. The present experiment examined the effects of systematic changes in parts of this complex stimulus situation on the imitative and generalized imitative performances of these children. For all subjects, the study was divided into two consecutive sections, similar in method, but in which different major stimulus factors varied; for each section, these were:

Section 1. "Change of Location", the room in which experimental sessions were conducted, and

Section 2. "Change of Model", the identity of the model who demonstrated actions for reproduction.

It was anticipated that all subjects would show lowered rates of "imitations" and "generalized imitations" in either novel stimulus condition.

Although the red ball had been used consistently as a presumed cue for each trial, its role in the maintenance of 'imitations' and 'generalized imitations' in the original training situation remained uncertain. The view of Rincover and Koegel (1975) above, however, suggested that the presence of such an easily portable stimulus among novel setting conditions might facilitate generalization of imitative responding from an original training to these novel conditions. Thus, in both Section 1 and Section 2 above, under both original and novel stimulus conditions in each, rates of imitative responding were compared when the red ball was present and absent for trial presentations. In the absence of precedents, no prediction was attempted about the outcome of this ball present/absent stimulus variation but, rather, empirical evidence sought of any effects on 'imitative' and 'generalized imitative' response rates.

Finally, in a similar manner, empirical information was sought about the effects of change in each of the location, model identity and ball presence stimulus variables on additional performance measures of intertrial response emission rates and reaction times of 'imitations' and 'generalized imitations'.

## METHOD

### Subjects

Twelve subnormal children served as subjects throughout both sections of this experiment. Although previously nonimitative, all had been trained to reproduce actions demonstrated by a particular model in one location, without instructions but in the presence of a red ball. Further, no child had received programmed reinforcement for imitative behaviour under any other setting conditions, apart from the use of instructions in very early imitation training (see Experiment 1). These children, with developmental data gained immediately prior to participation in this experiment, are indicated in Table 17.

### Experimental Settings, Apparatus and Reinforcers

Both Section 1 (change of location) and Section 2 (change of model) included the apparatus, original 'treatment room' setting and male model described in the relevant part of Chapter 5 (General Method).

Table 17. Subjects

| Subject (Number) | Age | Primary P.A.C. Items Passed | Vineland | |
|---|---|---|---|---|
| | | | Social Age | Social Quotient |
| 1 | 5 yrs 6mths | 93 | 1.8yrs | 33 |
| 2 | 5yrs 9mths | 98 | 1.9yrs | 33 |
| 3 | 5yrs 8mths | 51 | 1.2yrs | 21 |
| 4 | 6yrs 9mths | 54 | 1.4yrs | 20 |
| 5 | 7yrs 6mths | 50 | 1.2yrs | 16 |
| 6 | 9yrs 2mths | 57 | 1.6yrs | 17 |
| 7 | 8yrs 10mths | 56 | 1.4yrs | 15 |
| 8 | 8yrs 10mths | 32 | 1.0yrs | 11 |
| 9 | 9yrs 10mths | 53 | 1.4yrs | 14 |
| 10 | 9yrs 4mths | 37 | 1.4yrs | 15 |
| 12 | 11yrs 3mths | 58 | 1.6yrs | 14 |
| 13 | 11yrs 5mths | 40 | 1.3yrs | 11 |
| Mean: | 8yrs 4mths | 57 | 1.4yrs | 18 |

This room and model will be termed the 'standard room' and 'standard model' respectively. In addition, however, each section involved separate variations of these stimulus features. These were:

for Section 1: the day rooms of the four wards from which subjects had been drawn. In each, the standard table, two chairs, screen and recording equipment were again arranged as shown in Figure 1. For each child, his or her own day room, with these additional features, will be termed the 'novel ward' location.

for Section 2: a female nursing officer. This lady was dressed in usual nurses' uniform and, although familiar to all the children, had not taken part in any previous formal training programmes. She will be termed the 'novel model'.

The specific reinforcers administered to individual subjects were also as described in the relevant part of Chapter 5 (General Method).

<u>Procedure</u>

For all subjects, Section 1 of this experiment preceded Section 2. A maximum of three children only served as subjects during any given time period and these were taken through both experimental actions without any break in continuity. Although each section involved change in different main setting variables, similar forms of procedure were used for both; that of Section 1 will be described in detail.

Section 1. Change of Location.

Sessions were conducted daily with each child individually, as indicated in Chapter 5 (General Method).

Preliminary Retraining. Prior to this investigation, varying periods of time had elapsed for each subject without formal training of 'imitations' in the standard experimental, or any other, setting. Thus, as a preliminary step, all subjects were retrained as necessary to a common criterion performance by reinforcement of correct 'imitations' of a limited set of five demonstrated actions. For all children except two, these were "training"actions 1-5 from Table 4; the exceptions were Subject 3 and Subject 8 with whom, for reasons previously detailed (p.111),"training" action 7 (patting chest) was again substituted for"training"action 1. Retraining was carried out as described in Experiment 2 (p.141) in the standard experimental location and with the standard model, who demonstrated each action in the presence of the red ball but without instructions. As previously, this process continued until, under these stimulus conditions, the child correctly imitated each of the 'training' actions 1 (or 7) to 5 twice over ten consecutive trials, concurrently emitted no similar intertrial responses and subsequently achieved a score of at least 90% for (nonreinforced) generalized imitation (see Chapter 5 for scoring method) during one presentation of all the 'standard test' actions from Table 4.

Change of Stimulus Conditions. This section involved systematic change in both the location and ball presence variables. The two possible instances of each made available, in all, four separate combinations of experimental stimulus conditions under which actions might be demonstrated for imitation. These were:-

a) standard room, ball present

b) standard room, ball absent

c) novel ward, ball present

d) novel ward, ball absent

With every subject, after retraining was complete, four separate 'test' sessions were carried out, each session under a different one of the stimulus combinations (a) - (d) above; for each child, the 'novel ward' situation was the day room of the ward in which that child lived. Without exception, the first 'test' session took place under the 'standard room, ball present' stimulus condition for every subject. The other three remaining stimulus conditions could be arranged in six different orders; thus, with twelve subjects available, two children were randomly assigned for presentation of these stimulus conditions in each possible order on subsequent 'test' sessions. Table 18 indicates the order in which these stimulus conditions were presented to each subject.

During each 'test' session with every child, the five 'training' actions 1 (or 7) to 5 and the five 'standard test' actions from Table 4 were alternately demonstrated for one trial each under the appropriate stimulus condition by the standard model without instructions. At the start of each of the ten trials, the model looked towards the subject, brought the ball into view if appropriate, and then exhibited the scheduled action. During these 'test' sessions there were no programmed consequences for either correct 'imitations' or 'generalized imitations' and each trial lasted for 10 seconds regardless of the subject's behaviour. At the end of this time interval, the model removed the ball if present and ceased to look at the subject. A constant period of 10 seconds always elapsed between trials.

Between each of these 'test' sessions were interspersed three

| Subjects (Numbers) | FIRST | SECOND | THIRD | FOURTH |
|---|---|---|---|---|
| 2, 10 | Standard room, ball present. | Standard room, ball absent | Novel ward, ball present | Novel ward, ball absent |
| 5, 13 | " | Novel ward, ball present | Standard room, ball absent | Novel ward, ball absent |
| 6, 9 | " | Standard room, ball absent | Novel ward, ball absent | Novel ward, ball present |
| 1, 8 | " | Novel ward, ball absent | Standard room, ball absent | Novel ward, ball present |
| 4, 7 | " | Novel ward, ball present | Novel ward, ball absent | Standard room, ball absent |
| 3, 12 | " | Novel ward, ball absent | Novel ward, ball present | Standard room, ball absent |

Table 18. Presentation Order of Separate Stimulus Conditions for 'Test' Sessions to each Subject in Section 1.

'maintenance' sessions in which the 'training' actions 1 (or 7) to 5 were demonstrated to each subject, one action per trial with 30 trials in each session, giving a total of 90 trials in all. The standard model exhibited each action in the standard room with the red ball visible but without instructions; the actions were arranged in the sequence shown in Table 10. Each action was demonstrated for a maximum of 10 seconds and on every trial, the subject was reinforced for a correct 'imitation' within that time, whereupon the trial ended and the red ball was removed. Once again, a 10 seconds period always elapsed between trials.

Thus, in summary, with each child 'test' sessions of imitative behaviour under varied stimulus conditions were interspersed with 'maintenance' sessions of continued training in the original setting conditions. For illustrative purposes, the procedural sequence of Subject 12 is presented:-

| | Test Session | 3 | Test Session | 3 | Test Session | 3 | Test Session |
|---|---|---|---|---|---|---|---|
| Preliminary Retraining | Standard room, Ball Present | 'Maintenance' Sessions | Novel Ward, Ball absent | 'Maintenance' Sessions | Novel Ward, Ball Present | 'Maintenance' Sessions | Standard Room, Ball Absent |

Section 2. Change of Model.

The procedure used in this section was the same in form as that of Section 1.

Preliminary Retraining. Firstly, each subject was retrained to the same criterion performance with the same 'training' actions as previously described in Section 1.

Change of Stimulus Conditions. This section involved systematic change in both the model identity and ball presence variables. Once again, the two possible instances of each made available, in all, four separate combinations of experimental stimulus conditions under which actions might be demonstrated for reproduction. These were:-

a) standard model, ball present
b) standard model, ball absent
c) novel model, ball present
d) novel model, ball absent.

The appropriate 'training' and 'standard test' actions were demonstrated to every child as previously described for Section 1 in four separate test sessions with a specific stimulus condition operating throughout each session. Without exception the 'standard model, ball present' was used on the first 'test' session of this section with each subject. As before, six different orders of presentation were possible for the subsequent three stimulus conditions; with twelve subjects available, these separate stimulus conditions were again presented in all the possible orders, to two randomly selected children in each order. The arrangements of these stimulus conditions, and the subjects to whom they were allotted, are shown in Table 19.

All sessions were carried out in the "standard room" and every trial was introduced without instructions. When 'test' sessions involved the 'novel model', she was alone with the subject; throughout, she demonstrated each action, and otherwise behaved, in a manner similar to that of the 'standard model'.

As before, with every subject, each of these 'test' sessions was separated by three consecutive 'maintenance' sessions which involved

| Subjects (Numbers) | FIRST | SECOND | THIRD | FOURTH |
|---|---|---|---|---|
| 1, 9 | Standard model, ball present | Standard model, ball absent | Novel model, ball present | Novel model, ball absent |
| 4, 10 | " | Novel model, ball present | Standard model, ball absent | Novel model, ball absent |
| 3, 13 | " | Standard model, ball absent | Novel model, ball absent | Novel model, ball present |
| 2, 8 | " | Novel model, ball absent | Standard model, ball absent | Novel model, ball present |
| 5, 12 | " | Novel model, ball present | Novel model, ball absent | Standard model, ball absent |
| 6, 7 | " | Novel model, ball absent | Novel model, ball present | Standard model, ball absent |

Table 19. Presentation Order of Separate Stimulus Conditions for 'Test' Sessions to each Subject in Section 2.

reinforcement of 'imitations' of 'training' actions and were conducted as described for Section 1.

Finally, once again the procedural sequence of Subject 12 is presented for illustrative purposes:-

| | Test Session | | Test Session | | Test Session | | Test Session |
|---|---|---|---|---|---|---|---|
| | | 3 | | 3 | | 3 | |
| Prelim-inary Retrain-ing | Standard model, Ball present | 'Mainten-ance' Sessions | Novel model, Ball present | 'Mainten-ance' Sessions | Novel model, Ball absent | 'Mainten-ance' Sessions | Standard model, Ball absent |

Throughout both sections of this experiment, each session was recorded on videotape and played back later for analysis. Data were collected in the forms described in Chapter 5 (General Method). At a number of points throughout the study, independent observers checked the reliability of the experimenters' scoring of the subjects' behaviour.

RESULTS

Observer agreement on scoring of trials in both sections always exceeded .96.

Section 1. Change of Location.

During preliminary retraining, all subjects at once or very rapidly reached criterion level performance for 'imitations' and 'generalized imitations' of the 'training' and 'standard test' actions respectively.

The rates of 'imitative' and 'generalized imitative' responding by all subjects in 'test' sessions under each of the relevant stimulus conditions are indicated in Table 20. Every child emitted both sets of responses at high rates under the usual 'standard room, ball present'

| | STANDARD ROOM | | | | | | NOVEL WARD | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ball Present | | | Ball Absent | | | Ball Present | | | Ball Absent | | |
| | Mean | Range | | Mean | Range | | Mean | Range | | Mean | Range | |
| | | Min | Max | | Min | Max | | Min | Max | | Min | Max |
| Percentage Correct 'Imitations' | 96.6 | 80 | 100 | 86.6 | 60 | 100 | 66.6 | 20 | 100 | 60.0 | 20 | 100 |
| 'Generalised Imitation' Score | 95.0 | 80 | 100 | 84.1 | 50 | 100 | 55.8 | 10 | 100 | 47.5 | 0 | 100 |

Table 20. Imitations and Generalized Imitations emitted by all Subjects under each of Section 1 Test Session Stimulus Conditions.

setting condition; some children showed slight decrements in both 'imitations' and 'generalized imitations' in this location when the red ball was removed from trial presentations. Variation between the performances of individual subjects became more marked in both the 'novel ward' 'test' sessions; subject 1 and subject 2 showed little change from maximum response rates despite the change in this stimulus variable, while others, notably subjects 5, 8 and 10, exhibited large decrements in emission of both response sets under the 'novel ward, ball present' and 'novel ward, ball absent' stimulus conditions. Further, in the novel location, subject 3 and subject 13 reproduced 'training' and 'standard test' actions at markedly contrasting rates, retaining relatively high frequencies of 'imitations' while emissions of 'generalized imitations' fell to zero or near zero.

Table 21 shows the means of 'percentage imitations' and 'generalized imitation' scores obtained by all subjects during the 'test' sessions in second, third and fourth positions of presentation, irrespective of stimulus conditions used for particular children in each. From visual inspection, no consistent effect was apparent across successive positions and the differences in mean scores between positions were small when compared with those shown between stimulus conditions in Table 20. Thus, although a systematic 'stimulus condition presentation order' effect had not been rigorously disproven, it was disregarded as of relatively little importance during an analysis of variance of stimulus condition effects on 'imitative' and 'generalized imitative' response rates. A three-factor factorial design with repeated measures on every factor yielded a significant overall location effect, $F(1, 11) = 30.24$, $p < .001$, indicating lower incidence of 'imitations' and 'generalized imitations' in the 'novel ward' setting. Similarly, a significant overall ball presence effect was found, $F(1, 11) = 10.94$, $p < .01$, showing lower

Table 21. Mean Imitations and Generalized Imitations in Successively Presented 'Test' Sessions in Section 1.

| | POSITION IN PRESENTATION ORDER OF 'TEST' SESSIONS | | |
|---|---|---|---|
| | SECOND | THIRD | FOURTH |
| Mean Percentage Imitation | 70.0 | 73.3 | 66.6 |
| Mean Percentage Generalized Imitation Score | 68.3 | 70.8 | 63.3 |

emission rates of both sets of responses under the 'ball absent' stimulus conditions. In contrast, however, no significant difference transpired, $F(1, 11) = 3.28$, $p > .05$, between frequencies of reproduction for 'training' or 'standard test' actions, nor did any factor interactions prove significant.

Mean numbers of intertrial responses emitted under each set of stimulus conditions (all of 'training' actions only) are shown in Table 22. All subjects made few such responses when the 'standard room, ball present' condition operated; thereafter considerable differences emerged between individuals, ranging from Subject 1, who emitted no intertrial responses in any 'test' session in this section, to Subject 7 who showed eleven such responses under the 'standard room, ball absent' stimulus condition. In general, all changes in the setting conditions away from the original 'standard room, ball present' situation produced somewhat increased rates of intertrial response emission.

Table 23 indicates the mean number of intertrial responses shown by all subjects during the 'test' sessions in second, third and fourth positions of presentation, irrespective of stimulus conditions used for specific children in each. The mean figure (3.1) quoted for the 'test' sessions in fourth position included the single, exceptionally high number of such responses (11) emitted by Subject 7 under the 'standard room, ball absent' condition. When this result was taken into account, the mean figures quoted in Table 23 showed small differences in comparison with those in Table 22, and no obvious systematic effects. Thus, once again, in analysis of intertrial response emission rates under separate stimulus conditions, possible 'order of presentation' effects have been disregarded.

| | STANDARD ROOM | | | | | | NOVEL WARD | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ball Present | | | Ball Absent | | | Ball Present | | | Ball Absent | | |
| | Mean | Range | | Mean | Range | | Mean | Range | | Mean | Range | |
| | | Min | Max | | Min | Max | | Min | Max | | Min | Max |
| Intertrial Responses | 1.1 | 0 | 3 | 2.9 | 0 | 11 | 2.8 | 0 | 5 | 2.4 | 0 | 5 |

Table 22. Intertrial Responses Emitted by all Subjects under each of Section 1 Test Session Stimulus Conditions.

Table 23. Mean Intertrial Responses Emitted During Successively Presented 'Test' Sessions.

| | POSITION IN PRESENTATION ORDER OF 'TEST' SESSIONS | | |
|---|---|---|---|
| | SECOND | THIRD | FOURTH |
| Mean Intertrial Responses | 2.6 | 2.5 | 3.1 |

A two-factor factorial design analysis of variance with repeated measures on each factor did not yield significant effects for either the location or ball presence variables, nor the interaction between the factors.

The mean reaction times of 'imitations' and 'generalized imitations' shown by subjects under each stimulus condition in this section are indicated in Table 24. With the variation between children in response rates, particularly in the 'novel ward' location, each mean reaction time indicated may have been derived from widely differing numbers of responses; in addition, no particular 'training' or 'standard test' actions were reproduced consistently by all subjects under all stimulus conditions. With these limitations in the nature of this data, formal analyses of presentation order or stimulus condition effects seemed inappropriate. It appeared, however, that reaction times of 'imitations' emitted under the 'standard room, ball present' condition were shorter than those in other test sessions; meanwhile, reaction times of 'generalized imitations', when emitted, tended to remain stable under all stimulus conditions.

Some children, notably Subject 1 and Subject 2, attended to the model consistently in all test sessions, but many others showed increased levels of irrelevant behaviours and were particularly distracted by other external stimuli (e.g. sounds from other children) in the 'novel ward' setting. In this new location, some subjects tended to reproduce demonstrated actions accurately early in sessions but ceased to do so in latter parts.

Continuous reinforcement maintained 'imitations' of 'training' actions at high stable rates for all children during 'maintenance' sessions; the reaction times of these responses showed little variation

| | STANDARD ROOM | | | | | | NOVEL WARD | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ball Present | | | Ball Absent | | | Ball Present | | | Ball Absent | | |
| | Mean | Range | | Mean | Range | | Mean | Range | | Mean | Range | |
| | | Min | Max | | Min | Max | | Min | Max | | Min | Max |
| 'Imitations' | 2.9 secs | 1.0 | 4.1 | 3.3 secs | 1.4 | 5.2 | 5.0 secs | 1.0 | 9.0 | 4.5 secs | 1.6 | 8.0 |
| Generalized Imitations | 5.4 secs | 1.2 | 6.0 | 5.8 secs | 1.0 | 9.3 | 5.8 secs | 1.8 | 10.0 | 4.9 secs | 2.4 | 7.0 |

Table 24. Mean Reaction Times of 'Imitative' and 'Generalized Imitative' Responses emitted by all Subjects under each of Section 1 Test Session Stimulus Conditions.

between such sessions for each subject. Emission rates of intertrial responses remained low and stable.

