NATURALISTIC ANTECEDENT CONTROL AS A POSITIVE FACTOR IN THE GENERALISATION OF NEWLY ACQUIRED "PLAY" BEHAVIORS IN AUTISTIC CHILDREN

By

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Abstract

Four developmentally handicapped (autistic) boys in a treatment centre for behavior disordered children were taught to perform colouring and block-assembly "play" responses within the discrete trial format training paradigm. Two specific training strategies were compared, one using naturalistic, materials-presentation antecedent cues, and the other contrived, verbal ones. Generalisation across comparable tasks with only naturalistic cueing was probed. Findings indicated that, with all participants, the choice of antecedent cues for training which were found in the generalisation condition was strongly related to the degree to which learning carried over. These results are discussed in context of a behavioural contrast account of failures to generalise, and suggestions for future remedial practice based upon the related topics of behavioural contrast and antecedent control are offered.

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CHAPTER 1

STATEMENT OF THE PROBLEM

In their everyday practice, educators, psychologists, behaviour analysts and others who provide remedial services to the developmentally handicapped constantly face the problem of generalisation. Clearly, few would dispute that the introduction of the methods of behaviour analysis to practitioners in their fields of education and clinical psychology has produced quantum change. Yet, it has often been observed that the burgeoning technologies of behaviour change and instruction have not been matched by comparable growth in our ability to maintain and generalise the improvements witnessed in the performance of our handicapped clients (Koegel, Egel & Dunlap, 1980; Mirenda & Donnellan, Note 4; Stokes & Baer, 1977; Warren, Rogers-Warren, Baer & Guess, 1980; Wexler, 1973). As Warren, et al. (1980) worded it, "The task that now remains for both researchers and educators is to develop a technology for ensuring that both new skills and behaviour changes extend and maintain outside of training" (p. 227).

Most would agree that one of the more noteworthy differences between developmentally handicapped children and their normal peers is in the area of "play". This activity has been the focus of great attention in the fields of developmental psychology and education and the term (play) carries many connotations, depending upon the theoretical biases of those who observe play behaviour. Behaviourists (cf. Bijou & Baer, 1978) who examine child development tend to

emphasize the operationalisation of "play" behaviours and their functional relations to events in the environment. Psychoanalytic investigators on the other hand provide elaborate inferences about intrapsychic function -- indeed, Ekstein and Caruth (1976) have suggested that "[play] enables [the child] to master the passively experienced traumatic events of his macrocosmic real world by actively repeating them in his microcosmic play world" (p. 311). From a social validation perspective (Wolf, 1978; Woods, 1983b), it would seem that to many parents and teachers of the developmentally handicapped, some form of topographic correspondence to the "play" behaviour of "normal" children suffices to define "play". While it may not be possible at this time to train these children to play in as complex and as varied a way as do their normal age-mates, it has certainly been possible to create repertoires of responding which share some important and visible similarities with those play patterns (cf. Koegel, Firestone, Kramme & Dunlap, 1974; Wells, Forehand, Hickey & Green, 1977). This investigation has therefore approached the issue of defining "play" generally from the behaviour analytic perspective, relying upon social validation (as described above) to guide the choice of target responses to operationalise as "play" behaviours. Quotation marks are therefore used here to set the "play" behaviours created in training for handicapped children apart from those which arise naturally in the development of non-handicapped youngsters.

As is the case in all areas of functioning where skills are developed and behaviours are changed, the issue of generalisation is central in the creation of a "play" repertoire.

CHAPTER 2

STATEMENT OF THE RESEARCH OBJECTIVES

Given that programming for generalisation is one of the most significant challenges confronting the practitioner who serves the developmentally handicapped, this research will seek to (a) theoretically reconceptualise problems of generality and certain attempts which have been made thus far to remedy them; (b) derive from this theoretical analysis a systematic strategy (based upon the role of antecedents in instruction) to promote generalisation in performance; (c) apply the strategy to the development of specified "play" responses in developmentally handicapped children; (d) evaluate the effectiveness in promoting generality which accrues to the use of the strategy; (e) make suggestions as to the implications of the findings of the study for future remedial practice; and (f) make recommendations as to possible changes in methodology for future investigations of this topic, together with suggestions as to other possible research endeavours in this area.

CHAPTER 3

REVIEW OF THE LITERATURE

Current Views on Programming for Generality

Trends in the education of the severely handicapped learner have recently shown a change in emphasis. The historical tendency to build curriculum and instruction around developmental, academic priorities has begun to shift in the direction of functional programming (see Brown, Branston, Hamre-Nietupski, Pumpian, Certo & Grunewald, 1979) -- programming which derives its priorities from explicit surveys of the competencies required by the student to function in relevant environments. These changes in approach have brought with them a need for corresponding changes in instructional technology. This need is immediately apparent when we consider the conditions under which handicapped learners, notably the autistic, are taught. In large measure, the trend away from teaching such individuals under simulated conditions in classrooms and then passively awaiting generalisation derives from the recognition that generalisation does not occur spontaneously. Stokes & Baer (1977), after cataloguing and analysing existing knowledge pertaining to generalisation, suggested that " . . . perhaps the most pragmatic orientation for behaviour analysts is to assume that generalisation does not occur except through some form of programming . . . " (p. 365).

In their analysis of the currently implicit technology of generalisation, Stokes & Baer (1977) provided nine general categories within which current practices fall, viz: Train and Hope; Sequential

Modification; Introduce to Natural Maintaining Contingencies; Train Sufficient Exemplars; Train Loosely; Use Indiscriminable Contingencies; Programme Common Stimuli; Mediate Generalisation; and Train "to Generalise". As in most operant methodology, the right-hand, consequence side of the three-term paradigm of operant learning is most heavily emphasized. For the purposes of this study, the following strategies specifically will be examined in greater detail: Use Indiscriminable Contingencies, Introduce to Natural Maintaining Contingencies, and Programme Common Stimuli. These have been chosen because of their apparent linkage to the problem of behavioural contrast -- the nature of that relationship is explicated in the pages that follow.

A common differentiator of training and post-training environments is the scheduling of reinforcement found in each. As a general rule, settings which are constituted for the purposes of changing behaviour or building skills will employ richer reinforcement scheduling; the reinforcement practices of personnel there also tend to differ from their counterparts in non-training settings in terms of reinforcer magnitude, latency, and so forth. Stokes & Baer (1977) argue that to the extent that we can minimise these differences in scheduling, we may anticipate greater generality. In their words, "If contingencies of reinforcement or punishment, or the setting events that mark the presence or absence of those contingencies, are made indiscriminable, then generalisation may well be observed" (p. 358). This approach to generalisation is referred to as Use Indiscriminable Contingencies.

Closely allied to the foregoing is a strategy described as Introduce to Natural Maintaining Contingencies. This has appeared elsewhere in the literature under the slightly different designation of "Behavioral Trapping" (cf. Baer & Wolf, 1970). The approach involves the deliberate use of stable and natural contingencies "that can be trusted to operate in the environment to which the subject will return, or already occupies" (Stokes & Baer, 1977, p. 353); in effect, a subject is "trapped" insofar as he/she is taught responses using the reinforcers found in natural settings, thereby ensuring that his/her responding will persist (and hopefully diversify) under the control of those reinforcers in the post-training environment.