The performances of Subject 2 and Subject 10 are presented for illustrative purposes as each demonstrates one extreme of the effects of change in the main experimental stimulus factors on "imitative" and "generalized imitative" response rates; the remainder of children in the group all showed intermediate performances between those of these two individuals in this section. As indicated in Figure 12, while Subject 2 maintained maximum rates of 'imitations' and 'generalized imitations' during all test sessions under varied stimulus conditions, Subject 10 showed a large decrement in reproduction of both 'training' and 'standard test' actions when demonstrated in the 'novel ward' location. Both children, however, exhibited increased incidence of intertrial responses in this novel setting. Meanwhile, these subjects kept consistently high rates of 'imitations' and low rates of intertrial responses during all 'maintenance' sessions.

The mean reaction times of 'imitative' and 'generalized imitative' responses emitted by both individuals during corresponding sessions in Section 1 are indicated by Figure 13. Subject 2 exhibited fastest times for both sets of behaviours under the 'standard room, ball present' stimulus condition with minimal increases in subsequent 'test' sessions. A similar pattern was shown by Subject 10 but with a greater magnitude of change, particularly with mean reaction times of responses emitted in the 'novel ward' location. Finally, the mean reaction times of 'imitations' from both children during 'maintenance' sessions appeared stable, although those of Subject 2 were consistently shorter than those of Subject 10.

FIGURE 12.

Imitative performances of Subject 2 and Subject 10 during Section 1 (Change of Location) of Experiment 3. Percentage of demonstrations imitated (training responses; filled circles) are expressed as a percentage of the total number of 'training' action demonstrations in a session; the occurrence of similar responses between trials is shown as a percentage of the total number of trials in a session (intertrial responses; open circles). 'Maintenance' and 'test' sessions are indicated in their experimental sequence for each subject at the top of each graph, with stimulus conditions operating within individual 'test' sessions. Vertical arrows indicate tests for generalized imitation; the generalized imitation score obtained on each presentation of the "standard test" actions is shown as a percentage.

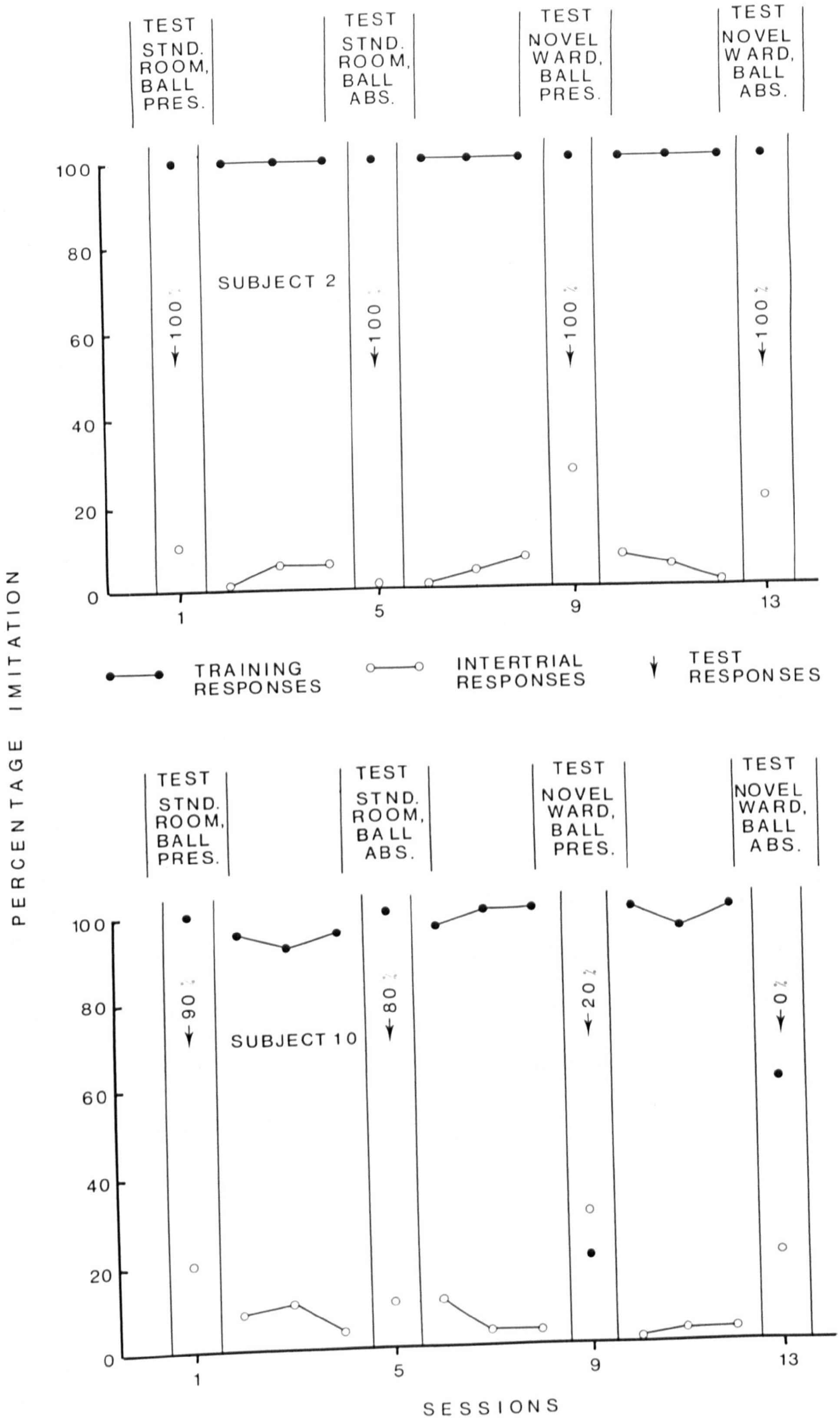
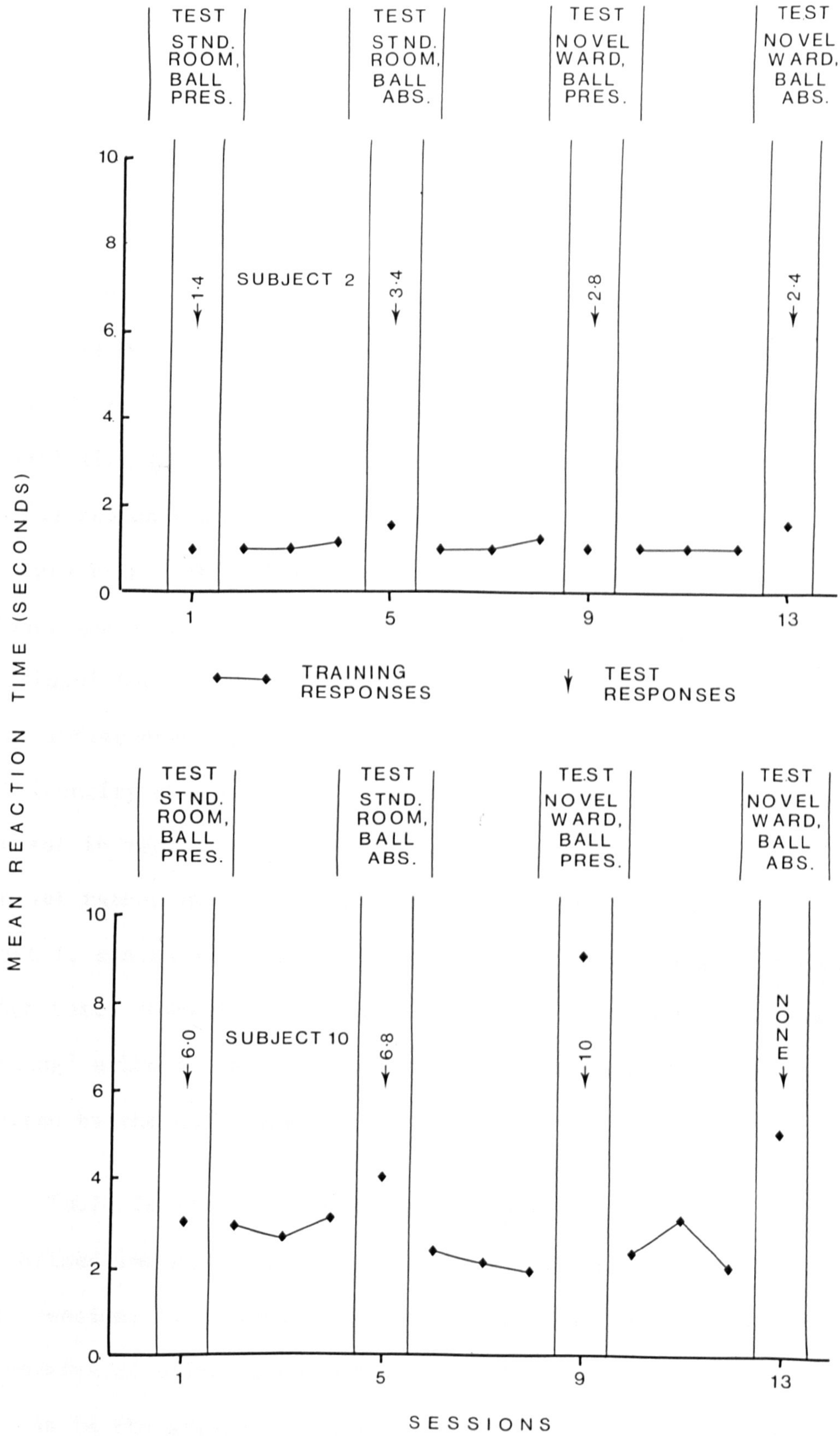

TEST STND. ROOM, BALL PRES.
TEST STND. ROOM, BALL ABS.
TEST NOVEL WARD, BALL PRES.
TEST NOVEL WARD, BALL ABS.
SUBJECT 2
100%
100%
100%
100%
PERCENTAGE IMITATION
TRAINING RESPONSES
INTERTRIAL RESPONSES
TEST RESPONSES
SUBJECT 10
90%
80%
20%
0%
SESSIONS

FIGURE 13.

Mean reaction times of imitative behaviours exhibited by Subject 2 and Subject 10 during Section 1 (Change of Location) of Experiment 3. Mean reaction times are shown for 'imitations' during each session (filled diamonds). 'Maintenance' and 'test' sessions are indicated in their experimental sequence for each subject at the top of each graph, with stimulus conditions operating within individual test sessions. Vertical arrows indicate tests for generalized imitation; the mean reaction time of generalized imitative responses on each presentation of the 'standard test' actions is marked in seconds above each arrow.


TEST STND. ROOM, BALL PRES.
TEST STND. ROOM, BALL ABS.
TEST NOVEL WARD, BALL PRES.
TEST NOVEL WARD, BALL ABS.
SUBJECT 2
1·4
3·4
2·8
2·4
MEAN REACTION TIME (SECONDS)
TRAINING RESPONSES
TEST RESPONSES
SUBJECT 10
6·0
6·8
10
NONE
SESSIONS
0
2
4
6
8
10
1
5
9
13

Section 2. Change of Model.

Once again, during preliminary retraining all subjects immediately, or very rapidly, reached criterion level of 'imitative' and 'generalized imitative' behaviours.

Response rates of the experimental group during 'test' sessions conducted under each of the relevant stimulus conditions in this section are indicated in Table 25. Every child reproduced both 'training' and 'standard test' actions at high rates in the 'standard model, ball present' situation and mean frequency of these responses fell slightly when the standard model did not introduce each trial by bringing the ball into view. When, however, the novel model demonstrated these actions, the mean incidence of 'imitations' and 'generalized imitations' for the whole group fell dramatically, although there were marked differences between some individuals in the effect of this model-identity change. Thus Subjects 2, 5, 6 and 13 showed a sharp decrement in reproduction of actions when these were demonstrated by the novel rather than standard model, while other children, notably Subject 1, continued to emit 'imitations' and 'generalized imitations' at high rates throughout. Subject 10 tended to reproduce many more 'training' actions than 'standard test' actions when both sets were exhibited by the novel model.

Table 26 shows the means of 'percentage imitations' and 'generalized imitation' scores obtained by all subjects during the 'test' sessions in second, third and fourth positions of presentation, irrespective of stimulus conditions used for particular children in each. As in the previous Section 1, visual inspection suggested no consistent 'order of presentation' effect and the differences in mean scores between positions were small in comparison with those shown

| | STANDARD MODEL | | | | | | NOVEL MODEL | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ball Present | | | Ball Absent | | | Ball Present | | | Ball Absent | | |
| | Mean | Range | | Mean | Range | | Mean | Range | | Mean | Range | |
| | | Min | Max | | Min | Max | | Min | Max | | Min | Max |
| Percentage Correct 'Imitations' | 98.3 | 80 | 100 | 90.0 | 80 | 100 | 51.6 | 20 | 100 | 35.0 | 0 | 80 |
| Percentage 'Generalized Imitation' Score | 92.5 | 80 | 100 | 85.8 | 70 | 100 | 37.5 | 0 | 100 | 33.3 | 0 | 80 |

Table 25. Imitations and Generalized Imitations Emitted by all Subjects under each of Section 2 Test Session Stimulus Conditions.

Table 26. Mean Imitations and Generalized Imitations in Successively presented 'Test' Sessions in Section 2.

| | POSITION IN PRESENTATION ORDER OF 'TEST' SESSIONS | | |
|---|---|---|---|
| | SECOND | THIRD | FOURTH |
| Mean Percentage Imitation | 53.5 | 61.7 | 61.7 |
| Mean Percentage Generalized Imitation Score | 47.5 | 57.5 | 51.7 |

between stimulus conditions in Table 25. Thus once again this possible effect was disregarded during an analysis of variance of stimulus condition effects on 'imitative' and 'generalized imitative' response rates. A three-factor factorial design with repeated measures on every factor produced a significant overall model identity effect, $F(1, 11) = 48.66$, $p < .001$, indicating lower rates of 'imitations' and 'generalized imitations' of actions demonstrated by a novel model, imitation of whom had not been previously trained. Similarly, a significant overall ball presence effect was found, $F(1, 11) = 14.75$, $p < .01$, showing a lower frequency of responses under "ball absent" stimulus conditions. In this section, a significant difference emerged between 'imitation' and 'generalized imitation' response levels, $F(1, 11) = 6.83$, $p < .05$, with lower reproduction rates of 'standard test' actions than 'training' actions. Finally, none of the possible factor interactions proved significant.

Mean numbers of intertrial responses (all similar to 'training' actions only) emitted under each specific set of stimulus conditions in this section are shown in Table 27. As in Section 1, all subjects exhibited such responses at low or zero rates in the 'standard model, ball present' situation; thereafter, the mean number of intertrial responses increased to a similar level under all subsequent 'test' session stimulus conditions but with an increased range of results between individual children. Thus Subject 1 emitted no intertrial responses under any of these stimulus conditions while Subject 10 exhibited seven such responses in each of the 'novel model' test sessions.

Again, as previously, visual inspection of mean numbers of intertrial responses emitted by all subjects during the 'test' sessions

| | STANDARD MODEL | | | | | | NOVEL MODEL | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ball Present | | | Ball Absent | | | Ball Present | | | Ball Absent | | |
| | Mean | Range | | Mean | Range | | Mean | Range | | Mean | Range | |
| | | Min | Max | | Min | Max | | Min | Max | | Min | Max |
| Intertrial Responses | 1.0 | 0 | 3 | 2.3 | 0 | 4 | 2.5 | 0 | 7 | 2.2 | 0 | 7 |

Table 27. Intertrial Responses Emitted by all Subjects under each of Section 2 Test Session Stimulus Conditions.

in second, third and fourth positions of presentation (see Table 28) revealed no clear 'presentation order' effect. Also, the differences between positions appeared small when compared with the range of means under all stimulus conditions quoted in Table 27. Thus, yet again, in analysis of intertrial response emission rates under separate stimulus conditions, possible 'order of presentation' effects have been disregarded.

A two-factor factorial design analysis of variance with repeated measures on each factor revealed nonsignificant overall effects for both model identity and ball presence variables on intertrial response emission. In contrast, however, the model identity x ball presence interaction did prove significant $F(1, 11) = 11.0$, $p < .01$; the presence or absence of the red ball appeared to control intertrial response rates in sessions conducted with the standard model but to make little difference in those involving the novel model.

The mean reaction times of 'imitations' and 'generalized imitations' emitted by subjects during 'test' sessions under each of the experimental stimulus conditions in Section 2 are shown in Table 29. For reasons similar to those described under Section 1, formal analysis of this data was not attempted. It appeared, however, that reaction times of responses, particularly 'imitations', emitted in the 'standard model, ball present' condition were shorter than those shown in subsequent 'test' sessions under all the other stimulus conditions.

During 'test' sessions involving the novel model, many subjects appeared surprised and confused but the incidence of irrelevant behaviours remained low; rather, the children watched the actions of the adult closely but tended to reproduce them sporadically.

Table 28. Mean Intertrial Responses Emitted During Successively Presented 'Test' Sessions.

| | POSITION IN PRESENTATION ORDER OF 'TEST' SESSIONS | | |
|---|---|---|---|
| | SECOND | THIRD | FOURTH |
| Mean Intertrial Responses | 2.3 | 2.2 | 2.4 |

| | STANDARD MODEL | | | | | | NOVEL MODEL | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ball Present | | | Ball Absent | | | Ball Present | | | Ball Absent | | |
| | Mean | Range | | Mean | Range | | Mean | Range | | Mean | Range | |
| | | Min | Max | | Min | Max | | Min | Max | | Min | Max |
| 'Imitations' | 3.4 secs | 1.0 | 6.2 | 3.6 secs | 1.0 | 6.5 | 4.3 secs | 1.4 | 8.0 | 4.3 secs | 1.5 | 8.0 |
| 'Generalized Imitations' | 4.8 secs | 1.0 | 6.6 | 5.1 secs | 1.0 | 7.8 | 4.9 secs | 2.0 | 8.0 | 5.6 secs | 2.8 | 10.0 |

Table 29. Mean Reaction Times of 'Imitative' and 'Generalized Imitative' Responses Emitted by all subjects under each of Section 2 Test Session Stimulus Conditions.