The other most directly relevant strategy for encouraging generalisation in the Stokes & Baer (1977) paper -- namely, Programme Common Stimuli -- is the only one (other than Use Indiscriminable Contingencies) which directly attributes major significance to response antecedents. Under this heading, the authors describe various studies where the generality of learning appears to have been influenced by the extent to which ambient stimuli present in a training environment were represented in a post-training environment. For example, Rincover and Koegel (1975) were able to enhance the generalisation of imitative and instruction-following repertoires in four autistic children by carrying over certain stimulus features of the training environment (such as tables and chairs) to the post-training setting. Similar findings were obtained by Koegel & Rincover (1977) and Walker & Buckley (1972).

A Theoretical Analysis of Problems in Generality

Critics of behaviour analysis (e.g., Westby, 1966) have wrongly decried it as an atheoretical enterprise, and therefore lacking the standing and promise of a true science. While this position has been successfully challenged by many writers (cf. Baer, Wolf & Risley, 1968; Hineline, 1980; Michael, Note 1; Paniagua & Baer, 1981; Skinner, 1969; Woods, 1980a, 1983a), it is generally acknowledged that practitioners of applied behaviour analysis devote less time than is desirable to the problem of linking their methods and findings to basic principles (see Deitz, 1978; Hayes, Rincover & Solnick, 1980; McReynolds, 1978; Pennypacker, 1981; Pierce & Epling, 1980; Woods, 1980a, 1982, 1983a, 1983b). In keeping, therefore, with the practice of deriving a rationale for intervention from interlocking theoretical and empirical analyses, a theoretical foundation for the generalisation-promoting strategy employed in this research is here presented.

The approach to facilitating generalisation which is applied in the present study is based upon what might be described as a "behavioural contrast" interpretation of failures to generalise. Reynolds (1961a, 1961b, 1961c, 1961d) and others (Brethower & Reynolds, 1962; Catania, 1979; Hanson, 1959; Johnson, Bolstad & Lobitz, 1976; O'Brien, 1968; Waite & Osborne, 1972) have shown that when an organism discriminates a difference between contingencies of reinforcement for the same behaviour in separate settings, the strengthening of responding in one setting (analogous here to the treatment environment) is followed by a concomitant weakening of responding in the other (analogous here to the non-treatment environment). This occurs despite

the absence of any systematic changes in the reinforcement contingency in the latter, adversely affected setting. Teachers and behaviour therapists will immediately recognise in this the all-too-familiar case of the child whose improvements at school are accompanied by reports of deterioration at home. Others (most notably Gross & Drabman, 1981, and Koegel, Egel & Dunlap, 1980) have raised the subject of behavioural contrast in their discussions of problems in generalisation.

The analysis advanced here proposes a synthesis of the knowledge currently available concerning behavioural contrast in the context of the three strategies for promoting generalisation (as described by Stokes & Baer, 1977) highlighted above. Specifically, it is the contention of the author that, individually, each of the strategies in question functions as it does because it serves to mitigate the effects of behavioural contrast upon the generalisation of learned behaviour.

Use Indiscriminable Contingencies. Inasmuch as behavioural contrast derives, as a phenomenon, from discriminability in the contingencies of reinforcement across environments or sets of conditions, any strategy which seeks to reduce or eliminate that discriminability might reasonably be expected to weaken the probability that a behavioural contrast effect will be observed.

Introduce to Natural Maintaining Contingencies. Rincover & Koegel (1975), Koegel & Rincover (1977), Walker & Buckley (1972) and Woods (1980b, Note 2) have all systematically observed that the probability that learning will generalise is directly affected by the

presence (in the generalisation environment) of ambient stimuli found in the training environment. In particular, however, Koegel & Rincover (1977) were able to show that noncontingent reinforcement, as an ambient stimulus factor, enhanced the generality of performance when it was introduced randomly into the generalisation setting. From this we may conclude that, in addition to the trapping phenomenon described above, the presence of stimuli in the transfer setting which are familiar from the training setting functions to produce a net reduction in the degree of contrast between the two. Note here that the stimuli common to both settings are in fact introduced as part of consequence/contingency operations, yet necessarily become part of the ambient stimulus array. These stimuli may therefore be seen as setting events, which by their presence in both environments, lose their ability to differentially "mark the presence of absence of . . . contingencies" (Stokes & Baer, 1977, p. 358).

Programme Common Stimuli. Rincover & Koegel (1975), in an approach very similar to that described above, systematically carried ambient stimuli (such as tables and chairs) from a training environment to a post-training one, and observed measurable improvements in the generality of learning. This method differs from the foregoing in that these stimuli were strictly ambient (as opposed to contingency related) stimuli in the training setting, just as they came to be ambient stimuli in the post-training setting. Again, by virtue of their appearance in both settings, these ambient stimuli could not potentiate subjects' discrimination of the presence or absence of contingencies.

The foregoing argument has attempted to collapse under one rubric three formerly separate strategies for the promotion of generalisation. That rubric could be phrased, "Mitigate the Effects of Behavioural Contrast," of which Use Indiscriminable Contingencies, Introduce to Natural Maintaining Contingencies, and Programme Common Stimuli are individual instances. To these might be added a fourth, new strategy entitled Programme Common Antecedents. This strategy differs from those previously listed to the extent that it isolates the discriminative stimuli explicitly manipulated in training as a special class of stimuli. The distinction is most easily drawn if the term "antecedents" is taken to refer to stimuli which are introduced into the environment specifically for training purposes, whereas "ambient stimuli" describes those which are present and more-or-less incidental to the behaviour change/instructional process.

Programming Common Antecedents: The Present Strategy

It has been observed that, traditionally, many antecedent cues are of a highly contrived nature in the instruction of the severely handicapped (Falvey, Brown, Lyon, Baumgart & Schroeder, 1980; Mirenda & Donnellan, Note 4). This project therefore commenced with an informal examination of the play behaviours of "normal" toddlers, with one eye to the degree to which the cues which set these behaviours in motion are "natural" or "contrived". It was noted that when entering a room, or happening upon a toybox in a corner, a toddler will typically display a play response, spontaneously. Periodically, mothers or other caregivers will respond with some form of social reinforcement, sometimes entailing an elaboration of the child's first

response. For example, a child who, upon creating a two-piece block assembly is observed to have done so by an adult, is likely to be told, "Oh, aren't you clever! Let's see if we can't make a big tall building like the one where Daddy works?", whereupon the adult guides the child through an elaboration/extension of his first response. Similar exchanges are witnessed between parents and young children engaged in many types of early play behaviour. The sequence where a child's play response is followed by a parent's reinforcement and elaboration tends to be observed most often; hence, the spontaneity of play behaviour in normal children is seldom a source of concern to their parents. Children with developmental handicaps, on the other hand, are often described as demonstrating little "spontaneous" play (Wing, 1971). More importantly, even after intensive intervention, autistic children in particular continue to have major difficulties in maintaining and generalising the adaptive repertoires built for them in therapy (Lovaas, Koegel, Stevens & Long, 1973).

It is interesting to compare the interactions in "normal" families described above to those which typically obtain between behaviour-disordered children and their therapists, parents, etc. The same type of informal observation discloses that a much higher proportion of the behaviour of the handicapped child is under verbal antecedent control. During his time in the playroom, the developmentally handicapped child is frequently redirected to his toys, reminded where his books are, instructed to follow step A with step B. Without this constant verbal cueing, he tends to be at best inactive, or often off-task and disruptive.