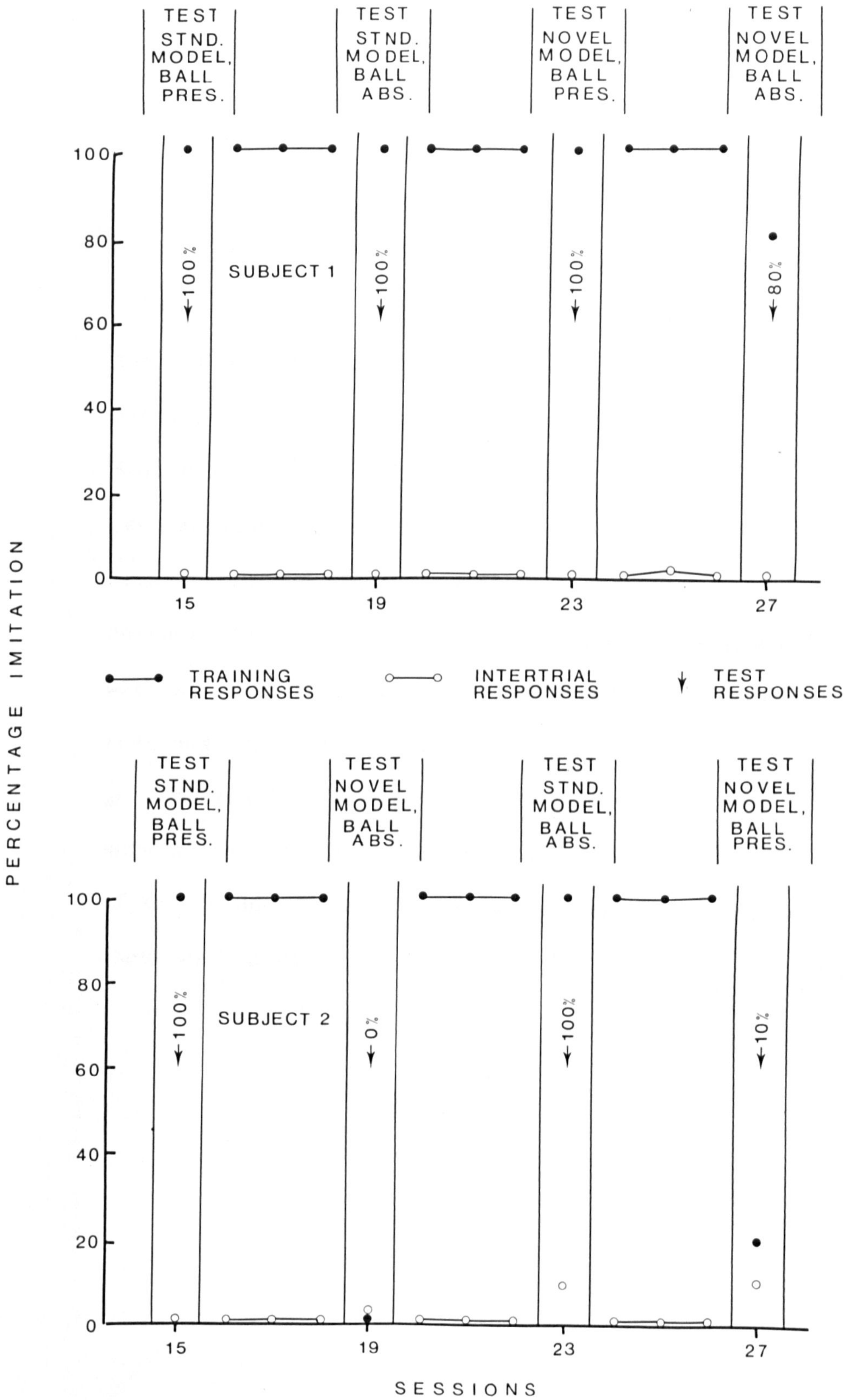
As in the previous section, continuous reinforcement maintained 'imitations' of 'training' actions at high stable rates for all children during 'maintenance' sessions. The reaction times of these responses showed little variation for each subject and the incidence of intertrial responses remained uniformly low.

Once again for illustration the individual performances are presented of subjects who each demonstrate an extreme of the effects of change in the main experimental stimulus factors on 'imitative' and 'generalized imitative' response rates. For this section, these were Subject 1 and Subject 2. As shown in Figure 14, Subject 1 maintained maximum rates of 'imitations' and 'generalized imitations' under all 'test' session stimulus conditions except 'novel model, ball absent' for which there was a small decrement in response emission; in contrast, Subject 2 exhibited very few 'imitative' or 'generalized imitative' behaviours during either session involving the novel model but showed a slight increase in intertrial responses. Meanwhile, both children imitated 'training' actions at high stable rates with very few intertrial responses during all 'maintenance' sessions.

Mean reaction times of 'imitative' and 'generalized imitative' responses emitted by these two children in each corresponding session of Section 2 are shown in Figure 15. Subject 1 exhibited an increase in the reaction times of both sets of responses when the novel model rather than the standard model demonstrated actions; this pattern was reflected in the performance of Subject 2 with, in addition, a slight lengthening of reaction times of 'generalized imitations' in the 'standard model, ball absent' 'test' session. Finally, the mean reaction times of 'imitations' shown by both children during 'maintenance' sessions remained fast and stable.

FIGURE 14.

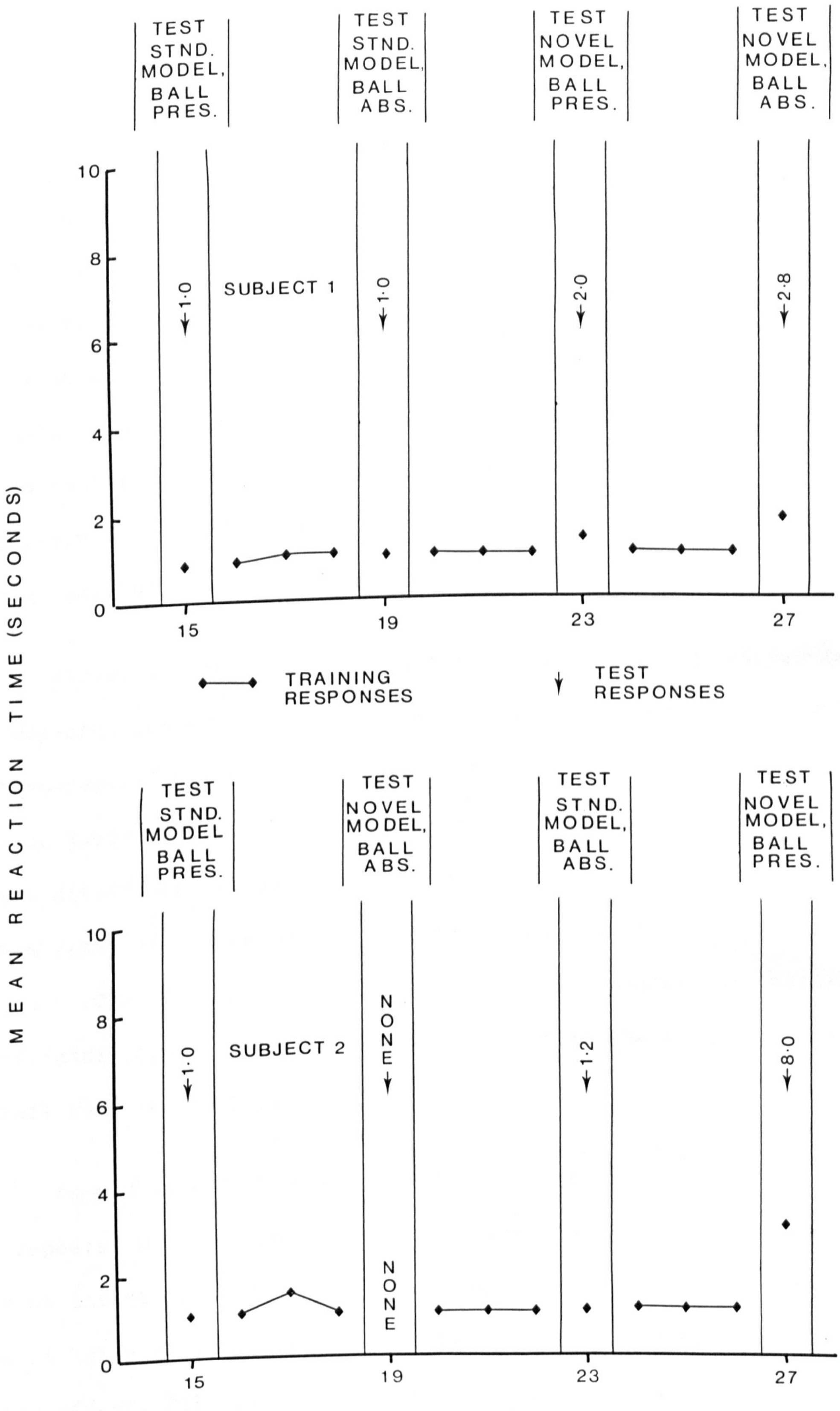
Imitative performances of Subject 1 and Subject 2 during Section 2 (Change of Model) of Experiment 3. Percentage of demonstrations imitated (training responses; filled circles) are expressed as a percentage of the total number of training action demonstrations in a session; the occurrence of similar responses between trials is shown as a percentage of the total number of trials in a session (intertrial responses; open circles). 'Maintenance' and 'test' sessions are indicated in their experimental sequence for each subject at the top of each graph with the stimulus conditions operating within individual 'test' sessions. Vertical arrows indicate tests for generalized imitation; the generalized imitation score obtained on each presentation of the "standard test" action is shown as a percentage.



TEST STND. MODEL, BALL PRES.
TEST STND. MODEL, BALL ABS.
TEST NOVEL MODEL, BALL PRES.
TEST NOVEL MODEL, BALL ABS.
SUBJECT 1
100%
100%
100%
80%
TRAINING RESPONSES
INTERTRIAL RESPONSES
TEST RESPONSES
TEST STND. MODEL, BALL PRES.
TEST NOVEL MODEL, BALL ABS.
TEST STND. MODEL, BALL ABS.
TEST NOVEL MODEL, BALL PRES.
SUBJECT 2
100%
0%
100%
10%
PERCENTAGE IMITATION
SESSIONS
0
20
40
60
80
100
15
19
23
27

FIGURE 15.

Mean reaction times of imitative behaviours exhibited by Subject 1 and Subject 2 during Section 2 (Change of model) of Experiment 3. Mean reaction times shown for 'imitations' during each session (filled diamonds). 'Maintenance' and 'test' sessions are indicated in their experimental sequence for each subject at the top of each graph, with stimulus conditions operating within individual test sessions. Vertical arrows indicate tests for generalized imitation; the mean reaction time of generalized imitative responses on each presentation of the 'standard test' actions is marked in seconds above each arrow.



TEST STND. MODEL, BALL PRES.
TEST STND. MODEL, BALL ABS.
TEST NOVEL MODEL, BALL PRES.
TEST NOVEL MODEL, BALL ABS.
SUBJECT 1
1·0
1·0
2·0
2·8
MEAN REACTION TIME (SECONDS)
0
2
4
6
8
10
15
19
23
27
TRAINING RESPONSES
TEST RESPONSES
TEST STND. MODEL BALL PRES.
TEST NOVEL MODEL, BALL ABS.
TEST STND. MODEL, BALL ABS.
TEST NOVEL MODEL, BALL PRES.
SUBJECT 2
1·0
NONE
1·2
8·0
NONE
SESSIONS

Comparison between similar parts of Section 1 and Section 2.

Although Sections 1 and 2 of this experiment involved change in different aspects of the complex stimulus situation in which actions were demonstrated for imitation, these sections had in common two 'test' sessions each which were conducted under identical stimulus conditions; that is, both involved demonstration of 'training' and 'standard test' actions in the 'standard room, standard model, ball present' and 'standard room, standard model, ball absent' situations. Thus, analyses of data from these 'test' sessions provided information on the reliability of imitative behaviour between sections and effects of removing the ball in the standard stimulus situation.

Firstly, a three-factor factorial design analysis of variance, with repeated measures on every factor, was carried out on 'imitative' and 'generalized imitative' response rates for these sessions (see relevant parts of Table 28 and Table 25). This showed no significant overall difference between sections, $F(1, 11) = .30$, $p > .05$, nor between rates of 'imitation' and 'generalized imitation', $F(1, 11) = 3.01$, $p > .05$. The incidence of both sets of responses was, however, significantly lower, $F(1, 11) = 16.5$, $p < .01$ in the absence of the red ball than in its presence.

Secondly, a two-factor factorial design analysis of variance, with repeated measures on every factor, was applied to the emission rates of intertrial responses during these sessions (see relevant parts of Table 22 and Table 27). This yielded no significant overall section effect, $F(1, 11) = .57$, $p > .05$, but the number of intertrial responses increased significantly, $F(1, 11) = 12.68$, $p < .01$, on sessions when the ball was not present to introduce trials.

Finally, for the reasons previously stated, the reaction time data from the 'imitations' and 'generalized imitations' in these sessions (see relevant parts of Table 24 and Table 29) were not subjected to formal analysis. Visual inspection, however, suggests considerable similarity between sections on this measure. In addition, it appears that mean reaction times were longer in sessions where the ball was absent.

## DISCUSSION

All the subjects' imitative behaviour was readily scored and the interjudge reliability of scoring (.96) compares well with figures quoted by other authors (e.g. Steinman, 1970a).

The only formal prediction proved substantially correct in that all children except one (Subject 2) showed lowered rates of 'imitations' and 'generalized imitations' when either the location where actions were demonstrated or the identity of the demonstrating model varied from previous setting conditions of original training. This deterioration in performance was not only confined, however, to frequency of response emission but was also reflected in lengthened reaction times and concurrent increased incidence of similar intertrial responses for all subjects. Thus, although the degree of performance decrement shown under various novel stimulus conditions varied greatly between individuals, the results from this study of imitative behaviour with young retardates tend to concur with findings from similar studies using other response types with varied populations (Lovaas et al., 1973; Lovaas and Simmons, 1969; Wahler, 1969; Walker and Buckley, 1972). All suggest a lack of spontaneous generalization of treatment gains to novel situations. Nevertheless, had slight prompts or contingent reinforcement for correct 'imitations' been available to the present subjects in either novel stimulus situation, the degree of generalization might have been much higher.

Unfortunately, for the group as a whole, introduction of the red ball (previously used in training) when actions were modelled for reproduction in novel settings did not prove empirically an effective method of ensuring transfer to new stimulus situations. Although in both sections response rates were somewhat higher under 'novel' conditions with the red ball rather than without, in practical terms the increase was not dramatic. Perhaps such a result is not surprising. Terrace (1966) has pointed out that a given stimulus often may only acquire a discriminative function, (thus 'setting the occasion' for a conditioned operant and, when present, facilitating responding across settings) after differential reinforcement of the desired behaviour in the presence of one stimulus and not in the presence of a second. Simply repeatedly reinforcing an operant in the presence of one stimulus, as had happened here with the red ball, would not establish this control.

If presence or absence of the red ball did not exert clear control over 'imitations' and 'generalized imitations' in the novel stimulus conditions of this experiment, the view of Rincover and Koegel (1975) implies that other aspects of the complex stimulus situation of training may have done so. In the case of Subject 2 it was clearly demonstrated that the identity of the model controlled such responding. For many others who showed some degree of generalization to both novel location and model, the specific controlling stimuli were not delineated, but include possible stimulus elements common to all settings like recording equipment, the nature and layout of furniture or even the (probably by then very familiar) individual actions demonstrated. Similarly, however, the novel ward setting may through other previous experience, have been discriminative for other behaviours, thus accounting for the increase in irrelevant responses there; setting familiarity for individual subjects may have been gained at the expense of close attention to the model.

Particularly in the standard experimental setting, the red ball, once incorporated into reinforced 'imitation' training trials, seemed to act as a cue which although not exerting strong control over imitative behaviours, served with some subjects to 'sharpen' performance in a variety of ways; these included increased response rates, reduction of reaction times and lowered frequencies of intertrial responses. When, however, other gross parts of the complex total stimulus situation were changed, specifically here location or model identity, this general 'sharpening' function was largely lost in the subsequent disruption of 'imitative' and 'generalized imitative' behaviours. Other cues such as renewed eye contact or other preparatory behaviour by the model may have served to initiate trials when the ball was not present.

Some procedural points have particular bearing on these results and their derivation, and these will now be considered in turn:-

1) the use of other performance measures in addition to the conventional 'imitative response rate' of previous authors proved justified. Commonly, for each subject, raised frequency of intertrial responses and lengthened response reaction times coincided with lowered rates of 'imitations' and 'generalized imitations', suggesting that all three indices concurrently reflected performance deterioration. Mean reaction times of individuals taken from these periods of intermittent imitative responding were derived from varied numbers of single responses and thus were regarded with less confidence than similar measures when

the incidence of 'imitations' and 'generalized imitations' was high and stable. Some children, however, while maintaining maximum response rates on trials under changed stimulus conditions, showed raised intertrial response frequency and lengthened reaction times only. Thus, perhaps in certain cases, change in these two latter indices provide additional, finer measures of performance strength when the frequency of imitative behaviours is at or near maximum.

2) For every subject, this study involved many consecutive sessions with a small number of actions for imitation thus raising the possibility of systematic changes in performance characteristics during 'test' sessions over this time. That no differences should emerge, however, during comparison of similar sessions in Sections 1 and 2, suggests a high degree of performance stability by individual children.

3) When compared with the standard number of trials in 'maintenance' sessions (30), the number in each 'test' session (10) was small and thus, it could be argued did not provide an adequate sample of imitative behaviour under every stimulus condition used. This limited number was chosen so as not to train a discrimination, as described by Terrace (1966) by reinforcement of 'imitations' under 'standard' stimulus conditions contrasted with no reinforcement under 'novel' conditions. The formation of such a distinction would have destroyed the main point of the experiment, but the lack of order effects suggests no such discrimination developed.

4) The use of analysis of variance techniques has been discussed in Experiment 2 (p.170); suffice to say the same comments also apply here.

The present results also allow comment on various hypothesized 'explanations' of the 'generalized imitation' phenomenon that have been previously described in detail in Chapter 3. Gewirtz and Stingle (1968) suggested that (reinforced) 'imitations' and (nonreinforced) 'generalized imitations' be regarded as a single response class with the implication that both sets would be influenced in closely similar ways by any given treatment. For the group as a whole, this view was supported in that change of location brought about changes in response rates and these were similar in magnitude for both 'training' and 'standard test' actions. Some differentiation in response rates for the total group of subjects was, however, shown in the changes resulting from introduction of a novel model. This latter might be interpreted as evidence that the children had at least learned to discriminate between reinforced and nonreinforced actions after prolonged training, thus supporting the view of Bandura (1968) that they were initially unable to do so. Interestingly, trends noted for reaction times of 'imitations' and 'generalized imitations' respectively were similar in both sections during 'test' sessions, but differed between sets of responses, so suggesting discrimination between sets of actions and contradicting the 'single response class' hypothesis of Gewirtz and Stingle (1968). Thus, in brief, the different measures of 'response rate' and 'response reaction time' support conflicting views.

Steinman (1970a, b) has argued that generalized imitative responding occurred at least in part because of 'social setting' factors in common to the conditions under which 'training' and 'standard test' actions were demonstrated. If so, presumably a change of experimental location or model should markedly disrupt 'generalized imitative' responding far more than 'imitative' responding. In fact, only Subject 3, Subject 10 and Subject 13 showed highly contrasting response rates under the 'novel ward' or 'novel model' stimulus conditions; thus the view of Steinman (1970a, b) appears to hold for some individuals only.

Lastly, although not the primary aim of Section 2 in this experiment, change of model identity provides one method by which to test the suggestion of Bandura and Barab (1971) that 'generalized imitation' occurs because of social coercion and pressures in the experimental setting. It could be argued that a change of the model who demonstrated actions changed the social demands acting on the subject, in which case again generalized imitative responding should rapidly decrease. Interestingly, however, only one child (Subject 10), showed marked differential response rates of 'imitations' and 'generalized imitations' under this stimulus condition, and the hypothesized result is, perhaps, more marked by its absence for the group as a whole.

Thus, to conclude, no single 'explanation' of 'generalized imitation' appeared consistently supported by the performance of all subjects in this study; rather, different hypotheses seemed appropriate to different children. Further, separate measures of imitative performances sometimes provided conflicting views of possible 'explanations'.