Instructional programming for children with severe behaviour and learning disorders has become highly systematised and has had impressive results. The discrete trial format (DTF), for example (Koegel, Russo & Rincover, 1977; LaVigna, Traphagen, Allen, Cooke & Appoloni, 1978), has been employed to great advantage with autistic and other behaviour-disordered children. Like most operant approaches to explicitly teaching language, DTF specifies distinct (antecedent) discriminative stimuli, target responses, and consequent stimulus events. Most often, the antecedents are verbal (Lovaas, 1977, 1981); indeed, hierarchies or "levels of assistance" in training procedures typically designate verbal cues as the least intrusive (Fredericks, Riggs, Furey, Grove, Moore, McDonnell, Jordan, Hanson, Baldwin & Wadlow, 1976). To the extent then that type of antecedent control appears to be a reliable discriminator of training and post-training settings, it is suggested here that antecedents as a special class of stimuli may bear examination and manipulation as a unique fourth case of the strategy described above as Mitigating the Effects of Behavioural Contrast. By bringing the learner's behaviour under "natural" stimulus control in training, it may then be reasonable to expect better transfer to post-training conditions. In a word, if developmentally handicapped autistic children perform poorly outside training conditions, perhaps it is because we train them to attend and respond to verbal cues when, so often, post-training environments supply non-verbal ones.

Woods (Note 3), in the pilot project for the present study, conducted the only other comparable research examining relationships between types of antecedent control and the generality of learning. In that investigation, two autistic children with limited repertoires

of expressive language were taught to emit verbal tacts under two experimental conditions -- one employing contrived antecedents in the training process, and the other employing so-called naturalistic antecedent stimuli. Specifically, in the contrived condition, language descriptive of the environment on walks or of the pictures in storybooks was evoked by queries such as, "What do you see there?" or "What is happening on this page?". On the other hand, in the naturalistic condition, the descriptive language was occasioned by pauses and "expectant looks" as the antecedent stimuli. It was found that although acquisition was more rapid when verbal antecedents were employed, the generality of the learning taught under naturalistic stimulus control was in fact substantially better.

CHAPTER 4

METHOD

Response Definitions

Two sets of related play behaviours (comprising the main dependent variable) were chosen as target responses in this investigation. They were operationalised as follows:

1. Colouring-1 (using a large wax crayon and a single page from a commercially available colouring book). A response was scored if the participant (with a back-and-forth and/or circular action) caused a visible mark to be made within any distinct area of a figure outlined on a single page of a colouring book. Such distinct areas were set apart from one another by border lines and/or by indentity (e.g., head, arm, torso, hand, etc.)
2. Colouring-2 (using a small "wipe-off" crayon and "wipe-off" colouring book). A response was scored if the participant (with a back-and-forth and/or circular action) causes a visible mark to be made within any distinct area of a figure outlined on a single page of a "wipe-off" colouring book. Such distinct areas were set apart from one another by border lines and/or by indentity (e.g., legs vs. rungs of a pictured ladder).
3. Assembly-1 (using large bristle blocks of multiple shapes). A response was scored if, by manual manipulation, the participant caused two or more large, multiply-shaped bristle blocks to be fitted together with sufficient force as to remain together after

the participant's hands had been withdrawn. Specifically, the number of "interfaces" between blocks were counted and recorded for each trial.

4. Assembly-2 (using small bristle blocks of uniform shape). A response was scored if, by manual manipulation, the participant caused two or more small, uniformly shaped bristle blocks to be fitted together with sufficient force as to remain together after the participant's hands were withdrawn. Specifically, the number of "interfaces" between blocks were counted and recorded for each trial.

Participants and Participant Selection

Participant number 1, Roger, is a 7.11 year old boy who was admitted to a treatment centre for behaviour-disordered children approximately five months prior to the beginning of this investigation. Roger was described by the local Diagnostic Centre as being a child with "infantile autism and delayed development" -- major presenting complaints at the time of admission related to hyperactivity, limited language, aggressive and destructive behaviours, and a tendency to engage in high rates of self-stimulation. His self-stimulatory rituals included repetitive "sifting" of small objects and dashing from one location to another.

Roger displays few if any normal play skills and both his natural parents and his temporary foster parents have expressed a desire to see him develop the ability to amuse himself in a more productive, independent fashion.

Jerrold, participant number 2, is a 4.5 year old boy who has been a residential client of the treatment centre for approximately six months. Jerrold is the child of a single parent who lives in a small community in the northern part of the province; although his problems in functioning are considerable, it is likely that were his family to live within a reasonable distance of the centre, he would, like Roger, have taken his place in the day programme. This boy was initially referred to the Child Development Centre in his own community because of a diagnosed "severe behaviour disorder and language delay." The staff of that centre, as well as an inservice resource team which provided them consultation and training, agreed that Jerrold required more intensive service than he was receiving in his home community -- hence the referral to the treatment centre. His delays in self-care skills, language and social behaviour, in addition to his self-injurious face-hitting and tantrum responses were the main precipitating factors in that decision. Like Roger, Jerrold displays few independent play skills and so claims a significant amount of adult attention throughout most of the day. The development of an independent play repertoire of some kind was considered essential to prepare him for his return home and to the school system.

The third participant, Tony, was admitted to the residential programme at the centre two years, 11 months prior to the commencement of this investigation. He had been diagnosed as autistic, although it was suggested that some of his autistic features and skill deficits may be secondary to "organic damage". This has not been verified, however. Tony is 8.1 years of age, has a normal monozygotic twin

brother, and a sister one year his junior. The major presenting complaints at the time of Tony's admission were related to his extremely violent aggressive and tantrumous behaviours; in addition, he displayed many digital stereotypies and a variety of forms of self-stimulatory screaming and noise-making. Tony's tantrums and aggression have been virtually the most challenging of those seen at the treatment centre and have dominated his programming over his stay as a residential client. Concurrently (behaviour management issues permitting) instruction has been provided in self-care skill development (i.e., dressing, feeding, toileting) and communication. Significant progress has been seen in these two areas, particularly since the rates of aggression and tantrumming have declined. Tony has essentially no "play" skills and so the development of some independent, self-directed leisure behaviours is considered a priority for him.

Nigel, the fourth participant, was admitted 19 months before this investigation commenced and is 10.7 years of age. He has been diagnosed as having autistic features and a severe behaviour disorder in association with tuberous sclerosis. Like Tony, Nogel's temper tantrums and his severe self-injurious head banging and face slapping behaviours received the major part of the emphasis during most of his time at the centre to date, with some concurrent programming in self-care and communication. Nigel's "play" repertoire consists essentially of repetitive page-turning behaviour with books and catalogues.

Formal standardised testing, because of problem behaviour, could not be conducted in conventional ways with any of these boys. Comments such as "whether or not a general cognitive retardation is also involved is not determinable at present, although he is clearly functioning

in the MR range" (taken from a psychological assessment in Roger's file) is typical of the contents of such reports for these, and most other clients of the facility.

Roger and Jerrold were chosen as participants for this investigation primarily because the development of generalised "play" behaviours is considered a priority in their programming. Since Roger and Jerrold have each been admitted to the centre relatively recently, they have as yet received comparatively little intervention, of which none has addressed the question of play in particular. Tony and Nigel, on the other hand, have been residential clients for considerably longer. While the evolution of a repertoire of "play" behaviours is similarly a priority for them, this area has had to take second place to the extensive difficulties in behaviour management, self-care, and communication described above.

Experimental Design

Training sessions were conducted approximately four times weekly, each of which consisted of one block of five trials on each of the experimental tasks. Training data are therefore charted in terms of the number of independent target responses per five-trial session. The investigation employed a Multiple Baseline Across Subjects and Behaviours design (Bailey & Bostow, 1979) to assess the impact of training upon the above-described play behaviours of the four participants. This design is described (by Bailey and Bostow) as a variant upon the Multiple Baseline designs presented by Baer, Wolf & Risley (1968) and Hersen & Barlow (1976) and has appeared in other research (cf. Briscoe, Hoffman & Bailey, 1975; Woods, Note 3). Baseline

measurement of pre-treatment performance was conducted on all tasks for all four participants, but was extended for an additional block of five trials for each successive participant to satisfy the "temporal stagger" requirements of the multiple baseline design (Hersen & Barlow, 1976). The design also incorporated a Multiple Probe Technique component (cf. Horner & Baer, 1978) to assess the comparative effects of the naturalistic vs. contrived antecedent cue conditions upon generalisation of the play repertoires built in training. Specifically, at every fifth training session, five generalisation probe trials per task were randomly intermixed with the training trials to determine the extent of transfer. Generalisation probe data are superimposed in histogram form) upon training data plots to aid in visual inspection analysis of the results of this research (cf. Parsonson & Baer, 1978).

The small N (4) which characterises this investigation was not considered restrictive in view of the fact that the design is derived from an established single-subject methodology (cf. Baer, Wolf & Risley, 1968; Bostow & Bailey, 1979; Hersen & Barlow, 1976; Horner & Baer, 1978; Sidman, 1960). That methodology is arguably superior to group comparison approaches in research such as this because it is most responsive to intra-subject variability, while not suffering the problems of averaging effects which are associated with traditional group comparison designs (Bergin & Strupp, 1972; Chassan, 1967; Hersen & Barlow, 1976). Because this study replicates across a total of four baselines per task (one for each participant), it conforms with the recommendation of Hersen & Barlow (1976) that "a minimum of three to four baselines [be employed] if practical and experimental considerations permit" (p. 227).

With respect to the multiple-probe comparison component, Horner & Baer (1978) have highlighted advantages over continuous baseline measurement primarily with respect to reactivity. Precedents for the use of this multiple-probe analysis in other studies of generalisation are common in the literature (see Baer & Guess, 1971; Streifel, Bryan & Akins, 1974; Streifel & Weatherby, 1973).

Training and Probe Procedure

As described above, this investigation examined the play behaviour of the participants when exposed to predetermined, chronologically age-appropriate toys. Specifically, participants were taught to colour within specified boundaries in books and on worksheets, and to assemble two types of bristle blocks into multi-block combinations/shapes. Two distinct criteria were set in advance to determine the termination of training. The first (which was actually employed), related to arrival at the point where four generalisation probe sessions had been conducted. The choice of this criterion was based upon a concern that an excessive number of generalisation probe trials (with their necessarily "scaled down" reinforcement) may in fact become reactive -- specifically acting to extinguish previous learning (see Horner & Baer, 1978, for a discussion of the advantages of the multiple probe design with respect to this problem of potential reactivity). Second, a decision to terminate would alternatively have been based upon there appearing 13 out of any 15 successive data points in a declining trend, had such a trend been witnessed. It has been noted elsewhere (Ritvo, 1977; Woods, 1981) that acquisition patterns in the autistic/severely behaviour disordered do not always conform to linear types of analysis; sporadic peak and

plateau patterns are often recognised in the performance data of such individuals. Therefore, a rather large quantity of poorly-trended data was chosen here to define a contraindication for continued training. Data which represent a "plateau" were not included in this criterion for similar reasons; in addition, there is some evidence in the literature to support the contention that "consolidation" effects accrue to overtraining, despite the absence of positively trended acquisition data (Chasey, 1971; Mandler & Kuhlman, 1961; Van Houten, Note 6). The likelihood that overtraining effects might serve to confound the independent variable under study with respect to generalisation is considered minimal in context of the negative findings (with autistic subjects) of Britten, Schreibman & Baer (Note 7).

Tasks. As the response definition section above discloses, participants in this study were taught specific colouring and assembly play responses. Tasks were counterbalanced across subjects, viz: two children were trained to colour individual pages from a commercially available book with a large wax crayon (generalisation probes conducted with smaller "wipe-off" crayon and "wipe-off" books) whereas the two others were trained with "wipe-off" books and smaller "wipe-off" crayons, and probed for generality in their performance with the wax crayon and the colouring book pages. The pattern was essentially the same on the second task -- that is, the participants were taught to assemble multi-block structures using two types of block-assembly material. Two participants were trained with larger, multiply-shaped bristle blocks, with generalisation to smaller, uniformly shaped bristle blocks probed; the two others were trained on small,

uniformly shaped bristle blocks with probes for generality conducted using the larger, multiply-shaped ones. This counterbalancing of the training/probing status against actual tasks was done to control for any systematic effects which might be attributable to unexpected inherent differences in the tasks themselves.

Cue Conditions. This study specifically proposed to examine differences in the generalisation of play behaviours occasioned by two distinct types of antecedent stimulus or cue. Training within the contrived cue condition employed verbal antecedents, whereas training within the "naturalistic" cue condition employed a "materials presentation" type of discriminative stimulus (S^d) similar to that reported by Halle, Marshall & Spradlin (1979). Specifically, contrived verbal cues consisted of trainer requests such as, "It's time to play" or "Let's build a tower." Natural cues, on the other hand, consisted of a simple placement of the task materials on the table within the child's reach. Training cue conditions were also counterbalanced over tasks. Table I presents all information regarding the counterbalancing of participants, cue conditions and tasks.

Training and Generalisation Probes. Given the differences in cue conditions described above, the remainder of the training process followed conventional operant training lines. Sessions commenced with the trainer and participant seated on stools opposite one another, with a desk-level table between them. Each trial began with the trainer delivering the S^d (whichever was appropriate according to condition) following which a limited hold of 5 seconds then came into effect. If the child began to exhibit a target response (e.g., if he produced a

coloured mark at least partially within the designated boundaries or if he succeeded in fitting two or more block-materials together) within the limited hold of 5 seconds, he was reinforced with a form of 'sustaining social reinforcement' such as "good . . . very good" so as not to artificially limit the quantity of his performance. When a period of 5 seconds of no further activity passed, the child's responding was deemed to be finished and he was reinforced vigorously (i.e., with a physical component such as a pat-on-the-back) for his play behaviour in a manner which, by modeling, also expanded upon what the child himself had done (e.g., "Yes, that's the idea . . . let's see if we can fill in a few more of these squares" or "Very nice . . . if we add a couple more of these here, we'll have a really big tower!"). Specifically, the trainer guided the child's hands to completion of a more elaborate response, be it a larger number of coloured areas or a larger number of connected blocks. On occasions where a child either failed to respond within the limited hold of 5 seconds, or displayed materials-related behaviours which were tangential to the target responses, a response was modeled by the instructor in a fashion similar to that found in the mand-modeling procedures reported by Rogers-Warren & Warren (1979) and Halle (Note 5). Response-modeling closely resembled the elaboration feature of the reinforcement described above. Specifically, again, by guiding the participant's own hands, block-assembly or colouring target responses were prompted to completion. Following the execution of the response (independently or with prompting, as the case may be), the trial was considered to be terminated, at which point a 10 second intertrial

interval began. In the case of the contrived antecedent condition, the instructor simply turned aside and marked the trial data; however, under the naturalistic antecedent condition, the training materials were also removed from within the participant's reach at trial-end so that they could be placed back on the table (as the materials-presentation S^d) for the next trial. This training paradigm, including the durations for intertrial intervals, limited holds, and so forth, derives from established discrete trial format convention, as reported by researchers such as Koegel, Russo & Rincover (1977) and LaVigna, et al. (1978).