Finally, for reasons to be discussed later, although a few subjects showed high degrees of transfer to a new location and a new model, this study allows no conclusions about possible spontaneous generalization to new settings that may have occurred naturally outside experimental sessions; certainly, though, the possibility exists that previously trained imitative behaviour may have come gradually under more extended social control (e.g. having been reinforced by other personnel in other parts of the hospital). In practical terms, however, if extended to include imitative behaviour, the view of Stokes et al. (1974) appears justified, namely that generalization to novel locations and personnel does not automatically occur simply because a behaviour change or acquisition has been accomplished. It may be necessary with this subject population that original training of imitation be carried out in different locations and with different models in rotation to achieve such generalization, despite the probable inconvenience caused to ward routine.

## SUMMARY

Twelve initially nonimitative young subnormal children had previously acquired 'generalized imitative' behavioural repertoires through training under laboratory conditions in a standard location with a standard model; each action had been demonstrated in the presence of a red ball. The present experiment was divided into two sections of similar design. In the first section, when actions were demonstrated by the standard model but in a novel location, each of these subjects showed decrements in 'imitative' and 'generalized imitative' response performances; the form and degree of these decrements, however, varied greatly between individuals, varying from slight increases in response reaction times to gross loss of imitative responding. In the second section, when actions were demonstrated in the standard location but by a novel model, deterioration also occurred in the imitative behaviour of this subject group, although once again with considerable variation between children in the form and degree of the decrement shown. The presence of the red ball during trials appeared, on several measures, to 'sharpen' imitative performance under the standard experimental conditions but did not significantly facilitate transfer to either a novel location or a novel model. This

experiment supports with particular reference to imitative behaviour, the view of previous authors that treatment gains brought about by behaviour modification procedures in one situation may not spontaneously transfer at high levels to novel settings.

# EXPERIMENT 4

## Stimulus Control of 'imitations' and 'generalized imitations'.[1]



1. Results of this study have been previously published as:- Furnell, J.R.G., & Thomas, G.V. Stimulus control of generalized imitation in subnormal children. Journal of Experimental Child Psychology, 1976, 22, 282-291.

# INTRODUCTION

Various authors (e.g. Baer and Sherman, 1964; Baer et al., 1967) have demonstrated that children will show 'generalized imitations' of many actions performed by a model if 'imitations' of only a few actions are reinforced extrinsically. Among various hypothesized 'explanations' of this phenomenon reviewed in Chapter 3 is the proposal of Gewitz and Stingle (1968) that 'imitative' and 'generalized imitative' behaviours be considered as a single functional response class which can be established and thus defined by extrinsic reinforcement. This view implies that reinforced and 'generalized' imitations should be influenced in closely similar ways by any given treatment, and this has been confirmed for such variables as experimenter absence after action modelling (Peterson et al., 1971; Peterson and Whitehurst, 1971). Further, any treatment applied only to experimentally reinforced 'imitations' should produce similar effects on both the reinforced and 'generalized' imitations. The present experiment examined this proposal by attempting to establish discriminative stimulus control over reinforced 'imitations'.

Stimulus control over simple responses such as lever pressing (by rats) and key pecking (by pigeons) is usually achieved by differentially reinforcing responses with respect to two stimuli. After training, stimulus control can usually be demonstrated in two ways; firstly, by showing that responding occurs at a higher rate to S+ (the stimulus associated with reinforcement) than to S- (the stimulus associated with nonreinforcement) and, secondly, by showing that rate of responding to other stimuli on a dimension containing S+ and S- decreases with increasing distance from S+ (see, for example, Terrace,1966).

In the present investigation, previously established imitative responding (see Experiment 1) was reinforced only in the presence of one stimulus and not in the presence of another. To minimize the influence of previous social learning, subjects with known and controlled histories of imitative behaviour were chosen. Simple stimuli (red balls of different sizes) were used as discriminative cues.

Specifically, it was predicted that after differential training imitative responding would occur in the presence of the discriminative stimulus associated with reinforcement and not in the presence of the stimulus associated with non-reinforcement. Second, it was predicted that, in a test for stimulus generalization with various sizes of ball, rates of imitation and generalized imitation would decrease as the test stimuli increasingly differed from S+. Finally, the suggestion by Gewitz and Stingle, that imitative behaviour be regarded as a single response class, leads to the prediction that rates of imitation and generalized imitation to any given stimulus should be approximately equal.

## METHOD

### Subjects

The subjects of this study were three severely retarded boys. Although previously non-imitative, all three had been trained to reproduce actions demonstrated by a particular model in one location, without instructions but in the presence of a red ball, diameter 30.0 cms. None of these children had received programmed reinforcement for imitative behaviour under any other setting conditions, apart from the use of instructions in very early imitation training (see Experiment 1). These children, with developmental data gained immediately prior to participation in this experiment, are indicated in Table 30.

TABLE 30.

SUBJECTS

| Subject (Number) | Age | Primary P.A.C. Items Passed | Vineland | |
|---|---|---|---|---|
| | | | Social Age | Social Quotient |
| 1 | 5 yrs. 8 mths. | 93 | 1.8yrs | 30 |
| 2 | 5 yrs.11 mths. | 99 | 1.9yrs | 27 |
| 5 | 7 yrs. 9 mths. | 50 | 1.2yrs | 12 |

## Experimental Setting, Apparatus and Reinforcers

The experimental setting and apparatus were as described in the relevant sections of Chapter 5. Also available, specifically for this study, were six identically coloured red balls of different sizes (see Table 31); these were kept within easy reach of the experimenter but concealed from the subject behind a screen.

TABLE 31. Size of Red Balls used as Discriminative Stimuli

| Stimulus | S- | S2 | S3 | S+ | S5 | S6 |
|---|---|---|---|---|---|---|
| Diameter (cm) | 3.8 | 11.8 | 20.8 | 30.0 | 41.6 | 49.2 |

The reinforcers administered to individual subjects were also as described in Chapter 5; the consumables, being liquids in each case, were delivered to the appropriate child with a plastic syringe.

## Procedure.

Daily experimental sessions, which involved the standard model only, were conducted with each subject individually, again in the manner indicated in Chapter 5.

Preliminary Retraining. Prior to this investigation, varying periods of time had elapsed for each subject without formal training of 'imitations' in the standard experimental, or any other setting. Thus, as a preliminary step, all three subjects were retrained as necessary to a common criterion performance by reinforcement of correct 'imitations' of 'training' actions 1 to 5 from Table 4. Retraining was carried out as described in Experiment 2 (p.141) with the standard model who demonstrated each action with the red ball (diamter 30.0 cms) on his knees but without instructions. This process continued until, under these stimulus conditions, the child correctly imitated each 'training' action twice over ten consecutive trials, concurrently emitted no similar intertrial responses and subsequently achieved a score of at least 90% for (non-reinforced) generalized imitation (see Chapter 5 for scoring method) during one presentation of all the 'standard test' actions from Table 4.

Discrimination Training. The five 'training' actions and the five 'standard test' actions were first demonstrated to each subject for one trial each under two stimulus conditions; the large red ball used earlier in training (S+) and a small red ball (S-). No instructions were given and no 'imitations' were reinforced. Trials were timed 10 seconds apart.

Following this pretest, the 'training' actions were modelled for imitation under both stimulus conditions. Over three sessions, each of the 'training' actions was presented on an equal number of trials, and each action was modelled with equal frequency under both stimulus conditions. Accurate 'imitations' of these actions were always reinforced in trials with the larger ball (S+), whereupon the trial ended, but were never reinforced in trials with the smaller ball (S-). Trials with S- always lasted 10 seconds, and 'imitations' had no programmed consequences. Particular care was taken to model each action in the same way on every trial so that no other cues about the availability of reinforcement were provided. The order of S+ and S- trials was randomized and unpredictable. Discrimination training continued until correct 'imitations' were made on 10 consecutive S+ trials, concurrently no 'imitations' occurred on S- trials and no similar intertrial responses were observed.

Tests for the generalization of stimulus control with balls of various sizes were then carried out. First (A), each of the five 'training' actions was modelled under the six stimulus conditions of different ball size (see Table 31); a total of 30 trials, all in extinction. The timing and presentation of these test trials were the same as before; all trials were unreinforced, and the subject's behaviour had no programmed consequences.

Next (B), each of the five 'standard test' actions was modelled once under every stimulus condition as above, again a total of thirty trials in random order. These unreinforced test trials were randomly interspersed with retraining trials, three presentations each of the five 'training' actions, under the S+ condition in which accurate 'imitations' were reinforced and a similar number of S- trials in which 'imitations' were not reinforced. Finally, over three sessions (C), each action in the larger set of 'comprehensive test' actions (see Table 4) was modelled with each of the test stimuli as described above. As before, unreinforced test trials were randomly interspersed with retraining trials with S+ and S-.

Depending on the child's condition from day to day, each session on average contained 30 trials and was about 10 minutes long. Each session was recorded on a videotape recorder and played back later for analysis. At a number of points throughout the study, independent observers checked the reliability of the experimenter's scoring of the subjects' behaviour.

## RESULTS

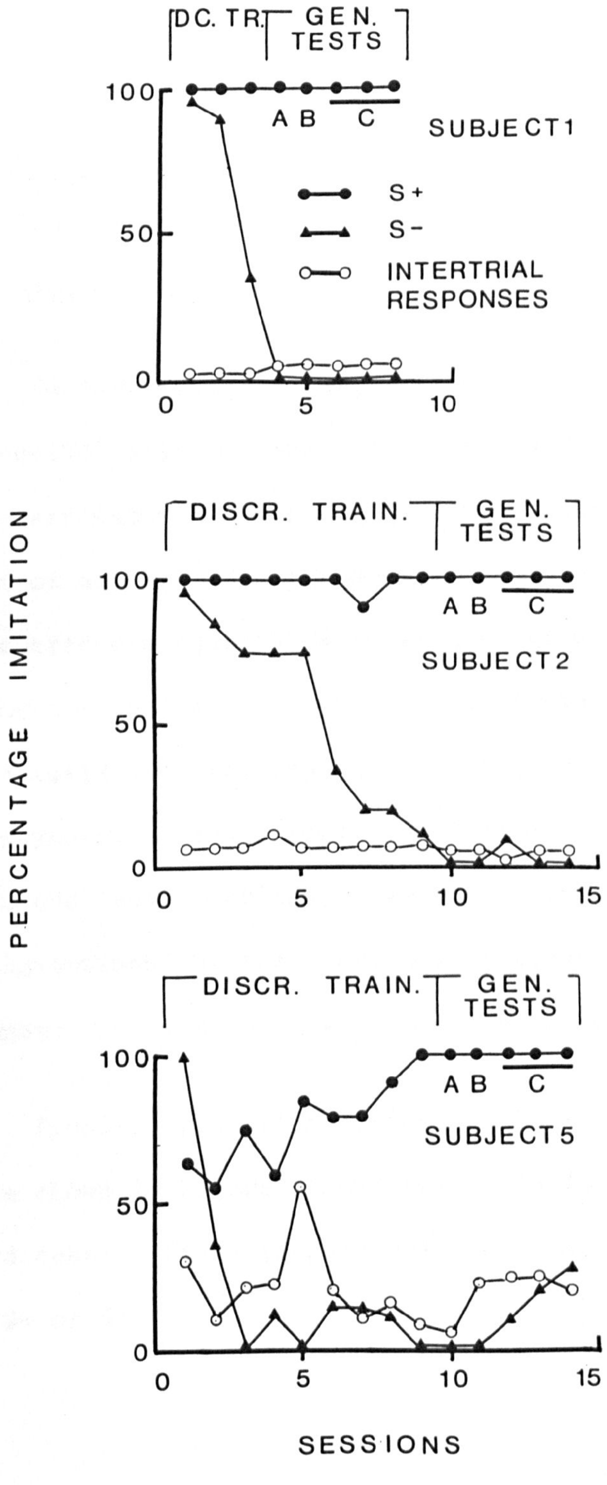
Observer agreement on scoring of imitative behaviours always exceeded .96.

Preliminary Retraining. All three subjects at once or very rapidly reached criterion level performances of 'imitations' and 'generalized imitations'.

Discrimination Training. On a stimulus discrimination test before discrimination training began all subjects reliably imitated the five 'training' actions in the presence of both large and small balls; a similar result was obtained for the five 'standard test' actions.

As discrimination training proceeded, each child continued to imitate in the presence of S+, but progressively ceased to do so in the presence of S- (see Figure 16). On S- trials, two of the children even began to pick up the S- ball and throw it away. At first, Subject 5 imitated less frequently to S+ but gradually recovered as 'imitations' to S- diminished. This child also emitted the greatest number of intertrial responses during discrimination training but these also diminished as training progressed. Subject 1 mastered the discrimination in three sessions, Subjects 2 and 5 both required nine sessions.

FIGURE 16. Percentage of demonstrations of 'training' actions imitated to S+ (filled circles) and to S- (filled triangles) during discrimination training. The occurrence of similar responses between trials is expressed as a percentage of the total number of demonstrations (open circles). Post discrimination tests for the generalization of stimulus control were conducted at the points marked A, B, and C.



DC. TR.
GEN. TESTS
100
50
0
A B
C
SUBJECT1
S+
S−
INTERTRIAL RESPONSES
0
5
10
DISCR. TRAIN.
GEN. TESTS
SUBJECT2
15
SUBJECT5
PERCENTAGE IMITATION
SESSIONS

Figure 17 shows the results for each subject individually of stimulus generalization tests carried out after discrimination training. The test stimuli were the six sizes of ball in Table 31. The first test (at point A, Figure 16) covered the original 'training' actions, and it can be seen (curves A, Figure 17) that all subjects imitated progressively fewer actions as ball size increasingly differed from S+. No 'imitations' occurred to S- and the generalization curves appear to be skewed away from S-.

Further stimulus generalization tests with the 'standard' and 'comprehensive' test actions (given at B and C in Figure 16) demonstrate essentially similar results (see Figure 17, curves B and C). For both sets of actions, the percentage of trials on which generalized imitation occurred was again high to S+ and tended to decline with larger and smaller ball sizes. As with the trained actions, the lowest percentage of imitations was generally to S-, and the generalization curves are assymetrical and skewed away from S-. 'Generalized imitations'of the 'test' actions, however, occurred at slightly higher rates than 'imitations' of the 'training' actions for some of the test stimuli (compare curves B and C with curve A for each subject).

Finally, for illustration, typical performances by Subject 2 are shown in Figure 18 and Figure 19 for trials when 'training' and 'standard test' actions respectively were each demonstrated in the presence of S+ or S-.

<u>FIGURE 17</u>. Postdiscrimination tests for the generalization of stimulus control for each subject. Percentage of demonstrations of 'training' actions imitated to each of the test stimuli (A, filled circles) is shown on separate axes from the corresponding data for actions in the standard test for generalized imitation (B, filled squares) and the comprehensive test for generalized imitation (C, filled triangles).

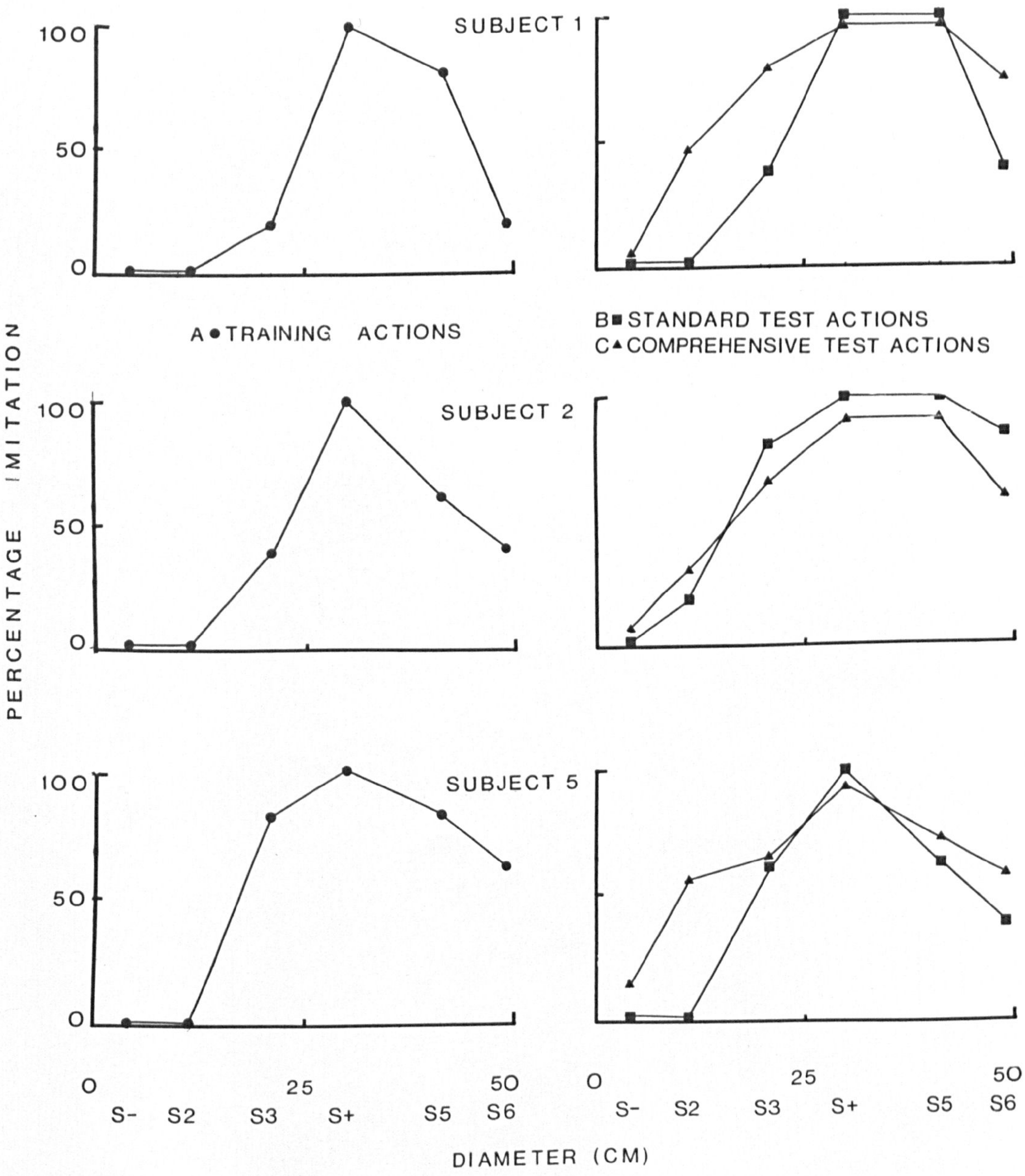
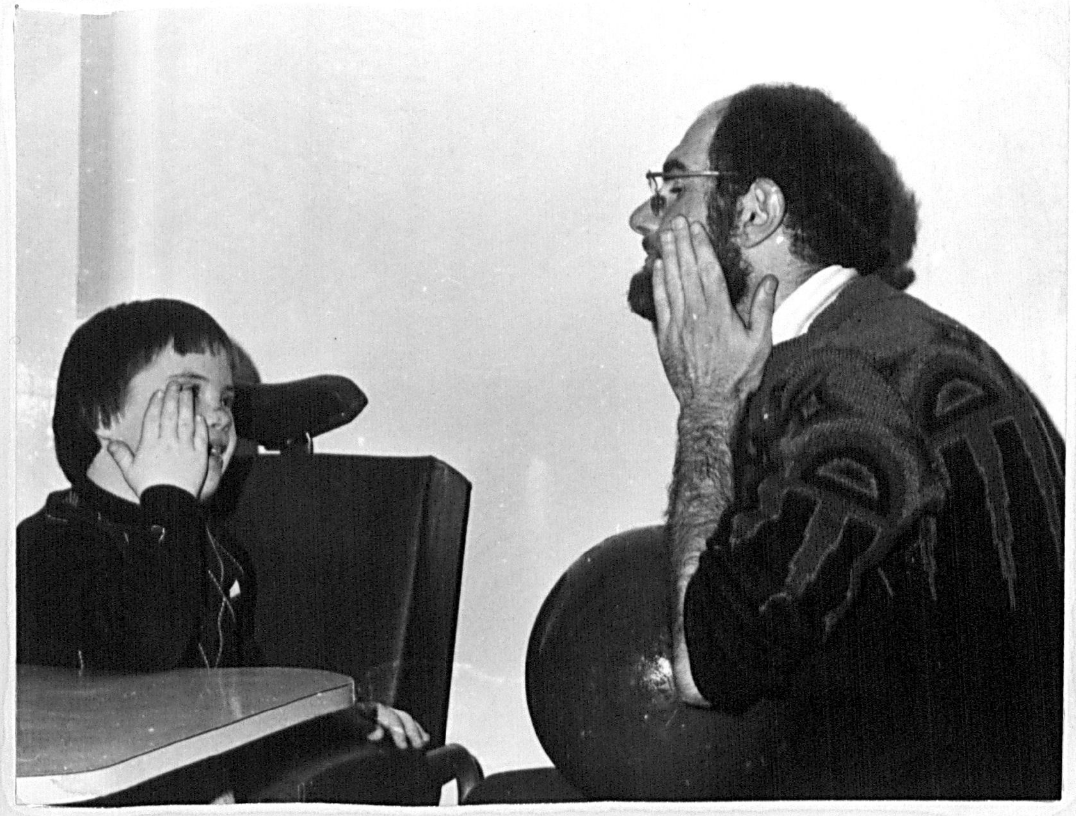
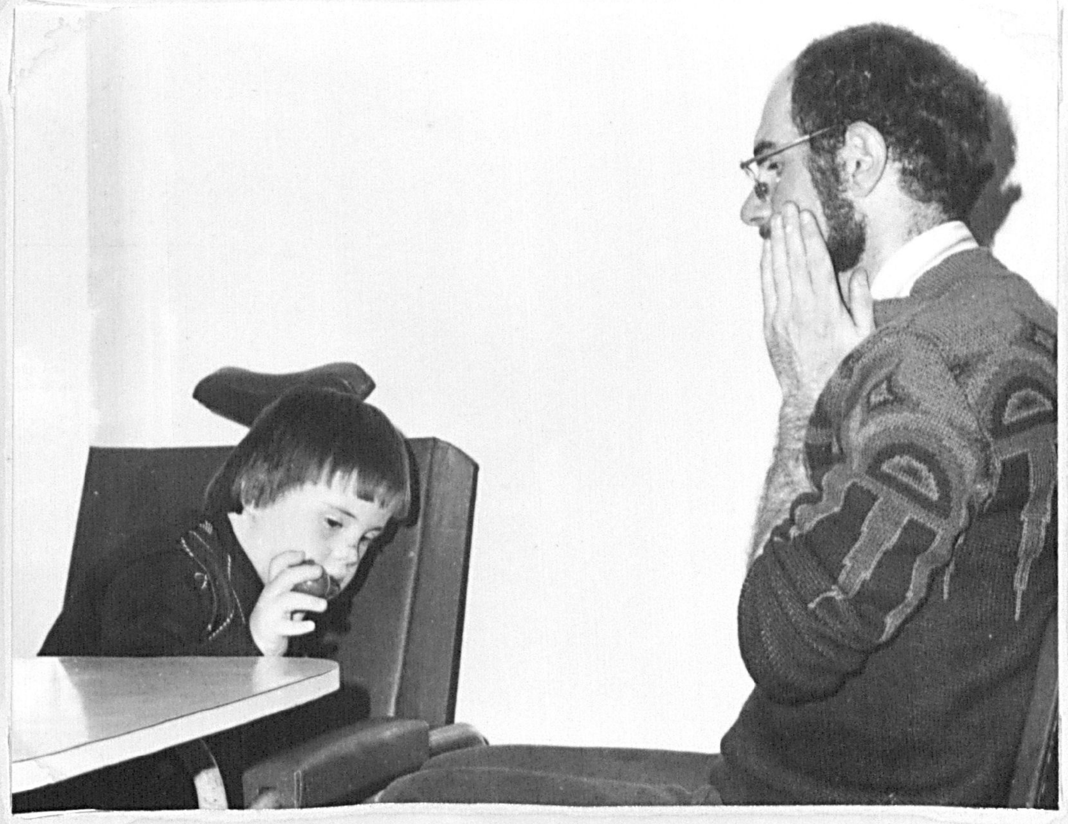