Whereas training was conducted under either contrived or natural conditions, generalisation probes always employed natural cues, on the presumption described above that non-verbal antecedents are more common in settings and situations to which play behaviours must ultimately generalise. Such probes were run after every five training sessions, and were identical to the training under the natural cue condition with the exception that they were randomly intermixed with training trials on a "probe day". To minimise the likelihood that the probe trials would result in adventitious training (or indeed in extinction) only one randomly chosen probe trial per probe day was reinforced in a manner considerably scaled down to "maintenance" proportions (i.e., essentially the same as the "sustaining" reinforcement described above, and in the section below on Reliability). As well, no response-elaboration figured in the reinforcement applied on generalisation probes, again, to minimise the potential for their becoming training trials.

Second order generalisation. In addition to the probes for generalisation described above, spontaneous carry-over to free-play situations which routinely occur at lunch and coffee-break times was assessed. The supervising staff members at those times were trained to observe and record any of the target behaviours which occurred. The experimental materials were left available in the play area at such times.

Reliability of Measurement

Reliability of measurement was assessed independently by recorders naive to the purposes of the study. Reliability probes were conducted in all phases, all conditions, and across all participants. Block assembly responses were measured concurrently by a reliability checker during the sessions; however, because of the difficulties associated with scoring the colouring performance (related to the time required), coloured sheets were evaluated at times outside the actual sessions. Interobserver agreement was calculated with a formula which divides agreements by the sum of agreements and disagreements, and multiplies the resulting figure by 100. Table II presents the reliability coefficients broken down according to task and experimental condition.

Insofar as it has been recently argued that independent variables in applied behaviour analysis have received insufficient attention with regard to reliability (Peterson, Homer & Wonderlich, 1982), this study also included probes to verify conformity of instructor performance with the specifications for discrete trial instruction described above. Specifically, the following instructor behaviours (independent variables) were recorded:

1. Cue condition. A naturalistic "materials presentation" cue was recorded if the instructor initiated the learning trial by moving the training materials from a position out of the participant's reach to a position well within his reach. Conversely, a contrived "verbal" antecedent was recorded if throughout the session the materials remained within the participant's reach and the instructor initiated the learning trial with a verbal instruction such as "Colour" or "Build a tower."
2. Limited hold. All training was conducted in close proximity to a quartz clock which is equipped with a sweep second hand. The targetted 5 seconds of limited hold were recorded if a maximum period of 5 seconds (+/- 1 second) elapsed between the introduction of the instructional cue and the emission of a response by the participant.
3. Response termination. A response was recorded as terminated if 5 seconds of non-target responding elapsed after the commencement of target responding.
4. Prompt. The participant's response was recorded as having been prompted if, following 5 seconds of limited hold, or the emission of an off-task response within the limited hold, the instructor grasped the participant's hands and guided him to execute the target response.
5. Sustaining reinforcement. The delivery of ongoing sustaining reinforcement was recorded if the instructor made comments such as "Good . . . that's a nice job" while the participant was engaged in target responding.

6. Post-termination reinforcement. The delivery of post termination reinforcement was recorded if the instructor provided a combination of "animated" social reinforcement and physical feedback (such as a tousling of the hair, handshake, etc.) followed by a brief modeling/elaboration of target responding (i.e., guidance of participant's hands in fitting more blocks together, or in colouring more uncoloured areas, etc.).
7. Intertrial interval. The presence of an intertrial interval was recorded if a minimum period of 10 seconds of non-instructional time (i.e., no delivery of antecedents, modeling, prompting, and/or responding) elapsed after the termination of the reinforcement component of the preceding trial.

Reliability of the independent variable is expressed in terms of the conformity of the trainer's actual instructional performance to the above specifications. Percentage conformity figures are provided for each of the seven characteristics of instructional behaviour given above in Table III (again, broken down in terms of experimental condition).

CHAPTER 5

RESULTS

Contrived Antecedent Control Condition

Figure 1 presents a multiple baseline analysis of all training and probe data gathered under the contrived (verbal) antecedent cueing condition. Jerrold and Tony made no target responses whatever during baseline on either the training or the probe tasks; Roger and Nigel made totals of 2 and 1, respectively. These levels of performance operationalise an essentially non-functional level of ability in colouring and block assembly prior to training for all participants.

Roger was trained to colour on pages of a colouring book with large wax crayons under the contrived cue condition. His data show a slightly delayed change in level and slope following the onset of training. In the context of changes witnessed in the performance of other participants in the multiple baseline (see Figure 1), this may be considered evidence of experimental control, inasmuch as it has been argued (cf. Parsonson & Baer, 1978, p. 126ff) that abruptness in behavioural change need not be regarded as a necessary criterion of "good" data. Following the short delay, the slope of Roger's acquisition curve becomes very steep, stabilising after the ninth training session in the range of 90 independent responses per session. Roger's probe data (represented by the histograms in Figure 1) describe his performance on the small crayon/wipe-off book probe task. They reveal considerable carryover on the first probe (50 responses), but this

transfer is not maintained thereafter, dropping to 0 on the three remaining probes.

Jerrold was trained to assemble small, uniform bristle blocks into differing shapes and configurations under the contrived (verbal) cue condition, and the generality of his learning was probed on large, multiply-shaped bristle blocks. Jerrold's training data disclose an immediate change in level and slope following commencement of instruction, rising to approximately 30 independent responses per session as of the ninth session. Performance did stabilise for several blocks of trials, but near the end of training declined and partially restabilised in the 20 independent response range. Like Roger, Jerrold displayed performance close to his training performance on early generalisation probes -- indeed his carryover persisted through two of these. However, it then declined to 0 for the final two.

Tony's block assembly skills were trained with large, multiply-shaped bristle blocks under the contrived (verbal) cueing condition. Generalisation across small, uniformly shaped bristle blocks was probed. Training data reveal a slightly delayed, modest change in level and slope initially, followed by a rapid rise to the 15-20 independent response range as of the fifth session. Performance remained relatively stable until the 15th session at which point it rose sharply, stabilising at about 25 independent responses per session. Unlike Roger and Jerrold, no carry over to the generalisation task was observed for Tony during any of the probes.

Nigel was trained (under the contrived cue condition) to colour with small crayons on wipe-off colouring books, and the generality of his learning was assessed on probes which employed large crayons and pages from standard colouring books. Nigel's training data reveal an immediate but modest change in level and slope which accelerates quickly as of the third session. After rising to the 45 independent responses range, Nigel's data continue to show considerable variation but generally reveal a slight upward trend resolving in the range of 55 responses per session as of the end of training. As was the case with Tony, no transfer of training effects to the generalisation task was found to occur on any of the probes.

Naturalistic Antecedent Control Condition

Figure 2 presents a multiple baseline analysis of all training and probe data gathered under the naturalistic (materials-presentation) antecedent cue condition. Roger made no target responses on either the training or the probe tasks during baseline; Jerrold, Tony and Nigel's pre-training performances fluctuated between 0 and 3 responses per session and was untrended. Again, such data may be taken as an operational definition of a non-functional level of ability in colouring and block assembly prior to instruction for all participants.

Roger was trained to assemble large, multiply-shaped bristle blocks under the naturalistic cue condition. His training data reveal an immediate change in slope and level following the commencement of instruction. His acquisition curve is accelerated to about the 11th session at which point it stabilises in the range of 44 independent sessional responses. Roger's performance on generalisation probes

tended to emulate his performance in training. Each of the first three probe scores rises in concert with the increases seen in training; the final probe score drops, however, but not significantly.

Jerrold was trained (with naturalistic antecedents) to colour on wipe-off cards with small crayons. The generality of his learning was probed with large crayons and pages from a colouring book. There is a brief (two session) delay in the onset of a training effect, followed by a sharply accelerated pattern of acquisition which stabilises briefly between 35 and 40 independent responses per session, drops briefly to the 14 response range, and then continues to increase and stabilise once at approximately 47, then 67, and finally concludes at 80 independent responses. Jerrold's acquisition pattern reveals experimental control, but there is considerable variability evident in his responding under the training condition. As was the case with Roger, Jerrold's probe performance tends to mirror his training performance. He begins with a score on his first probe which falls roughly in the range of his acquisition data at that point. The second probe discloses a substantial drop which corresponds to a similar decline in training performance and, following that, probe scores rise steeply to the ranges where training data have generally stabilised.

Tony was trained to colour pages from a standard colouring book with large wax crayons under naturalistic antecedent control. Generalisation was probed across the small crayon/wipe-off book task. Acquisition data disclose an abrupt change in level and slope, rising sharply to stabilise between 40 and 45 until session eight. At this point, performance data begin to fluctuate markedly, ranging from a low of 18 through a high of 128 independent responses per session.

Stability is partially regained in the region of 90 responses by the 16th session, although a declining trend is recognisable in the final data points. Probe performance follows acquisition performance in the main, dropping slightly during the period of wide variation, but generally matching the levels set during the training sessions.

Nigel was trained to assemble small, uniformly shaped bristle blocks under the naturalistic cue condition, and the generality of his learning was assessed on probes which employed the large, multiply-shaped bristle blocks. Following the onset of training a very slight increase in independent responding is visible which, in general, maintains above base-rate levels but which fluctuates considerably and shows no definable positive trend -- indeed, the final 5 data points reveal a slight but steady decline. Probe performance reflects this pattern insofar as it increases slightly over baseline levels and varies minimally within the region occupied by the training data.

Second Order Generalisation

With respect to second-order generalisation, experimental materials were made available in play areas during regularly scheduled "independent play" periods of one and one-half hour's duration daily (coinciding with staff breaks), and over the five week course of training one assembly response was displayed by Roger with a pair of the large, multiply-shaped bristle blocks. Comparable blocks were used with Roger during training which employed naturalistic antecedent control. This response was displayed during the fourth week of training, and was independently recorded by two trained observers. No other instances of second-order generalisation were reported.

CHAPTER 6

DISCUSSION

The findings of this research lend support to the position advanced by Woods (Note 3) in the pilot study for this investigation -- namely, that the choice of antecedent cues for training which match those employed under generalisation conditions favourably affects carry-over. Visual inspection of the data presented in Figures 1 and 2 strongly confirms acquisition of target behaviours during training in seven out of eight cases, and weakly but verifiably confirms the same in one other (Nigel/Assembly-2/Figure 2). Furthermore, however, substantial and sustained carry-over to generalisation probe tasks is in every case associated with the naturalistic antecedent cue condition. No comparable pattern is discernible in relation to either participant or specific task -- both of which factors were counterbalanced to assist in establishing any inherent variation attributable to them. Figure 3 compares, in histogram form, the ratio of generalisation: training responses obtained under naturalistic and contrived antecedent cue conditions for each subject. The differences are immediately recognisable when presented in this fashion, as well.

While individuals may have differed in their rates of acquisition, and in the ranges within which their performance ultimately fell, the extent of carry-over remains visibly and uniquely a function of the type of antecedent control.

The implications of these data for future remedial practice are clear. The use of the antecedents in training which are the controlling

stimuli in the generalisation condition has now been shown in two studies to enhance the extent of carry-over. It follows that a careful determination of the antecedent control under which a behaviour typically falls in the post-training circumstance will reveal the type of cue condition of choice in the instructional process. Teachers and others who work with the developmentally handicapped are advised (when surveying relevant environments to uncover functional priorities in training) to take specific note of the controlling stimuli for the behaviours they wish to develop. The incorporation of those stimuli as the instructional antecedents in training bodes well for generalisation. To take this point a step further, the failure to incorporate such antecedents in training runs the risk, by behavioural contrast logic, of effecting an aggregation of performance only to the artificial training conditions -- a result which is not simply unsupportive of generalisation but militates specifically against it.

Three apparent anomalies deserve mention here. First, Roger's and Jerrold's performance trained under the contrived cueing condition carried over to generalisation probes rather well early on, but dropped quickly to zero as training progressed. Tony and Nigel, on the other hand, demonstrated no ability to generalise from the outset, and continued to perform in that manner throughout. One might speculate that these differential effects relate to length of time in treatment at the facility where, as in all programmes for the developmentally handicapped, verbal antecedents have historically been used a great deal. It may be that for Tony and Nigel, a tendency to "wait" for verbal cues was already well established as a function of previous instruction.

Roger and Jerrold, conversely, may have learned to "wait" for verbal antecedents as a function solely of the training they received under verbal antecedent control. Due, therefore, to the fact that these children had had little exposure to any systematised instruction (which typically employs verbal antecedents), it is suggested that Roger and Jerrold did the majority of their "learning to wait" during the early part of training. The second anomaly is manifest as a tendency for acquisition data to decline somewhat near the end of training. There is some evidence of this (see Figures 1 and 2) for Roger, Tony and Nigel under the naturalistic cueing condition, and for Jerrold under the contrived cueing condition. Anecdotally, these declines appeared to covary with other behaviours which might be related to "loss of interest" in the experimental tasks, such as pushing the materials away partway through a session, protesting when reseated if temporarily out-of-seat between trials, and so forth. Third, Nigel's acquisition curve under the naturalistic cue condition is qualitatively very different from all of the other acquisition curves seen in this study. Rather than generating a typically trended pattern, training appears to have produced a minimal but verifiable improvement in his block assembly skills, and then essentially maintained that improvement at a relatively low level over the remainder of the sessions. This appeared to have been the result of the problems in muscle tonus characteristic of Nigel's diagnosed tuberous sclerosis. Although he acquired the ability to stack the blocks, his performance with respect to forcing them together improved very little. Consequently, Nigel often knocked down as many block assemblies as he created and, as the response definition states, only free-standing

structures were scored for this task. Within the bounds of that limitation, then, Nigel appears to have learned and maintained a stacking (but not "cohesive stacking") skill during the training sessions.

The fact that there was virtually no second-order generalisation is predictable within the context of the underlying assumptions of this study. Insofar as the naturalistic "materials presentation" antecedent cue was absent from the second-order generalisation situation, circumstances in training and outside it were easily discriminable. The behavioural contrast effect would therefore be expected to occur. Had materials-presentations been built into the second-order generalisation settings, some transfer on some tasks (for participants trained with naturalistic cues) would be predicted. Alternatively, had a "free-operant" naturalistic training paradigm been employed, where blocks, crayons, papers and books as ambient factors had been developed as the controlling stimuli, carry-over to the second-order conditions would as well have been predicted. In every case, such predictions rest upon the extent to which antecedent/ambient stimuli serve to mediate participant discrimination of the reinforcement differential between training and non-training situations.

It remains true, however, that the absence of second order generalisation witnessed in this study appropriately circumscribes the scope of these results insofar as it reminds us that antecedent control, although significant, is only one of a number of markers which signal the learner of the potential for a reinforcement differential. Koegel & Rincover (1977); Rincover & Koegel (1975) and Woods (Note 2, 1980b, 1983c)

have revealed that other ambient stimuli play a role in this process as well. It is evident that programming for generalisation will, for such children, require the combined thrust of several stimulus control and other manipulations aimed at defeating behavioural contrast effects.