SUBJECT 1
SUBJECT 2
SUBJECT 5
A ● TRAINING ACTIONS
B ■ STANDARD TEST ACTIONS
C ▲ COMPREHENSIVE TEST ACTIONS
PERCENTAGE IMITATION
100
50
0
0
25
50
S- S2 S3 S+ S5 S6
DIAMETER (CM)

FIGURE 18. Performance by Subject 2 on separate trials in which 'training' action 'patting cheek' was demonstrated by the standard model in the presence of the stimulus balls S+ and S- respectively.

In the upper picture, the subject accurately reproduces the behaviour of the model while the S+ ball rests on the knees of the latter. In the lower picture, the model again demonstrates the 'patting cheek' action but in the presence of the smaller S- ball; the subject is seen grasping the ball prior to throwing it.





<u>FIGURE 19</u>. Performance by Subject 2 on separate trials in which 'standard test' action 'wave hand' was demonstrated by the standard model in the presence of the stimulus balls S+ and S- respectively.

In the upper picture, the subject accurately reproduces the action while the S+ ball rests on the knees of the model. In the lower picture, the model again demonstrates the 'wave hand' behaviour but in the presence of the smaller S- ball; this ball is seen in the air (arrowed) having just been thrown by the subject.

# DISCUSSION

In the present experiment, all the subjects' imitative behaviour was readily scored and the interjudge reliability of scoring (.96) compares well with figures quoted by other authors (e.g. Steinman, 1970 a).

The similar rates of imitation to S+ and S- before discrimination training suggest that a test with a variety of different sizes of ball at this stage would have yielded flat generalization gradients. The red balls had been chosen as stimuli because it was hoped that they would be easily discriminated by the children who might have had slight but undetected visual defects. However, initial imitation training had apparently not established the large ball as a discriminative cue for responding. It is probable that, up to this point, the children had discriminated trials by attending to other cues (e.g. the experimenter's behaviour in preparing for a trial and modelling an action).

Reinforcing 'imitations' only to the large ball and not to the small ball established stimulus control over both reinforced and 'generalized' imitations. Closely similar stimulus generalization curves were obtained for reinforced and 'generalized' imitations, both of which usually occurred at similar frequencies for any given test stimulus.

'Generalized imitation', however, did sometimes occur at a higher frequency than 'imitations' of the training actions to some of the test stimuli. It seems unlikely that the subjects were discriminating between reinforced and unreinforced actions. Had that been the case, 'generalized imitations', which were never reinforced, should have occurred at lower rates than 'imitations' of actions that had previously been reinforced in training. It is possible, however, that the observed differences in rates of 'imitation' and 'generalized imitation' are an artefact of the testing procedure. Since tests with 'training' actions were carried out before tests with 'generalized imitations', these differences could be the result of a deteriorating discrimination as testing proceeded. All subjects had many more trials during preliminary imitation training (when the ball was not attended to) than during discrimination training (which established ball size as a discriminative cue). Consequently, as stimulus generalization testing proceeded there may have been too few retraining trials to fully maintain ball size as a discriminative cue. Clearly, it would have been better to have arranged the generalization tests so that such effects would have been distributed more evenly across the different categories of response.

The present stimulus generalization curves for reinforced and 'generalized' imitation, however, are sufficiently similar to support the hypothesis that, at least for subnormal children, imitation can be a single functional response class.

The shape of the generalization curves is also broadly similar to the shape of generalization curves obtained after discrimination training with simpler response classes such as button pushing and lever pressing (e.g. Terrace, 1966). Research into animal discrimination learning also suggests that, as in the present study, differential reinforcement may often be necessary for discrimination learning and the occurrence of the typical sloping gradients of both sides of S+ (Jenkins and Harrison, 1960). The nature of the processes involved has not been clearly established.

The skew of the stimulus generalization curves is not easy to interpret. Empirically determined comparison curves are lacking because without discrimination training ball size was not a discriminative cue. Theoretical curves have not been derived because of the difficulty of constructing a scale of equal intervals for the test stimuli. The test stimuli have, in fact, been plotted on a scale of diameter; alternative measures of ball size (e.g. surface area or volume) would have exaggerated the observed skew. However, the direction of the skew obtained is consistent with the peak shift found in studies of stimulus generalization with simple responses after differential reinforcement (Hanson, 1959).

Finally, the present results suggest the feasability of another proposal made by Gewitz and Stingle. Normally a child does not imitate continually but only at certain times and in certain circumstances. Gewitz and Stingle suggested that in a child's daily life certain events (such as verbal cues) can become discriminative stimuli for imitation when they are differentially associated with the availability of reinforcement for imitation. The present study provides a demonstration of such discriminative control in subnormal children under laboratory conditions.

## SUMMARY

Generalized imitation had been previously established in three young subnormal children by reinforcing their 'imitations' of a limited set of modelled actions in the presence of a large ball. A discrimination was then established by training nonimitation in the presence of a small ball. Imitation was then tested for various other ball sizes. Rate of 'imitations' decreased as the test stimuli increasingly differed in size from the large ball. 'Generalized

imitations' that were never reinforced occurred at about the same rate as those that were reinforced when in the presence of the large ball in training. The results support the view of Gewirtz and Stingle (1968) that 'imitations' and 'generalized imitations' be regarded as a single functional response class.

## EXPERIMENT 5

Retention and recovery of 'imitative' and 'generalized imitative' responses after a period of no formal practice.

# INTRODUCTION

The acquisition under laboratory conditions of (reinforced) 'imitations' and (nonreinforced) 'generalized imitations' by previously nonimitative children is a well documented phenomenon (Baer et al., 1967; Lovaas et al., 1966; Metz, 1965) that has been described for Experiment 1 of this thesis. Similarly, techniques involving the use of such imitative behaviours to aid development of new behavioural repertoires by developmentally retarded children have also been detailed by various authors (e.g. Baer et al., 1967; Lovaas et al., 1966; Garcia, 1974). These modelling techniques would probably not, however, feature continuously in behaviour modification programmes with young subnormal children, but rather be used periodically, as necessary, for the training of specific skills (e.g. self-feeding or dressing). Such a hiatus suggests the possibility of deterioration in imitative performance through lack of formal maintenance. Clearly, the usefulness of imitation as a means of bypassing time-consuming shaping procedures depends in part upon the ease with which 'imitative' and 'generalized imitative' responses can be reliably elicited from subjects even after periods of no training. The resiliance of the 'generalized imitation' phenomenon in retarded children following such lack of use has not, however, been established, but two facets of performance have practical relevance. These are:-

1) the degree of spontaneous retention of 'imitative' and 'generalized imitative' behaviours after a period that involved no formal imitation training or retraining, and

2) the amount of subsequent 'refresher' retraining, if required, that is needed to recover previous high, stable emission rates of both response types.

The present study examined both of these features of imitative performance in a group of young retardates. These children, having previously acquired and maintained an 'imitative' and 'generalized imitative' behavioural repertoire under laboratory conditions, then received no further formal imitation training for a period of three months. At the end of this interval, the level of retention of imitative behaviour was determined for each subject; then, subsequently, the amount of retraining necessary (if any) was found to bring about full recovery of 'imitations' and 'generalized imitations' to previous high rates in each child.

## METHOD

### Subjects

The original subjects of this study were the children who had previously participated in Experiment 3 (and some, in addition, Experiment 4). These twelve young retardates all had in common that they would emit 'generalized imitations' in a context of continued reinforcement for 'imitations' when all actions were demonstrated without instructions in the presence of a red ball of 30 cms. diameter. Subjects 7 and 12, however, were unavailable for assessment of imitative performance recall, having left the hospital in the intervening period. The remaining ten children present throughout the experiment are indicated in Table 32 with developmental data for each obtained at the end of the 'no formal training' period just prior to the determination of imitative retention levels.

### Experimental Setting, Apparatus and Reinforcers

The experimental setting, apparatus and specific reinforcers administered to individual subjects were as described in the relevant sections of Chapter 5 (General Method).

Table 32. Subjects.

| Subject (Number) | Age | Primary P.A.C. Items Passed | Vineland | |
|---|---|---|---|---|
| | | | Social Age | Social Quotient |
| 1 | 5yrs 11mths | 98 | 2.0yrs | 34 |
| 2 | 6yrs 3mths | 102 | 2.1yrs | 33 |
| 3 | 6yrs 0mths | 53 | 1.3yrs | 21 |
| 4 | 7yrs 1mth | 54 | 1.4yrs | 20 |
| 5 | 8yrs 1mth | 54 | 1.4yrs | 17 |
| 6 | 9yrs 6mths | 59 | 1.7yrs | 17 |
| 8 | 9yrs 2mths | 35 | 1.1yrs | 12 |
| 9 | 10yrs 2mths | 55 | 1.5yrs | 14 |
| 10 | 9yrs 8mths | 38 | 1.4yrs | 15 |
| 13 | 11yrs 9mths | 43 | 1.4yrs | 12 |
| Mean: | 8yrs 4mths | 59 | 1.5yrs | 20 |

Procedure

During experimental periods, sessions were conducted daily with each child individually, as indicated in Chapter 5 (General Method; see p.91 ).

Preliminary Retraining. Immediately after the end of participation in their most recent previous study (that is, Experiment 4 for Subjects 1, 2 and 5, and Experiment 3 for the remainder), all children were retrained as necessary to a common criterion performance by reinforcement of correct 'imitations' of a limited set of five demonstrated actions. For all children except two, these were 'training' actions 1-5 from Table 4; the exceptions were Subject 3 and Subject 8 with whom, for reasons previously detailed (p.111), 'training' action 7 (patting chest) was again substituted for 'training' action 1. Retraining was carried out as described in Experiment 2 (p.141) in the standard experimental location and with the standard model, who demonstrated each action in the presence of the red ball but without instructions. As previously, this process continued until the child correctly imitated each of the 'training' actions 1 (or 7) to 5 twice over ten consecutive trials, concurrently emitted no similar intertrial responses and subsequently achieved a score of at least 90% for (nonreinforced) generalized imitation (see Chapter 5 for scoring method) during one presentation of all the 'standard test' actions from Table 4 under similar stimulus conditions.

"Preliminary" Imitation Test. Immediately after preliminary retraining was complete, an 'Imitation Test' session was carried out with each subject; the five 'training' actions 1 (or 7) to 5 and the five 'standard test' actions from Table 4 were alternately demonstrated for one trial each with the red ball present but without instructions.

At the start of each of the ten trials, the model looked towards the subject, brought the red ball into view and then exhibited the scheduled action. There were no programmed consequences for either correct 'imitations' or 'generalized imitations' and each trial lasted for 10 seconds regardless of the subject's behaviour. At the end of this time interval the model removed the ball and ceased to look at the child. A constant period of 10 seconds always elapsed between trials.

For all subjects, a period of three months then elapsed during which no formal imitation training was provided.

"Retention" Imitation Test. At the end of this interval with each child, another 'imitation test' session took place, to determine the level of retention of imitative behaviour. This session was carried out exactly as the 'Preliminary Test' session described above.

Refresher Retraining. Children who exhibited complete retention of imitative performances on the Retention Imitation Test (accurate reproduction of all 'training' actions, at least 90% generalized imitation score and no similar intertrial responses) received no further attention. The remaining subjects who showed some decrement in imitative behaviour were then retrained, using 'shaping' and 'fading' techniques as necessary, in the manner described for preliminary retraining above and in full in Experiment 2. This retraining of each child continued until the same criterion performance was reached as detailed in the Preliminary Retraining section above. Each retraining session contained thirty trials on which 'training' actions were demonstrated.

"Post Refresher Retraining" Imitation Test. When refresher retraining was completed, each subject who had required it took part in a final 'imitation test' session, once again carried out exactly as the 'Preliminary Test' session described above.

Each session was recorded on videotape and played back later for analysis. Data were collected in the forms described in Chapter 5 (General Method). At a number of points throughout the study, independent observers checked the reliability of the experimenter's scoring of the subjects' behaviour.

RESULTS

Observer agreement on scoring of imitative behaviours in this experiment always exceeded .96.

During preliminary retraining, all subjects at once or very rapidly reached criterion level performance for all 'imitations' and 'generalized imitations' of the 'training' and 'standard test' actions respectively.

"Preliminary" Imitation Test. The first secion of Table 33 indicates rates of 'imitations', 'generalized imitations' and intertrial responses emitted by all subjects in the 'imitation test' immediately after preliminary retraining had been completed. All the children achieved uniformly high levels of 'imitative' and 'generalized imitative' responses and low frequencies of similar behaviours between trials. Mean reaction times of 'imitations' and 'generalized imitations' emitted during this 'test' session, shown in the first section of Table 34 were, albeit with variations between individuals, grossly similar for both sets of responses. The shortest possible readings (1 second) were consistently obtained by Subject 1 and Subject 2.

| | "Preliminary" (N=10) | | | 'Retention" (After 3 months' Nonpractice) (N=10) | | | "Post 'Refresher' Retraining" (N=8)* | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mean | Range | | Mean | Range | | Mean | Range | |
| | | Min | Max | | Min | Max | | Min | Max |
| Percentage 'Imitations' | 100% | 100% | 100% | 60.0% | 0% | 100% | 100% | 100% | 100% |
| 'Generalized Imitation' Score | 98.0% | 90.0% | 100% | 64.0% | 20% | 100% | 96.3% | 90.0% | 100% |
| Intertrial Responses | 0.5 | 0 | 2 | 1.5 | 0 | 8 | 0.5 | 0 | 1 |

* Subject 1 and Subject 2 excluded

Table 33. Imitation, Generalized Imitation and Intertrial Response Rates in Separate 'Imitation Test' sessions.

| | "Preliminary" (N=10) | | | "Retention" (After 3 months' Nonpractice) (N=10) | | | "Post'Refresher' Retraining" (N=8)* | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mean | Range | | Mean | Range | | Mean | Range | |
| | | Min | Max | | Min | Max | | Min | Max |
| 'Imitations' | 4.6 secs | 1.0 secs | 6.8 secs | 7.2 secs | 1.4 secs | 9.0 secs | 5.2 secs | 2.8 secs | 7.2 secs |
| 'Generalized Imitations' | 5.4 secs | 1.0 secs | 7.8 secs | 6.6 secs | 1.2 secs | 8.4 secs | 5.0 secs | 3.2 secs | 7.6 secs |

*Subject 1 and Subject 2 excluded.

Table 34. Mean Reaction Times of 'Imitations' and 'Generalized Imitations' emitted by all subjects involved in each 'Imitation Test' Session.

"Retention" Imitation Test. Corresponding data from the similar 'imitation test' session after a three months' period of nonpractice are shown in the second sections of Table 33 and Table 34 respectively. Considered overall, the group exhibited a drop in mean rates of 'imitations' and 'generalized imitations' combined with an increase in the emission of intertrial responses when compared with results on the same measures obtained previously in the 'Preliminary' imitation test (see Table 33). There was, however, considerable variation between the performances of individual children. Subject 1 and Subject 2 retained maximum emission rates of both 'imitative' and 'generalized imitative' behaviours with no similar responses between trials. Meanwhile, Subject 4 showed no reproduction of 'training' actions at all and minimal reproduction of 'standard test' actions, again with no intertrial responses and, in contrast, Subject 5 maintained relatively high rates of imitative behaviours, but also reached a high level of intertrial response emission (a total of eight responses) in this session. The remaining children showed intermediate decrements in imitative responding combined with varied increases in intertrial responses. There was a close similarity between frequencies of 'imitative' and 'generalized imitative' responses emitted by each individual.

The mean reaction times of both 'imitations' and 'generalized imitations' shown on this occasion were longer than those from the previous 'Preliminary' test session (see Table 34); once again there was a considerable range of results between children. Subject 1 and Subject 2 maintained a position with the lowest reaction times for responses in both sets, although the results from both children indicated small increases over those from the previous 'test' session.

During this "retention" imitation test, some children attended closely to the model throughout; others, however, particularly Subject 3 and Subject 8 proved restless and emitted various irrelevant behaviours (e.g. hand and leg movements, and vocalizations) at high rates.

Refresher Retraining. Having exhibited maximum retention of imitative performance in the 'Retention' imitation test, Subject 1 and Subject 2 received no further attention. The remaining eight children required 'refresher' retraining, at the end of which all, once again, recovered criterion level performance for all 'imitations' and 'generalized imitations' of the 'training' and 'standard test' actions respectively, combined with no concurrent emission of intertrial responses during the last ten 'imitation' trials. The performances of this remaining group of subjects during the retraining period to reach this criterion are shown in Table 35, and, as indicated, there were considerable variations between individuals. Thus Subject 6 required only twelve 'training' action trials, correctly 'imitated' on each and emitted only one intertrial response in the period before reaching criterion level during one session; at the other extreme, Subject 3 took 191 retraining trials, imitated correctly on 135 of them and emitted 48 intertrial responses to reach the same point. For this latter subject, retraining required a total of seven consecutive sessions. The mean number of 'training' action trials for all these children represents approximately three sessions of 'refresher' retraining.

Details of recovery during this phase also varied between individuals. Some children needed 'shaping' and 'fading of prompts' techniques initially, while others did not. Some subjects showed an initial rapid increase in levels of both 'imitations' and intertrial

Table 35. Performances During Refresher Retraining of Children for whom it was required.

| | Refresher Retraining (N=8)* | | |
|---|---|---|---|
| | Mean | Range | |
| | | Min | Max |
| Training Action Trials to Retraining Criterion | 80.1 | 12 | 191 |
| Correct 'Imitations' to retraining criterion | 57 | 12 | 135 |
| Intertrial responses to Retraining Criterion | 16.3 | 1 | 48 |

* Subject 1 and Subject 2 excluded.

responses, after which the frequency of the latter again reduced over progressive sessions; other children, in contrast, showed low incidence of intertrial responses throughout with progressively increasing levels of'imitations' of 'training' actions on successive sessions only. The wide differences between individuals in the numbers of correct 'imitative' responses involved in retraining rendered group analysis of 'imitation' reaction time data impractical; most children, however, showed a tendency for mean reaction times of 'imitations' emitted in each session to decrease as retraining progressed.

Finally, during this period, the levels of irrelevant behaviours exhibited by all subjects rapidly fell, to be replaced by consistent attention to the model.

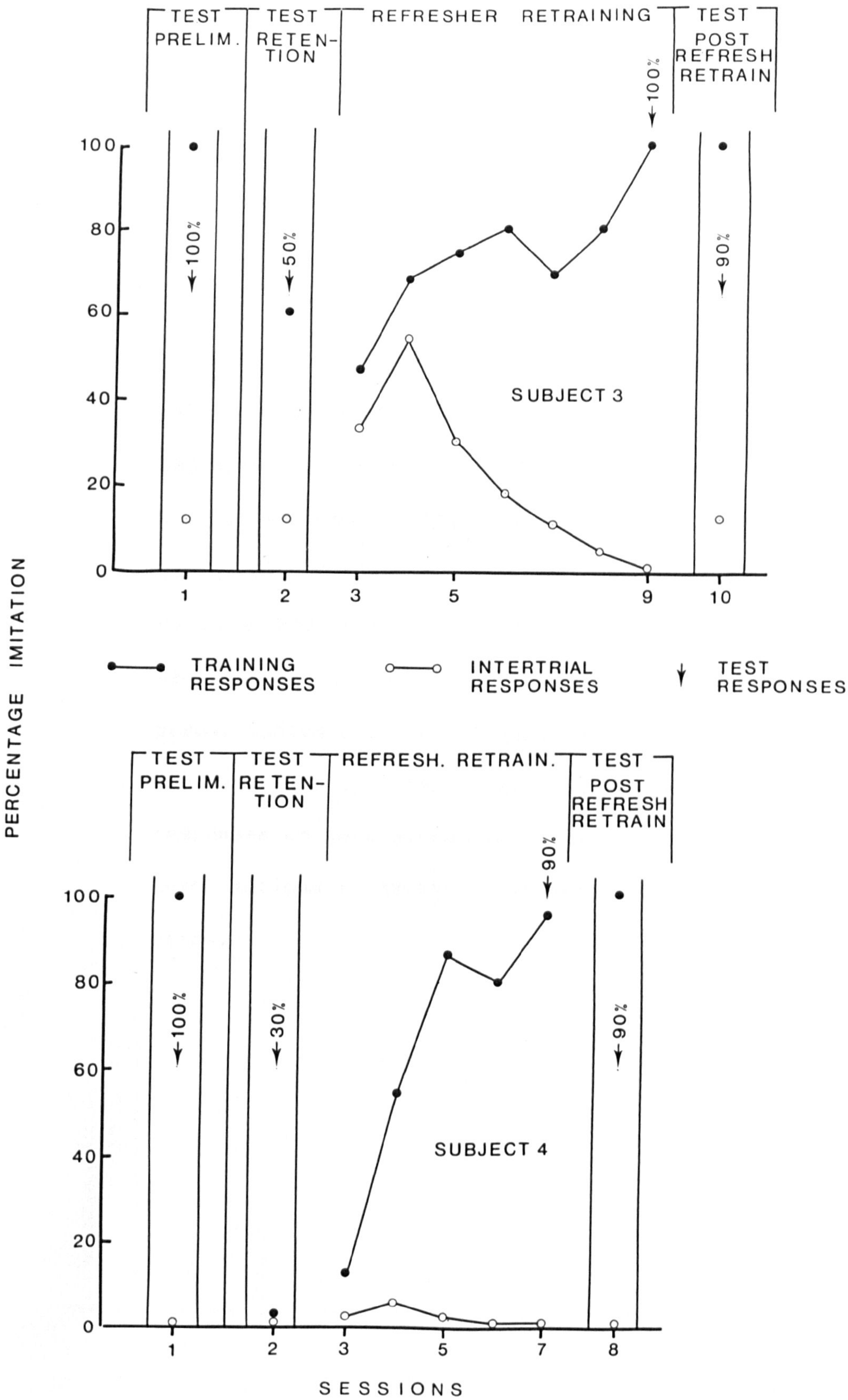
'Post Refresher Retraining' Imitation Test. As shown by the third section of Table 33 in this imitation test, the eight remaining participating children all exhibited high rates of 'imitations' and 'generalized imitations' similar to those obtained in the original 'Preliminary' imitation test and also comparable low frequencies of intertrial responses (see first section of Table 33). Mean reaction times of these 'imitative' and 'generalized imitative' responses are indicated in the third section of Table 34; once again, albeit with individual variation, these are shorter for both response sets than mean reaction times from the 'Recall' imitation test (second section of Table 34) and comparable with those from the original 'Preliminary' imitation test (first section of Table 34).

For illustration, the individual records of Subject 3 and Subject 4 are presented, the latter having shown, of all the children, greatest decrement in imitative performance upon retention testing and the former required the greatest number of training trials to recover criterion imitative performance during 'refresher' retraining. Both records are, however, representative of those of all eight subjects who required 'refresher' retraining. As indicated in Figure 20, both Subject 3 and Subject 4 showed maximum rates of 'imitations' and 'generalized imitations' combined with low or zero frequency of intertrial responses during the 'Preliminary' imitation test. In the 'retention' imitation test three months later, however, Subject 3 exhibited lower incidence of both 'imitative' and 'generalized imitative' responses and Subject 4 likewise, but showing no reproduction of 'training' actions at all. During subsequent 'refresher' retraining, both children showed gradually increasing rates of both response sets, Subject 3 requiring seven retraining sessions and Subject 4 five sessions to recover the criterion levels of 'imitative' and 'generalized imitative' performance. During retraining, Subject 4 showed initially high frequency of intertrial responses which subsequently diminished; in contrast, Subject 3 exhibited very few such responses throughout. On the later 'Post Refresher Retraining' imitation test, both children reverted to their former high levels of 'imitations' and 'generalized imitations', combined with low frequency of intertrial responses.

The mean reaction times of 'imitative' and 'generalized imitative' responses emitted by both individuals during corresponding parts of this study are indicated by Figure 21. The results for the 'generalized imitations' of both children had risen after the three months' no practice period and this trend was reflected in the 'imitations' of Subject 3. During 'refresher' retraining the mean reaction times of 'imitations' tended to shorten for both subjects, and the mean results for 'generalized imitations' at the end of retraining were lower than those in the previous 'retention' imitation test.

FIGURE 20.

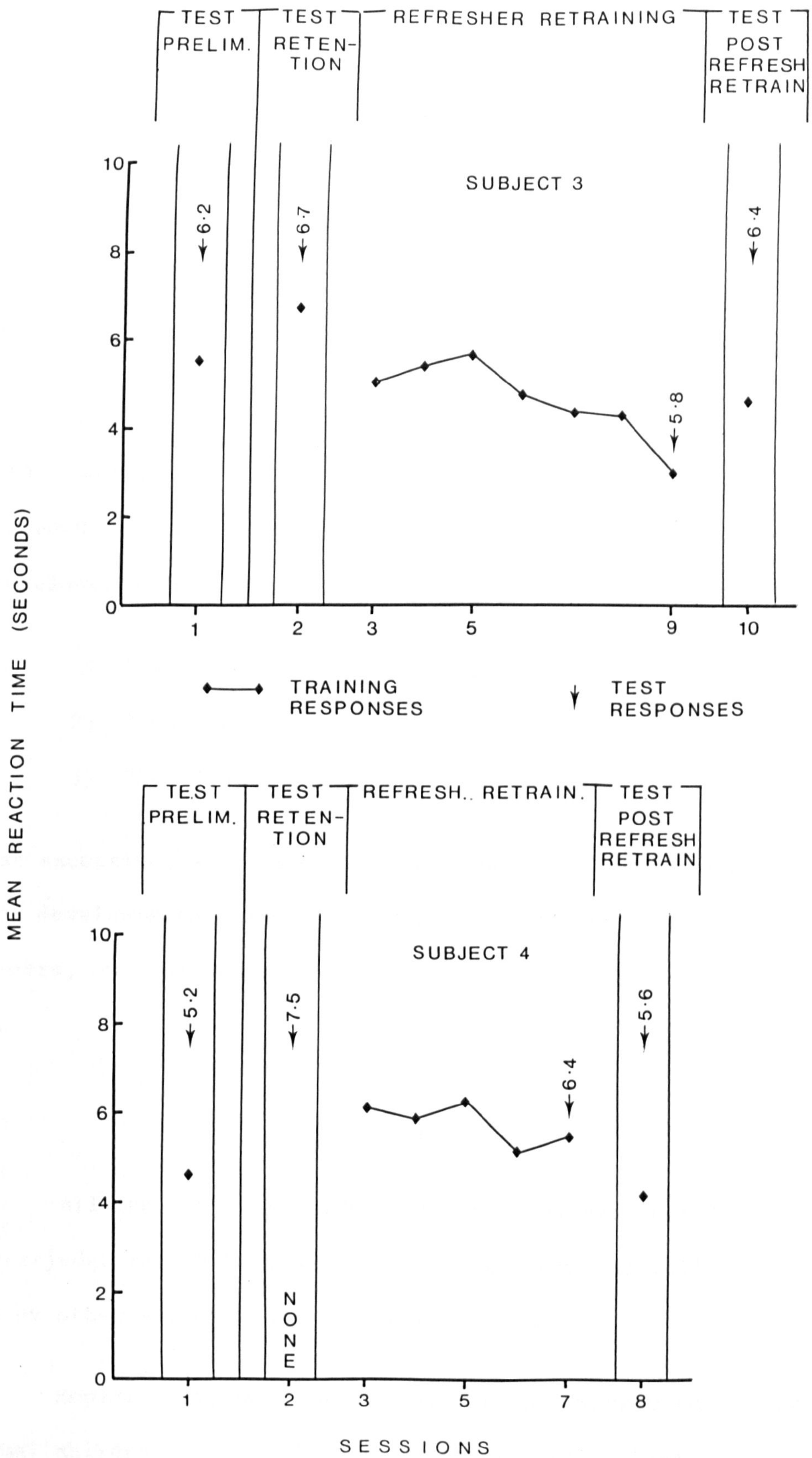
Imitative performances of Subject 3 and Subject 4 during Experiment 5. Percentage of demonstrations imitated (training responses; filled circles) are expressed as a percentage of the total number of 'training' action demonstrations in a session; the occurrence of similar responses between trials is shown as a percentage of the total number of trials in a session (intertrial responses; open circles). 'Imitation test' and 'retraining' sessions are indicated in their experimental sequence at the top of each graph. Vertical arrows indicate tests for generalized imitation; the generalized imitation score obtained on each presentation of the "standard test" actions is shown as a percentage.



TEST PRELIM.
TEST RETENTION
REFRESHER RETRAINING
TEST POST REFRESH RETRAIN
100%
50%
90%
SUBJECT 3
TRAINING RESPONSES
INTERTRIAL RESPONSES
TEST RESPONSES
PERCENTAGE IMITATION
REFRESH. RETRAIN.
30%
SUBJECT 4
SESSIONS

FIGURE 21.

Mean reaction times of imitative behaviours exhibited by Subject 3 and Subject 4 during Experiment 5. Mean reaction times are shown for 'imitations' during each session (filled diamonds). 'Imitation test' and 'retraining' sessions are indicated in their experimental sequence at the top of each graph. Vertical arrows indicate tests for generalized imitation; the mean reaction time of generalized imitative responses on each presentation of the 'standard test' actions is marked in seconds above each arrow.


TEST PRELIM.
TEST RETENTION
REFRESHER RETRAINING
TEST POST REFRESH RETRAIN
SUBJECT 3
6·2
6·7
5·8
6·4
MEAN REACTION TIME (SECONDS)
TRAINING RESPONSES
TEST RESPONSES
TEST PRELIM.
TEST RETENTION
REFRESH. RETRAIN.
TEST POST REFRESH RETRAIN
SUBJECT 4
5·2
7·5
6·4
5·6
NONE
SESSIONS

During the "Post Refresher' Retraining" imitation test, the mean reaction times of both response sets for each subject were comparable to the previous results in the 'Preliminary' imitation test. Throughout this experiment, with both children the mean reaction times of 'generalised imitative' responses were consistently higher than those of 'imitative' responses in the sessions during which the 'standard test' actions were demonstrated.

Finally, throughout these experiments, some members of the hospital nursing staff, concerned with the care of individual subjects, spontaneously commented on the progress of these children. Among their observations were:-

1) "he (Subject 1) is getting wild",
2) "she (Subject 4) has come to life", and
3) "he (Subject 5) is nicer to be with now".

Without exception, all comments on the subjects implied either some form of developmental progress not directly connected with imitative behaviours, or a positive change in the nurses' views of the relevant child.

## DISCUSSION

All the subjects' imitative behaviour was readily scored and the interjudge reliability of scoring (.96) compares well with figures quoted by other authors (e.g. Steinman, 1970a).

Empirically, it appears that for (previously imitative) subnormal children, a period of no formal imitation training and practice results in subsequent 'imitative' and 'generalized imitative' performance deficits, although the nature and degree of these decrements may vary considerably between individuals. Recovery to former high stable response rates can, however, be rapidly brought about by 'refresher' retraining. Thus, in general, this study tends to confirm the durable nature of the 'generalized imitation' phenomenon over time. The rapid recovery shown by most subjects suggests that, even after a period of nonpractice, the use of 'generalized imitation', although involving imitation retraining first, may still be a more economical method for the generation of varied novel behaviours than shaping of each desired response in turn independently.

The findings of the present experiment correspond in part to those of Lovaas et al. (1973) who examined the 'transfer across time' of behaviour therapy treatment gains by 'autistic' children. Subjects with continued training (e.g. to suppress biting and scratching) maintained improvements on later follow-up assessments; in contrast, institutionalized children who received no systematic maintenance were found to have largely reverted to pre-treatment levels of the relevant behaviours after a time interval had elapsed. Of these latter subjects, however, the authors pointed out "a brief reinstatement of behaviour therapy could temporarily re-establish, some of the original therapeutic gains" (p.131). Nevertheless, the Lovaas et al. (1973) investigation differs from the present imitation study in at least one important aspect. The earlier authors brought about varied but specific behaviour changes with the explicit intention that, once established, these new behaviour patterns should become self-maintained and autonomous for the subject in many situations. This present experiment, however, was primarily concerned with a phenomenon (with potential application in modelling techniques) as a general training procedure for use when required to facilitate such varied behaviour gains, rather than as a treatment goal in its own right.

Some procedural points have particular relevance to the present results and their derivation; these will now be considered in turn:-

1) once again, the use of other performance measures in addition to the conventional 'imitative response rate' of previous authors proved justified. In the 'Recall' imitation test, raised frequency of intertrial responses and lengthened mean reaction times coincided with lowered rates of 'imitations' and 'generalized imitations', suggesting that all three indices concurrently reflected performance deterioration. At the same time mean reaction times of individuals for this session should, from the intermittent nature of the data, be regarded with less confidence than similar measures from the other 'test' sessions when the incidence of 'imitations' and 'generalized imitations' was high and stable. In a similar manner to above, increased rates of 'imitations' during 'refresher retraining' coincided with lowered intertrial response emission and shortened 'imitation' mean reaction times (although this last should once again be treated with caution). Again, recovered 'imitative' and 'generalized imitative' responding was accompanied by low intertrial response frequency and low mean reaction times. Some children, while maintaining maximum response rates upon recall, showed lengthened mean reaction times only. Thus, perhaps in these cases, change in latencies provided additional, finer measures of performance strength when the frequency of imitative behaviours was at or near maximum.

2) in all imitation test sessions, there were no programmed consequences for correct 'imitative' responses. This procedure had the virtue of providing standard conditions for all such sessions, thus facilitating comparison of performances in each. It may be, however,

that reinforcement of correct 'imitations' early in the 'Retention' imitation test would have enhanced performance on subsequent trials and it is likely that such reinforcement would be available immediately upon correct recall in clinical practice. Thus, the 'Retention' imitation test was undertaken in less than optimum conditions needed to encourage responding; that reasonably high levels of recall were shown anyway seems to strengthen any comment about the durability of generalized imitation after periods of nonpractice.

3) the difficulties in attaining complete standardization of training procedures within and between subjects have been previously discussed in detail for Experiment 1 (see p.129); suffice to say that the same considerations also apply for this study.