In summary, then, the data gathered within this investigation support the claim that a "programming common antecedents" approach to enhancing generalisation can produce distinct and empirically verifiable positive effects. This approach was shown to derive from current knowledge regarding behavioural contrast and its possible role in generalisation deficits. That knowledge is an outgrowth of research conducted primarily in animal laboratories devoted to the experimental analysis of behaviour. Such research all too seldom reaches the practitioner (see Hayes, Rincover & Solnick, 1980; Woods, 1980a), yet its implications for those working in the field are often very far-reaching indeed.

In addition to adding another generalisation-promoting strategy to the list given by Stokes & Baer (1977), the theoretical argument advanced here linking "programming common antecedents" to three others (and possibly more) suggests a more parsimonious and theoretically consistent account for both problems in generalisation and successful attempts to remedy them. The author (Woods, 1980a, 1982, 1983a) and others (Fulton, 1982; Hayes, Rincover & Solnick, 1980; Pennypacker, 1982) have argued strenuously that concern with principle and theory must continue to be a priority for the applied behaviour analyst if we are to fulfill the vision of Baer, Wolf & Risley (1968) of a science which is evolving, self-examining, self-evaluating and discovery oriented.

To the extent that type of antecedent control is only one of a number of potential grounds for discriminating the existence of differential probabilities of reinforcement, there is yet much to study in the area of behavioural contrast and its implications for generalisation. Experimental manipulations of reinforcement latency and reinforcement event-magnitude as possible factors would add to the knowledge generated by the present research.

Certain methodological changes which could be made in future attempts to replicate this investigation deserve mention. First, the intermixing of probe trials randomly with one block of training trials may have controlled less well for extinction effects than would the intermixing of probe trials randomly with training trials over the full four or five blocks of training conducted on average each week. Presumably, however, residual extinction effects not controlled in this study would have partially reduced carry-over, weakening what is still clearly a strong case for the use of naturalistic antecedent control. Second, by conducting training on the two tasks (with the two stimulus control conditions) concurrently, this study may have risked sustaining moderating effects relating to generalisation across tasks as a function of temporal contiguity of the sessions. Such risks could easily be obviated in subsequent investigations by conducting training in the two tasks/conditions serially.

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Note 1.

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Note 2.

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APPENDIX I

TABLE I

Counterbalancing of Participants, Cue Conditions & Experimental Tasks

Participant	Training Cue Condition	Training Task	Generalisation Task[1]
1	Contrived[2]	Colouring-1	Colouring-2
1	Natural[3]	Assembly-1	Assembly-2
2	Natural	Colouring-2	Colouring-1
2	Contrived	Assembly-2	Assembly-1
3	Contrived	Assembly-1	Assembly-2
3	Natural	Colouring-1	Colouring-2
4	Natural	Assembly-2	Assembly-1
4	Contrived	Colouring-2	Colouring-1

[1]Cue condition for all generalisation probes was natural.

[2]Verbal.

[3]Materials-Presentation.

TABLE II

Reliability[1] of Measurement

of the Dependent Variable

Tasks	Conditions[2]			
	Baseline	Training	Generalisation Probes	Overall
Colouring	100.0	92.7	88.3	93.6
Block Assembly	90.0	98.2	100.0	96.1
Overall	95.0	95.5	94.2	94.9

[1]Expressed in percentage coefficients based upon calculation of Agreements/Agreements + Disagreements X 100.

[2]Total of 4 checks made in Baseline, 27 in Training, and 10 in Generalisation Probe Conditions.

TABLE III

Conformity[1] of Instructor Performance to Discrete Trial Format Specifications

Specification	Condition[2]			
	Baseline	Training	Generalisation Probes	Overall
Cue Condition	100.0	100.0	100.0	100.0
Limited Hold	100.0	100.0	100.0	100.0
Prompting	100.0	99.2	100.0	99.7
Response Termination Criterion	100.0	99.2	100.0	99.7
Sustaining Reinforcement	100.0	99.2	95.0	98.1
Post-Termination Reinforcement	100.0	93.3	100.0	97.7
Intertrial Interval	100.0	100.0	100.0	100.0
Overall	100.0	98.6	99.3	99.3

[1]Expressed in percentage coefficients based upon calculation of Conformities/Conformities + Non-conformities X 100.

[2]Total of 4 checks made in Baseline, 24 in Training and 4 in probe conditions.

APPENDIX II

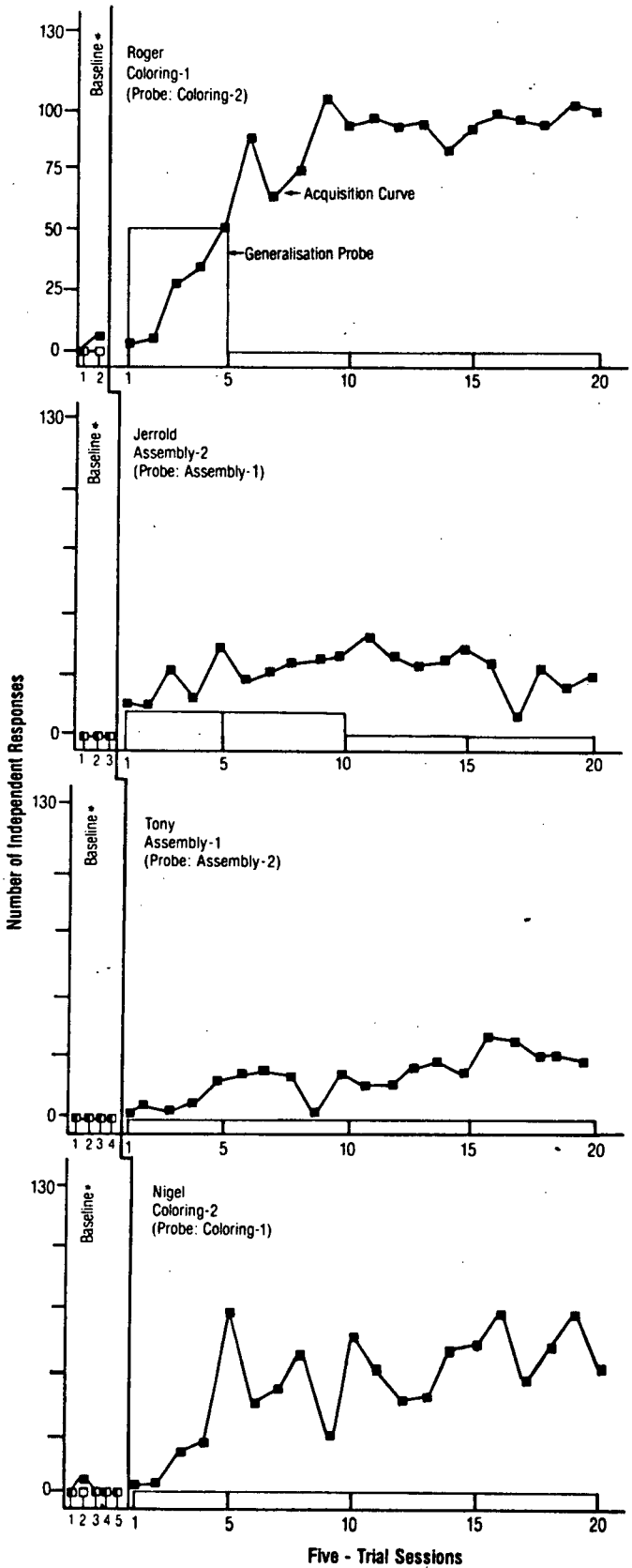

Figure 1

Multiple Baseline/Multiple Probe Analysis of Training and Generalisation Under Contrived Antecedent Control