4) this investigation does not comment on possible relationships between overall previous imitative experience (e.g. in terms of total trials or reinforced 'imitations') and either level of imitative recall or amount of 'refresher retraining' required to recover maximum response rates. The present subjects had, over the series of experiments reported in this thesis, participated in varying numbers of previous trials and, indeed, three (Subjects 1, 2 and 5) had taken part in an additional investigation (Experiment 4). The added number of reinforced trials involved in that experiment, however, represent a small proportion of the total number experienced by all other subjects. From a clinical viewpoint, it would have been totally unauthentic to ensure that all subjects had emitted the same total of reinforced 'imitations' before training was discontinued for the 'no formal training' period. The practice of ensuring that all children reached a common criterion performance prior to this period provided a more realistic alternative. Subjects 1, 2 and 5 had had additional experience of preliminary retraining, but this does not appear to have influenced

the performances of all three in any systematic way.

Again, the small number of children in this study does not allow any analysis of possible relationship between current developmental levels of subjects, the decrement in imitative responding after a period of no formal imitation training and the amount of subsequent 'refresher retraining' required. It is, however, perhaps worthy of note that the two children with by far the most competent levels on both the Primary P.A.C. and Vineland Social Maturity Scale also exhibited maximum retention of imitative performance over time.

5) it is not known how much spontaneous imitative behaviour (if any) each child showed in the wards or other settings during the 'no formal practice' period, nor the possible stimulus events that occurred contingent upon each potential response; this issue will be discussed in detail later. From the practical viewpoint of this experiment, however, the experiences of the present subjects that might influence levels of recall would probably in the main reflect those of any similar group of children in comparable institutional circumstances.

The data from this experiment appear to support the hypothesized 'explanation' of the 'generalized imitation' phenomenon proposed by Gewirtz and Stingle (1968), namely that (reinforced) 'imitative' and (nonreinforced) 'generalized imitative' behaviours be considered as a single functional response class. This view implies that 'imitations' and 'generalized imitations' should be influenced in closely similar ways by any given treatment; within this study, for both the 'response rate' or 'mean reaction time' measures, congruent trends were seen for reproductions of both 'training' and 'standard test' actions. A period of no formal training resulted in broadly similar subsequent, response rates of both 'imitations' and 'generalized imitations' for every subject, after which 'refresher retraining' restored both sets to similar high rates in children who had shown any response decrement. Mean reaction times of 'imitative' and 'generalized imitative' responses each showed similar trends with each treatment. It is interesting to note that, in this study, the 'imitative response rates' and 'mean reaction' time measures do both appear to support the same hypothesis, rather than contradict each other.

Finally, although to be discussed in detail later, the possible additional, secondary benefits from formal training of specific modes of behaviour are noted, both in terms of the subjects' extra-training behaviour patterns and the responses and attitudes of the caring staff.

SUMMARY

Ten young subnormal children had received reinforcement for correct 'imitations' in a standard setting, over long periods of time ; under such conditions, all subjects emitted 'imitations' and 'generalized imitations' at high, stable rates. For each of these children further formal imitation training was then discontinued for a period of three months. On a 'retention' imitation test, in the same setting, at the end of this interval, two subjects showed no decrease in rates of imitative behaviour; the remaining eight, however, exhibited varied lowered frequencies of 'imitative' and 'generalized imitative' responding combined with lengthened response reaction times and increased emission rates of intertrial responses. After further 'refresher retraining' of 'imitations', these latter eight subjects rapidly recovered former performance levels of 'imitation' and 'generalized imitations'. These results suggest that 'generalized imitation' is a resilient phenomenon,

(with retarded children) even after periods of no formal training and hence support claims of its usefulness for economy in the training of new responses in such subjects.

# CHAPTER 7

# FINAL DISCUSSION

The five experiments reported in this thesis have focussed on various practical aspects of generalized imitation as a method of training developmentally retarded individuals. The subjects were all drawn from a specific population for whom the possibility of imitation training had been previously demonstrated (e.g. Baer et al., 1967; Garcia, 1974), namely young, institutionalized, subnormal children. In Experiments 2, 3, 4 and 5 the outcomes of all operations and group performance comparisons were consistent and clear, despite variation between individual subjects.

The results of Experiment 1, a comparison of the efficiency of two methods for training generalized imitation, were complicated by the initial inequality of the groups, although the assignment of subjects had been essentially random. This initial disparity hindered direct interpretation of group performances after subsequent training of each group by different methods. Results suggested that a 'Cumulative' method (see p.112), involving possible alteration between previously taught 'training' actions and the current 'training' action being shaped on consecutive trials might make for faster training than a 'Serial' method (see p.112) where imitation of each action was taught to criterion in isolation. Although such a trend was indirectly indicated, the nature of the data did not allow total confidence in the conclusion.

However, unknown to this author when Experiment 1 was carried out and later described for this thesis, further experimental support was available for the tentative conclusion in favour of a 'Cumulative' method (Schroeder and Baer, 1972). This other investigation had involved only two retarded child subjects, 'training' actions demonstrated by a model were vocal only and the performance measure used had been 'imitation accuracy' of each response rather than imitative response rate per session. Nevertheless, training of vocal imitation was compared within each subject when a 'Concurrent' procedure "in which three words were shaped into accurate imitations at the same time" (p.293), was alternated with a 'Serial' procedure in which imitation of one vocal action was trained to criterion before the next action was introduced. The 'Concurrent' procedure of Schroeder and Baer (1972) has much in common with the 'Cumulative' method of Experiment 1 in that both involved changes in 'training' actions demonstrated on successive trials; the 'Serial' training procedures in both experiments were identical. Schroeder and Baer concluded "teaching verbal imitations concurrently may be advantageous in establishing a functional behavioural class of accurate imitation without increasing training trials"(p.293). Thus, outside support exists for the tentative results of Experiment 1; further, interestingly, the explanation proposed by Schroeder and Baer (1972) for the relative efficiency of the "Concurrent/Cumulative" form of training procedure was essentially similar to that put forward in the Discussion section of Experiment 1 (see p.130 ).

To summarize, three main conclusions arise from this series of experiments:-

1. Present results confirmed findings from previous studies of generalized imitation with retardates.

2. Empirically, throughout a series of different operations with subnormal child subjects, 'imitations' and 'generalized imitations' have, although with some exceptions, shown characteristics of a single functional response class.

3. This single response class of imitative behaviours is affected by various operations such as intermittent reinforcement or removal of reinforcement (Experiment 2), change of stimulus conditions (Experiment 3), discrimination training to establish stimulus control (Experiment 4) and lack of formal training (Experiment 5) much as many other single responses in most previously published laboratory and applied behaviour modification studies concerned with the behaviour of young developmental retardates.

This general conclusion having been stated, a number of methodological and procedural points arising from the present series of studies will now be considered:-

1. With the exception of (expensive) recording equipment present for experimental rather than clinical purposes, all the apparatus used was simple, commonplace and easily organized. Thus imitation training and maintenance procedures described in this thesis would be well within the range of material resources available to services and institutions dealing with the mentally handicapped.

2. In randomly selected sessions of every experiment, the level of agreement was high between different judges about scoring the occurrence of imitative behaviours on every trial. Measures of interjudge reliability quoted for each experiment compare well with figures given by previous authors (e.g. Steinman, 1970a). The lowest level of agreement occurred during one session of Experiment 1 when interscorer reliability exceeded .93; this represented disagreement about scoring on two out of thirty trials, clearly a small proportion of the subjects' performance in that session and, in general, agreement levels on scoring were even higher. Changes in the scoring of individual trials that gave rise to original disagreement would not essentially alter

the results and conclusions reached for any experiment. The overall consistently high levels of interscorer reliability quoted do, however, rather serve to emphasize the clarity and lack of ambiguity in subjects' behaviour on individual trials over considerable time periods. At the same time, checks on scoring by other independent judges provided a sensible (and arguably, essential) safeguard against possible loss of objectivity in a single experimenter involved with a series of studies over a considerable time interval.

3. In these experiments, various measures were used to record the performances of each subject in individual sessions; each measure will be considered in turn:-

Occurrence of Imitative Behaviour on Each Trial.

The presence or absence of 'imitations' or 'generalized imitations' on each trial is clearly a crucial performance index and as such has conventionally featured in previous discrete trial generalized imitation studies; the ease with which it may be used has been indicated above. One departure, however, from previous common practice was the inclusion of a 'poor' response category for scoring "generalized imitations" of 'test' actions. This step introduced a measure of emission accuracy for relatively unfamiliar (e.g. vocal) responses, in a manner somewhat similar to that of Schroeder and Baer (1972) with vocal imitations; it also made some allowance for limitations imposed on the behaviour of individuals by physical handicap. Thus a small degree of latitude in definitions of performance level criteria was possible with children for whom consistent accuracy of imitation may have posed particular difficulty. Empirically, this marking category proved useful throughout all the experiments for some subjects and allowed more representative recording of their performances than "generalized imitation present/absent" solely would have done.

Occurrence of Intertrial Responses.

The emission rates of responses similar to 'imitations' and 'generalized imitations' but occurring between trials have not been described in previous accounts of the generalized imitation phenomenon. The present studies, however, indicated systematic effects on intertrial response frequency, albeit with considerable variation between subjects, consequent on some experimental conditions. The recorded incidence of such responses depends in part upon the arbitrary maximum length of time chosen to define an imitative trial for any given study. For these experiments, the time interval was 10 seconds; therefore any appropriate reproduction of the action last demonstrated by the model, but emitted even only 11 seconds after the start of the trial (by which time stimulus conditions had changed) would constitute an intertrial response rather than a correct imitation. It could be argued that this was a very artificial distinction arising mainly from experimental convenience; the intertrial responses emitted by the present subjects, however, seldom corresponded to actions demonstrated on immediately preceding trials. Further, increased emission of intertrial responses frequently coincided with falling rates of 'imitations' and 'generalized imitations' while, conversely, decreases in frequency of such responses occurred at the same time as increasing rates of imitative behaviours. Thus, it may be that in experiments where criteria of imitative performance were defined not only in terms of 'imitation' and 'generalized imitation' frequency but also intertrial response frequency, the incidence of this latter provided at least for some individuals, an additional measure of changes in performance strength. In particular, however, the incidence of intertrial responses may be an indication of the stimulus control exerted over imitative behaviours by trial stimuli under any set of experimental conditions.

Reaction Time of 'Imitative' and 'Generalized Imitative' Responses.

This is a second novel measure of imitative performance introduced in this series of experiments. The mean reaction times of either all 'imitative' or all 'generalized imitative' responses emitted in single sessions tended, albeit with individual differences, to show systematic effects coinciding with changes in experimental conditions. In general, increased mean latencies of "imitations" occurred with falling frequency of imitative responses and rising incidence of intertrial responses; conversely, shortening of mean reaction times tended to coincide with rising imitative response rates and decreasing intertrial response frequency.

While, however, this measure may provide a further index of imitative performance strength, its use requires caution. The latencies taken for individual trials were accurate to the nearest second only, and on trials where responses were unclear even that level of accuracy might not be achieved. The practice of dealing in the means of all latencies of each response set obtained in each session provided one method to minimize the possible effects of such inaccuracy; this procedure in turn, however, may give rise to another limitation. Individual readings of reaction times can only be obtained on trials where a response is emitted. Thus under conditions where response rates are low or vary widely between sessions, mean latency figures may be quoted with varying or low levels of confidence in the extent to which they represent a performance. The situation is further complicated in that it appears empirically (see, for example, the performance of Subject 9, 'Serial' group in Experiment 1, shown in Figure 4) that imitations of different actions may typically require varying minimal times for completion by the subject, perhaps, possibly, because of the grossly different topographies of the behaviours involved in some cases. For example, the execution of a head nod ('training' action 2 from Table 4) may require less time than a movement involving a turn of the body trunk and reaching out to pat a wall ("standard test" action 11 from Table 4). In this series of experiments, no attempt was made to match the typical mean reaction times of "imitative" and "generalized imitative" responses. Indeed, this would probably have proved impossible for a group of subjects as there is no guarantee that different children would have shared a common typical latency for any particular imitative response under given experimental conditions; rather, the reverse appears to have been true. At least partial explanation may lie in the physical attributes of individual children. Thus, Subjects 1 and 2, both mongols, usually executed all responses very promptly, whereas the athetoid subject 12 showed some difficulty of limb control with the result that movements to reach criteria performance of individual imitations on each trial typically required longer.

With these limitations in mind, the most appropriate use of the reaction time measure in generalized imitation studies seems to be tracing of changes and trends in the performances of individual subjects (or group), rather than direct comparisons of absolute latency readings between children with implied comments on performance strength on that basis. In particular, however, some children (e.g. Subjects 1 and 2) showed changes in mean reaction time measures only under some experimental conditions, while still maintaining high or maximum response rates. Thus, it may be this measure provides a finer additional index of performance strength of specific value in such situations.

In summary, this thesis has made use of both conventional and novel measures of imitative performance. While the common 'response rate' index remains the single crucial index, the introduction of 'intertrial response frequency' and 'imitative response reaction time' measures also seems justified and, in some situations, served to indicate changes in performance levels not reflected in the 'response frequency' index only.

4. Seven of the present subjects received varied types of medication throughout their participation in these experiments. Sprague and Werry (1971) extensively reviewed psychopharmacological studies with the retarded and commented "very few empirically verified generalizations can be made about the effects of psychotropic drugs with the mentally handicapped" (p.167). Thus, no comment is attempted about possible ways in which the drugs of these children may have influenced their imitative performances, for example, in rates of learning or alteration of reaction times. At the same time, however, in that a proportion of any institutionalized retardate population will probably receive medication, the inclusion of such subjects in this series of studies probably serves to increase the representative nature of the experimental group.

In general, with the exception of innovations noted above, the methodology of this series of experiments broadly conformed to that of many previous investigations concerning the generalized imitation phenomenon.

All children selected to serve as subjects in these experiments met three initial criteria; namely, that all were grossly developmentally retarded, none showed impairment of auditory or visual capacity nor gross spasticity of upper limbs and finally, none exhibited imitative behaviour. Although chosen with these characteristics for experimental convenience, by meeting the latter two criteria, these children formed a distinct and possibly atypical subgroup within the heterogeneous retardate population. The question thus arises of the applicability of present results and conclusions to other subnormal children (or adults) who do not meet these conditions. All physical handicaps might be regarded as limiting conditions (or in the terms of Bijou and Baer (1961) "setting conditions") which serve to impede complete imitative behavioural repertoires. Specifically, the grossly spastic child might be unable to reproduce particular body movements or object manipulation actions from limited range of movements in appropriate limbs. Equally, an athetoid subject , if able to complete an imitation at all, would typically need to exhibit a variety of unwanted purposeless movements before reaching criterion performance of the response. The record of Subject 12 in this study, however, suggests mild athetosis need not render successful imitation training impossible, but with both athetoid and spastic subjects trials of more than 10 seconds maximum duration may be required.

Partially or totally blind children would be unable to observe body movements or object manipulations when demonstrated and thus be limited to repertoires of verbal imitative behaviours; conversely, subjects with gross handicaps of hearing, while able to see limb movements of a model would be unable to hear vocal actions demonstrated for verbal imitation. As a further complication, for children with such sensory deficits the practical range of cues available (e.g. the red ball, instructions or name calling) to indicate the start of trials, or stimuli (e.g. smiles or praise) to serve as reinforcers would also be limited.

The present subjects were also initially nonimitative. Although this is a common characteristic of subnormal children (Spradlin and

Girardeau, 1966), some may develop imitative behaviour without apparent formal training; it seems likely that behaviour modification programmes involving modelling techniques would also benefit this latter group, With many varied past experiences outwith the training environment, and the behaviour of each child controlled by previously acquired and probably idiosyncratic stimuli, it would, however, be necessary to bring the imitative behaviour of such individuals under appropriate control, probably in a particular setting, before therapeutic training programmes could begin (e.g. Risley and Wolf, 1967).

While children in the present studies were in some ways atypical of the retardate population, initial imitation training involved a considerable investment of time such that, in a clinical setting, some form of selection would be necessary for individuals most likely to benefit from such training. In practice, criteria for selection are likely to coincide with those for the subjects of this experimental series.

In this text, the term "developmentally retarded" has been used, without diagnostic implications, to describe all individuals (but particularly children)with gross specific or global delays in behavioural development. Children formally diagnosed either as 'autistic' or 'retarded' answer this description, and various studies (e.g. Baer et al., 1967; Lovaas et al., 1967) have indicated the efficacy and probable value of training generalized imitation for the acquisition of novel responses with grossly similar results for children of either given diagnoses. The question, however, remains of the extent to which the imitative behaviours of these two allegedly discrete subject populations differ; answers will probably only be found by empirical investigations that compare the performances of matched groups of retarded and 'autistic' children under various experimental conditions, and few such investigations have been reported.

In analysing Rimland's (1964) check list of 'autistic' symptoms, Douglas and Sanders (1968) regarded failure to imitate another person by the age of three as an item which differentiated 'autistic' from retarded children. This point seems to lack credibility when it is remembered that all the (retarded, rather than 'autistic') subjects of this thesis were all initially nonimitative and certainly over the age of three years! At the same time, however, Douglas and Sanders were commenting on children at rather more advanced levels than the present subjects; this in turn raises the possibility of varying differentiation between populations at different levels of 'ability'. DeMyer, Alpern, Barton, DeMyer, Churchill, Hingtgen, Bryson, Pontius and Kimberlin (1972) directly compared imitation of demonstrated body movement and object manipulation actions shown by groups of 'autistic' and subnormal children, roughly matched in terms of chronological age and intelligence quotient. These authors showed that the retardate subjects consistently achieved higher imitation scores with each type of demonstrated action than the'autistic'subjects. The latter "exhibited relatively specific patterns of imitative deficits. The "autistic" (or "early schizophrenic") children imitated infrequently or not at all when required to duplicate the pure body actions of an examiner. Thus, they might not imitate the body movements of a neurologist when he attempted to induce them to perform tests such as finger to nose, or hopping, although they might hop spontaneously. They could, however, imitate an examiner's use of objects, such as leafing through a book or scribbling" (p.265).

The results of one study cannot be regarded as conclusive, but it is interesting to note that the retardate subjects of the present thesis, although developmentally far more backward than those of the DeMyer et al. (1972) study above, also exhibited high levels of 'generalized imitation' of a variety of actions in the Comprehensive imitation test of Experiment 1, once imitation training had been completed.

A second, similar question also arises: does the imitative behaviour of developmentally retarded children differ from that of 'normal' children, and if so, in what ways? The 'natural' development of imitation in 'normal' children through stages from 3 months to 18 months of age, as described by Piaget (1951) has been outlined in Chapter 3 (p. 43). One clear distinction between 'normal' and 'developmentally retarded' child populations is that the latter may show no imitative behaviour until much later chronological ages than the former, if at all. No evidence is available of possible corresponding 'stages' in the development of imitation by subnormal or 'autistic' subjects. Once again, possible differences in the imitative behaviour of separate child populations could only be determined empirically, by comparing performances of different subject groups under specified conditions. Speculation suggests that particularly fruitful areas for such investigations might be comparisons between populations of:-

a) the amount of information or number of movements in a chain of demonstrated actions that can be successfully imitated on one trial;

b) tolerance of intervals between demonstration of an action and its (reinforced) imitation, and

c) the degree to which subjects are able to abstract and generalize 'themes' of demonstrated actions in subsequent imitation (e.g. "aggression").

There is also the possibility, albeit rather remote at present, that any differences emerging between populations might acquire diagnostic significance and use.