*Open Squares - Probe Tasks
*Solid Squares - Training Tasks

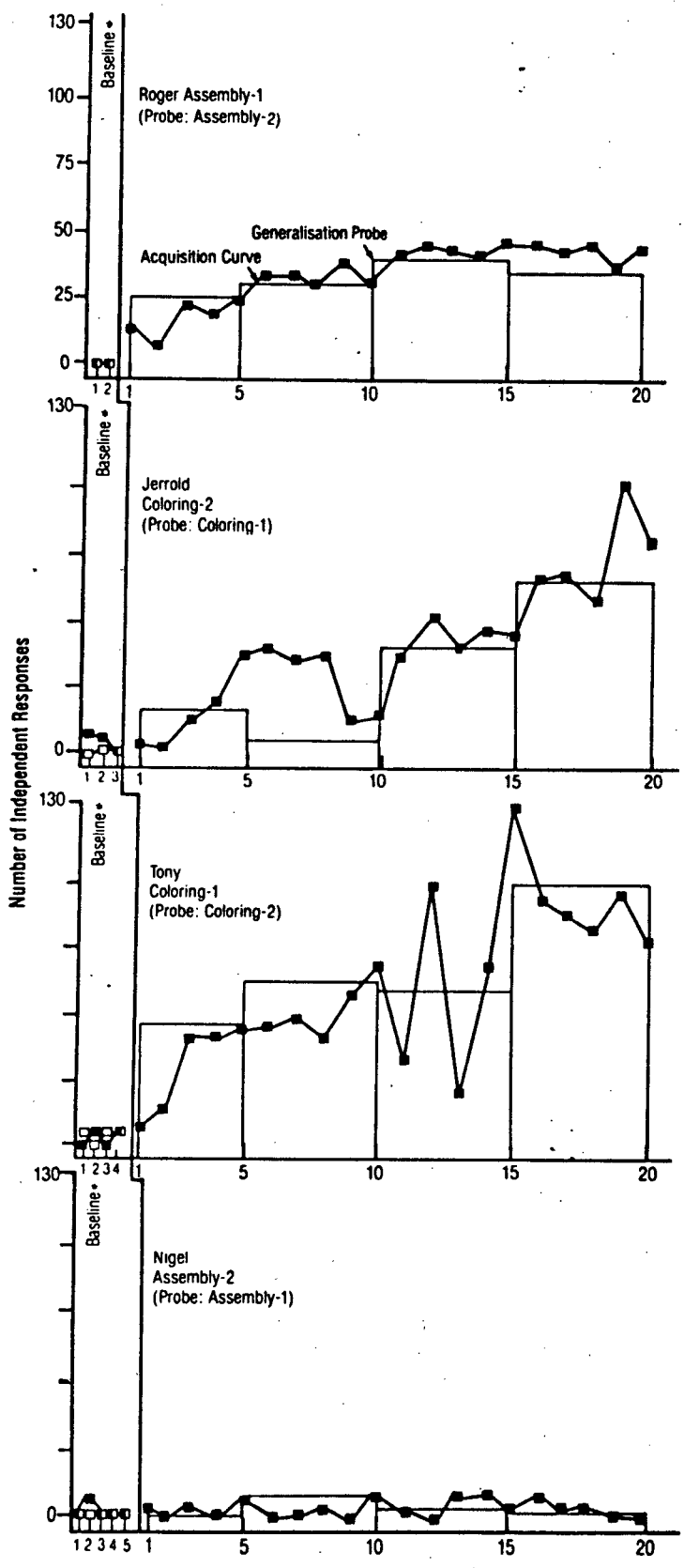

Figure 2

Multiple Baseline/Multiple Probe Analysis of Training and Generalisation Under Naturalistic Antecedent Control

*Open Squares - Probe Tasks

*Solid Squares - Training Tasks

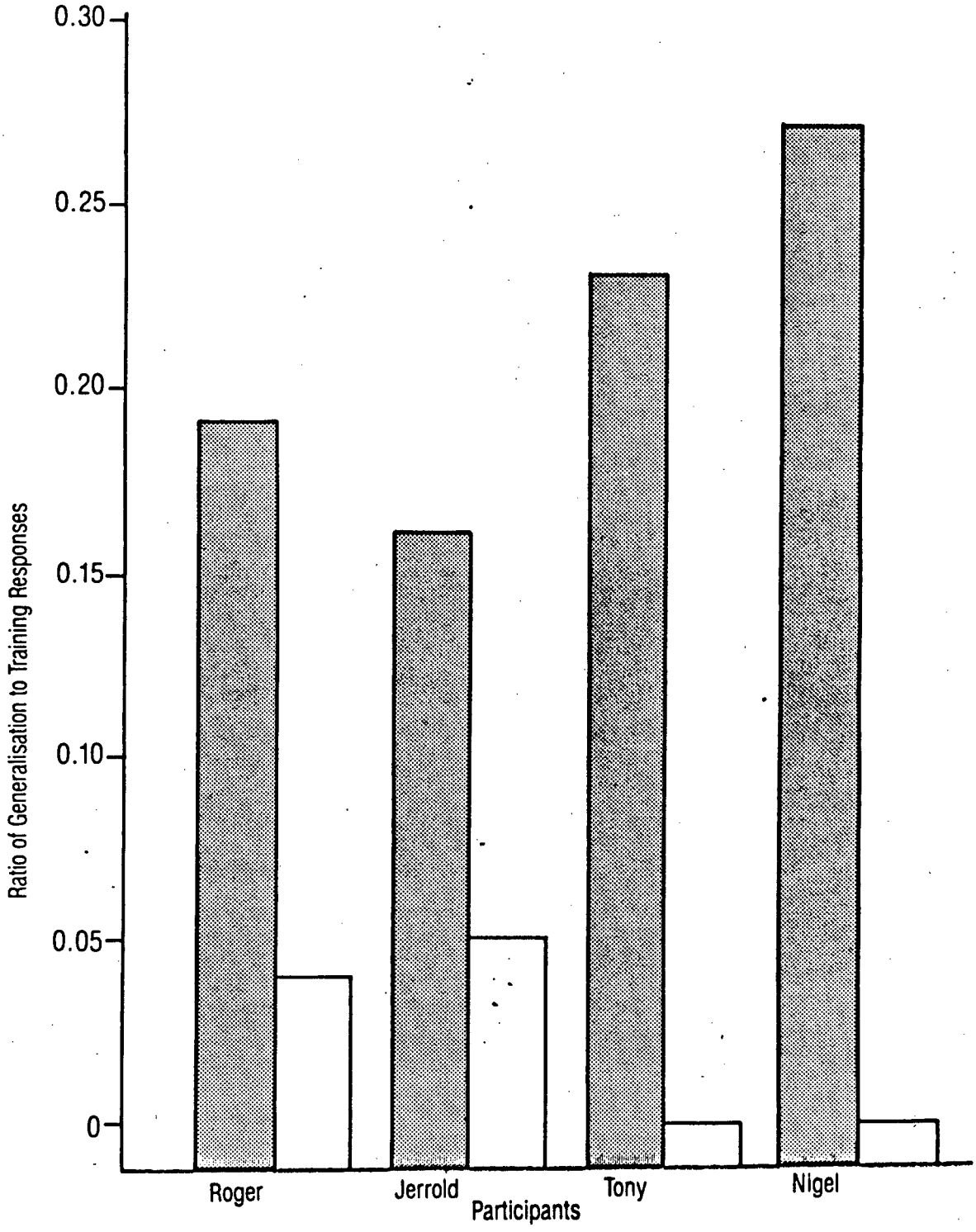

Figure 3
Ratio of Generalisation to Training Responses Against Participants

Solid Bars - Naturalistic Antecedent Control
Open Bars - Contrived Antecedent Control