The Literature Review (Chapter 3) has suggested that additional differences between specific subject groups might emerge in the relative influence over imitative behaviours exerted by consequent stimuli and antecedent setting variables. The present series of experiments has shown that both sets of stimuli will control the 'imitative' and 'generalized imitative' responses of a particular subnormal child population, but did not include an assessment of the relative influences of each at any given time as advocated by Martin (1972). Indeed, the wide range of control shown, amongst even these subjects, over imitative behaviour by specific antecedent setting stimuli (e.g. location or model identity), combined with no guarantee of reinforcer strength equivalence, brings the outcome and value of such comparisons into question. Once again, evidence of such differences between subject types could probably only be obtained by direct comparison of group performances; amidst such great individual variations, however, differences between child populations would need to be very marked before leading to convincing conclusions.

Consideration of subjects' experiences between experimental sessions may be necessary to account in part for some individual variations in the degree of generalization to novel location and model (Experiment 3), the number of trials required to reach extinction criterion of 'imitations' when reinforcement was withdrawn (Experiment 2), and levels of retention of imitative performance after a period of no formal training (Experiment 5). After initial imitation training (Experiment 1), the children may have reproduced other actions formally or informally demonstrated by other models outside the experimental setting, and these responses may or may not have been reinforced. In turn, the presence or absence of reinforcement for imitative responses might serve to increase or decrease the probability of such behaviours occurring later, in experiment sessions. In reality, the nursing and other staff of the wards knew the broad purpose of these experiments and may well have been alert for any imitative behaviour and accordingly reinforced such responses. Although these or similar events may have influenced formal experimental results to some degree, from a practical point of view, the experiences of this group are likely to reflect those of other similar children in institutions. The positive reinforcement of imitative responses in new locations and to new models should, however, serve to encourage spontaneous generalization of imitative behaviour to novel 'extra-therapy' settings, essentially in the manner suggested as necessary by Stokes et al. (1974).

This thesis has been primarily concerned with the generalized imitation phenomenon as a general training procedure for use when required to facilitate varied behaviour gains in subnormal children, rather than as a treatment goal in its own right. Thus, all experimental work has taken place in particular, structured circumstances. At the same time, clearly a useful additional gain for the child subjects would be spontaneous generalization of imitative responding to other settings, such that the behaviour came under control of setting conditions outwith the 'discrete trial' formal training situation, and perhaps intrinsically reinforcing for each child. No information, however, is available for the present subjects about such possible generalization. Prolonged noninterventive observation of subjects in their natural surrounds (presumably the ward) with peers and staff would have been required to gain relevant data, and considerable methodological difficulties seem attached to this proposal. For example, the presence of an experimenter recording responses, even if passive and not demonstrating actions, might serve as a cue for imitative behaviour in previously trained subjects; also, as described in Experiment 3, recording equipment might serve as a similar cue. In a 'free response emission' situation, the range of actions that might be demonstrated by models is limitless, thus judges scoring imitative behaviours would have great difficulty, outside the predetermined constraints of 'discrete trial' action demonstrations and time limits, in deciding if particular responses were imitative or not! In conclusion, 'ethological' study of generalization of imitative behaviour appears an interesting area that would probably repay investigation, but is outwith the scope of this thesis.

The present results lend support, with particular reference to subnormal children, to comments by previous authors (e.g. Burgess et al., 1970) who emphasized the essentially durable nature of the 'generalized imitation' phenomenon under a variety of experimental conditions. Various hypothesized 'explanations' have been proposed for why such nonreinforced 'generalized imitative' responses should occur so consistently under laboratory conditions, and these have been described in detail in Chapter 3. Each was based on speculation or experimental data involving the 'imitative response rate' measure only, and from the clinician's viewpoint this is clearly the crucial index of performance. One novel feature, however, of this thesis has been the introduction of an additional measure, that of 'response reaction time', and within the limitations previously indicated (see p.264) this index may also provide information on which to judge the relative merits of such 'explanations'.

Bandura (1969) suggested that 'generalized imitations' occurred in a context of reinforced 'imitations' because subjects were unable to discriminate between the two sets of demonstrated actions; differences in emission rates between 'imitative' and 'generalized imitative' responses were held to constitute evidence of such discrimination. The present series of experiments involved repeated demonstrations of very limited sets of 'training' and 'standard test' actions over prolonged periods, a situation likely to encourage 'discriminative' performance. Most subjects, however, did not exhibit differential emission rates of 'imitations' and 'generalized imitations', and those who did only under specific conditions (e.g. at the end of extinction in Experiment 2, or upon a change of model in Experiment 3) that varied between individual children. Further, even children who did show such 'discrimination' returned to high, stable rates of 'imitative' and 'generalized imitative' responses upon subsequent changes in experimental conditions. Thus, present results support the findings of previous authors (e.g. Bucher and Bowman, 1974; Steinman and Boyce, 1971) who suggested that retardates are well able to distinguish between actions, reproductions of which will or will not be reinforced, while still imitating both sets of actions in the typical 'generalized imitation' paradigm. Interestingly, upon occasion, the reaction time performance measures, also support such a view. For example, during the 'Maintenance' phase of Experiment 2, the groups reinforced on VR4 and CRF schedules both showed no evidence of discrimination, when performance was measured in terms of rates of 'imitative' and 'generalized imitative' responses. In contrast, however, the reaction times of 'imitations' and 'generalized imitations', within each group, showed opposite trends, suggesting some distinction between the different sets of actions by the children in the CRF group. At other times, the trends for mean reaction times of both response sets were congruent, providing no evidence of such 'discrimination'. Hence, in general, these results appear to diminish the credibility of Bandura's 'discrimination' hypothesis of the 'generalized imitation' phenomenon and suggest, rather, that retardate subjects can indeed distinguish between 'training' and 'test' actions but continue to imitate both anyway.

Steinman (1970a, b) proposed that generalized imitation occurred because 'training' and 'test' actions were demonstrated under similar antecedent setting conditions which controlled both subsequent 'imitations' and 'generalized imitations'. In Experiment 3, when location setting conditions were changed, three children showed dramatic loss of 'generalized imitations' only (i.e. "discrimination") in the novel location, thus supporting Steinman; the remainder, it should be noted, did not. In the latter part of Experiment 3, when the identity of the model was changed, the group as a whole did show a larger mean drop in 'generalized imitation' then 'imitation' (i.e. "discrimination" again) but, also again, there were exceptions to this pattern (e.g. Subject 1). Thus, it appears that, even if Steinman's view is correct, the specific controlling stimulus factors (the presence of which prevent 'discriminative' performance) probably differ between subjects.

The comment by Bandura and Barab (1971) about 'social coercion' giving rise to 'generalized imitative' responses may also apply to the present experiments. Each child was collected from his or her ward by the usual model and, after experimental sessions, returned by the same person; this process continued regularly over a number of months and certainly relationships did grow between subjects and experimenter. Thus it seems reasonable to suggest that these children were under some pressure to respond when the experimenter, as the usual model, demonstrated an action. A change of model (in Experiment 3) very much altered the social demands of the situation, and yet only one child (Subject 10) out of twelve exhibited a large decrement in 'generalized imitative' responding while maintaining a high rate of 'imitations' (i.e. showed a "discriminative" performance). Perhaps social coercion operated as a mechanism for one child, but seems unlikely to have done so for the remainder.

Finally, Gewirtz and Stingle (1968) suggested that 'imitative' and 'generalized imitative' behaviours be considered as a single functional response class which can be established and thus defined by extrinsic reinforcement. This view implies that reinforced and 'generalized' imitations should be influenced in closely similar ways by any given treatment, which in turn implies a lack of discrimination between the two sets of responses. The results of Experiment 4 have provided support for this proposal, as have, in a coincidental fashion, those of most subjects during the operations described in this thesis when the imitative response rate measure is considered. Exceptions have been noted, and at times the reaction time performance measure does not concur; as a broad generalization, however, in a practical situation it seems likely that a therapist might expect the 'imitations' and 'generalized imitations' of a retarded child to show the characteristics of a single response class, particularly in terms of response emission rates.

To summarize, the present evidence suggests that different proposed 'explanations' of the 'generalized imitation' phenomenon may account for the performances of individual subnormal children and, further, it cannot be asserted with confidence that a particular single 'explanation' will even apply consistently to any child. The view expressed by Bucher and Bowman (1974) that "these various 'explanations' are not contradictory and emphasize the influence of past and present contingencies on discriminative performance" (p.23) incorporates many of the available data, including that presented in this thesis, within a common framework. In particular, it suggests a possible account of the individual differences in performance noted above. That is, children may have been responding to different aspects of the total stimulus setting. The problem of determining aspects of a complex stimulus situation to which children attended is an empirical one (see, for example, Rincover and Koegel (1975)). Indeed, the present results, rather than allowing definitive statements about relative merits of supposed 'mechanisms' to account for the 'generalized imitation' phenomenon, bring into question the wisdom of attempting such single 'explanations' at all, and rather emphasize the need for flexibility when the performances of individual subjects are considered. In addition, the role of the response reaction time measure as an indicator of discriminative performance may repay further detailed investigation.

Peterson et al. (1971) and Steinman and Boyce (1971) have claimed that generalized imitation is nothing more than an artefact of laboratory experimental procedures. For the clinician, who wishes to use the phenomenon in a therapeutic manner, these views are arguably of secondary importance to its empirically demonstrated effectiveness, albeit under certain specified conditions. Such comments do, however, raise doubts about extension of the paradigm to account for the spontaneous imitative behaviour of children in natural settings. Results from some experiments in this thesis provide demonstrations under laboratory conditions of particular processes that might account for specific facets of imitative behaviour. For example, Experiment 1 suggests that nonimitative children may learn to imitate naturally because they are often reinforced when their behaviour matches that of more skillful models; again, Experiment 4 provides an idealized demonstration of a mechanism whereby children may learn to imitate under selective circumstances only. These instances do not, however, exclude the possibility of other processes that act in natural settings to produce similar performances. In general, the present studies do not allow firm conclusions on the applicability of the 'generalized imitation' paradigm to the behaviour of children under natural conditions.

In a similar manner, the present experiments were not designed to resolve theoretical questions about hypothesized processes (e.g. Allport, 1924; Humphrey, 1921; Mowrer, 1950, 1960; Piaget, 1950; Sheffield, 1961; Watson, 1925; see Chapter 3) underlying imitative behaviour and thus the results are not particularly pertinent and their implications are limited.

Bandura (1968) and Aronfreed (1968) suggested a two phase model of imitation. Firstly, the acquisition of imitative behaviour was said to be based on "observational learning" involving internal representations of perceived behavioural stimuli; once again, these studies shed no light on such a possibility in retardates. Secondly, performance of these acquired behaviours was then said to be primarily controlled by extrinsic, self-administered or vicariously experienced reinforcement. Certainly Experiment 2 has indicated a need for reinforcing stimuli in a situation to maintain the imitative behaviour of retardates. A case could also be made that the present, initially nonimitative, subjects did not show the results of such "observational learning" through a paucity or inconsistency of appropriate reinforcement in their institutional environment (Nawas and Braun, 1970b). This may be so, but if merely contingent reinforcement was needed to elicit imitative behaviour, it is perhaps surprising to note the prolonged number of sessions typically needed (see Experiment 1) to attain high, stable rates of 'imitations' and 'generalized imitations' with these subjects. After such remarks, however, the value must be acknowledged of Bandura's (1968) careful consideration of"interrelated subprocesses" which allegedly influence the degree and content of "observational learning". Consideration of these four components, namely Attention, Retention, Motoric Reproduction, Incentive and Motivation might, in careful analysis, suggest leads to account for the nonimitativeness of many retardates. During the training of the present subnormal children (Experiment 1) it is very likely that, in addition to 'imitations' of 'training' actions, other attentional behaviours (e.g. looking towards the model, or eye contact) were coincidentally shaped and later maintained by the reinforcing stimuli contingent on 'imitations'. Again, the possible limitations imposed by physical handicap on "motoric reproduction" have been previously indicated.

Within its field, this thesis follows in the tradition of Miller and Dollard (1941) and, later, Baer and Sherman (1964) who regarded imitation as an instance of instrumental learning. It seems that social and environmental cues do serve as discriminative stimuli, and the observer's (subject's) responses are differentially reinforced according to correspondence with the model's actions. Eventually, the observer generalizes imitative behaviour to other situations through identification of relevant discriminative cues. Thus, with this population of subnormal, institutionalized children, imitation is seen primarily as contingent upon reinforcement.

To turn to more practical matters, it will be noted that the present limited series of studies stop short of demonstrating the clinical use of imitation in behaviour modification procedures; accounts of such demonstrations (e.g. Lovaas et al., 1967) are available and have been briefly reviewed in Chapter 3. Rather, this thesis has attempted to explore the phenomenon of generalized imitation with subnormal children to increase our understanding of variables that affect it and hence facilitate its use as a practical training method. Clearly these studies have not exhausted the topic and other points remain to be made or clarified:-

1) for experimental clarity, verbal instructions were not used here. It seems likely, however, that for at least some children, the introduction of each trial with 'do this' or 'no' respectively when imitation was or was not required would have enhanced the efficiency of various operations.

2) the methods used in Experiment 1 to train generalized imitation in previously nonimitative children were confined to the use of positive reinforcers contingent on desired behaviour only. There is a suggestion (Mischel and Liebert, 1966, 1967) that combined contingent positive reinforcement of the subject for imitation and aversive stimuli contingent on alternative responses might prove even more efficient for fast training. Provided that a clinically acceptable aversive stimulus could be used, the point would require to be established empirically.

3) the actions demonstrated on each trial in these studies have all been confined to simple behavioural units. In practice (e.g. in training of feeding skills) it would

probably be necessary for a child to reproduce a far more complex series of movements. Only Baer et al. (1967) have investigated the development of behaviour 'chains' through imitation, and that in one subnormal subject. The topic would probably repay further attention, particularly in terms of the amount of information, or number of movements, that can be reproduced on one trial by such children.

4) the experiments in this thesis have followed the mainstream of generalized imitation literature in that, throughout, reinforcing stimulihave been delivered to subjects only, and sessions were carried out with children individually. These specific sets of conditions do not match all the possibilities described in the Literature Review (Chapter 3) and many avenues remain for exploration using the generalized imitation paradigm with subnormal children. For example, does the administration of reinforcement to the model after an action has been demonstrated (either 'vicarious' or 'double reinforcement', see Table 1) enhance imitation training? Also, does passive observation by a child of another subject being trained to imitate (that is, both in the experimental setting together) aid later imitation training in the previously observing child? This latter situation might also provide evidence of "observational learning" (Bandura, 1968) in such subjects.

This thesis has concentrated on the possible use of imitation specifically as a means of aiding acquisition of totally novel adaptive responses by subnormal children. At least one other therapeutic use has been found for such behaviour, however; Gardner (1971) comments that phobic behaviours in retardates and others may be eliminated, either vicariously by observation of a model who engages in feared behaviours or by actual imitation of the model in the activity. Gardner then suggests that in this way the subject does not experience aversive consequences.

Equally, to place the present studies in context, the point needs to be made that behaviour modification techniques form only a part of the therapeutic measures attempted with retardates. As mentioned in Chapter 2, some metabolic and storage disorders associated with subnormality may be alleviated by dietary or biochemical intervention; also, specific conditions (e.g. epilepsy) may be controlled by medication. Particularly for the less handicapped an increasing range of experiences and treatments including hospital schools, physiotherapy, occupational therapy and "activation therapy" (Elvin and Santer-Weststrate, 1974) are becoming increasingly available, each with more or less specified goals varying from definite treatment of specific physical handicap to "stimulation might aid development!" One strength of behaviour modification techniques is that their use compels close observation of the behaviour of the individual subject, combined with rigorous definition of treatment goals and assessment of changes and gains in response patterns; also, as a generalization, such procedures tend to work! If, however, they are to be used to full advantage with all individuals who might benefit, the number of professional personnel properly qualified to apply such procedures will need to be increased, and the training of "nurse therapists" as outlined by Hallam (1975) clearly offers one possible means of augmenting present resources.

Finally, comments by the nursing staff suggested that both during and after training of a particular behavioural skill, the child subjects also showed some sort of accelerated progress in other spheres of development. Certainly the staffs' perception of the children's behaviour changed favourably. The present reported experiments were not designed to provide possible hard evidence of such less specific changes in behaviour; all the children showed steady, if slow, development over the total experimental period when monitored by the Vineland Social Maturity Scale and Primary Progress Assessment Chart, but as no control group was used, no firm conclusions can be drawn as to the cause of this improvement.

One explanation of the nurses' comments might be as follows: during initial imitation training (Experiment 1), as previously pointed out, a variety of additional behaviours (e.g. eye contact, or attending to an adult) may also have been shaped concurrently with the specific imitative responses. Further interactions between the experimenter and individual children while transporting them to and from the wards for each session may also have established new social responses in these subjects; for example, most of the children learned to hold out their arms to be picked up when first collected. Once established, these behaviour patterns could well have generalized to other members of the hospital staff.

Secondly, Wahler (1975) has suggested that diverse behaviours in a child's repertoire may be organized into functional "clusters" of regularly occurring interrelationship between responses and events comprising the child's social environment. Thus such 'clusters' would describe "natural covariations" (either positive or negatively correlated in frequency) among behaviours and any environmental events. Wahler demonstrated the existence of "clusters" with "deviant, problem behaviours" of normally developed children, and went on to comment on "the situational nature of child behaviour" (p.41). Similarly, with the present subnormal subjects, the responses shaped during imitation training may have "clustered" with other socially beneficial behaviours not obviously connected with imitation at all.

However, whatever the explanation for reported changes in the subjects' behaviour, the consequent impact on the nursing staff's view of these children was marked. That children who had been previously unreactive now responded to social overtures and stimulation seems to have made interactions with these individuals more reinforcing for the nurses; this in turn encouraged further contact and more positive relationships between children and staff. Clearly the possibility of other tangential gains consequent on training programmes for particular skills is an important topic on which more information is required. Equally, the implications of changes in nurses' attitudes towards patients, both in terms of benefits to institutional inmates and staff morale should not be missed.

As a concluding remark to this thesis, perhaps the present experimental work adds in small measure to a conclusion put forward in a recent Scottish Education Department Document "The Training of Staff for Centres for the Mentally Handicapped" (1973): given appropriate resources and personnel "the existing practice of designating severely mentally handicapped children as ineducable or untrainable is no longer justifiable and no child should be categorized as ineducable" (p.35).

## SUMMARY

This chapter attempts a synthesis of the results from separate experiments described in this thesis. Four main conclusions emerge:-

1. Present results confirmed findings from previous studies of generalized imitation with retardates.

2. As a broad generalization, for practical situations a therapist may expect 'imitations' and 'generalized imitations' of a retarded child to show, with minor exceptions, the characteristics of a single response class when response emission rates are considered.

3. This single response class of imitative behaviours is affected by various operations much as many other single responses in most previously published laboratory and applied behaviour modification studies concerned with the behaviour of young developmental retardates.

4. Rather than allowing definitive statements about relative merits of supposed individual 'mechanisms' to account for the 'generalized imitation' phenomenon, the present results bring into question the wisdom of attempting single 'explanations' at all. They emphasize the need for flexibility when the performances of particular subjects are concerned, with particular emphasis on specific variables which may control differential, emission rates between 'imitations' and 'generalized imitations'.

Possible implications, albeit limited, of present results are considered for other theoretical views of imitation, clinical practice, and the behaviour of subnormal children in natural settings. Further areas of possible research are indicated.

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