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The development of rule-governed behaviour

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THE DEVELOPMENT OF RULE-GOVERNED BEHAVIOUR

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Abstract

Most researchers have treated the behaviour shown in equivalence as beyond the scope of Skinner's analysis of language in Verbal Behavior (1957). Sidman (1986) has put forward the notion of a four term contingency as being necessary to account for its emergent properties, whilst Hayes (in press) has interpreted equivalence behaviour as but one of a number of arbitrary patterns of relational responding he terms "relational frames". In both cases important material from Verbal Behavior remains unexplored. This thesis discusses the important properties which characterize certain types of autoclitics, extending Skinner's analysis to deal with features of equivalence, relational responding, and rule-governed behaviour. Schlinger and Blakely (1987a, 1987b) have discussed contingency-specifying stimuli (CCSs) as having a function-altering as opposed to a discriminative effect. Is is argued that this distinction is unnecessary within an autoclitic account of the action of rules.

A model of the acquisition of rule-following is outlined and experimental data arising from it are examined. It develops upon Skinner's (1957, 1966) notion that verbal behaviour, whilst giving rise to the unique properties characterized by rule-governed behaviour, may itself be ultimately contingency shaped. It is proposed that in humans a number of verbal behavioural primitives, termed higher-order response classes, are first established through direct shaping. These are combined to build up a hierarchy of more complex sequences and classes, circumventing the need for direct shaping and producing the control by autoclitic phrases and instructions characteristic of verbally competent humans. This allows the establishment of new environment - behaviour relationships, and changes in the strength of existing ones, using a time and effort which is orders of magnitude less than the traditional shaping paradigm.

The results of a series of experiments with young children on the acquisition of listeners' responses to negated mands and to conditional mands are presented. The conditional mand higher-order response classes are then used to build up networks of conditional relations in the manner of equivalence studies.

Contents

Chapter 1: Introduction

This thesis examines an area of behaviour that belies attempts at explanation in terms of simple conditioning accounts. This type of behaviour is referred to as "emergent" behaviour in that an organism never reinforced for its emission will display it consistently in test trials provided certain prerequisite experiences are provided.

Such emergent behaviour is characteristic of a number of uniquely human behaviours. Equivalence and other arbitrary relational patterns of responding, as well as much of rule-governed behaviour, show this property. One purpose of the sections which follow is to suggest how such behaviours might be reconciled with Skinner's attempt to provide an account of human language and thought using the response units of animal research, as expounded in his book Verbal Behavior.

In order to provide a fuller understanding of the dynamics of their use in the later construction of an explanatory system, there follows a section (Chapter 2) on the principle units outlined in Skinner's Verbal Behavior. Chapter 3 follows with a more detailed analysis of the role of autoclitics in the rapid transfer and modification of stimulus function. It illustrates how Skinner's account might be developed to deal with the phenomena shown in emergent behaviour, and provides alternative accounts, such as that of Hayes' (in press) 'relational frame' model. Proposed extensions to the concept of rule-governed behaviour by Place (1988), and in the 1987 papers by Blakely & Schlinger, are presented in the light of this discussion. An analysis of the role of relational classes in the use of names follows this.

French Structuralism suggests that discourse plays a central role in the processes of language and thought, yet it provides a contradiction between its notion of language as an autonomous self-referential process and that of the socio-historical materialist analyses of language found in the work of Skinner and Vygotsky. This contrasting perspective and the challenges it presents to materialist attempts at an understanding of language and thought is presented in Chapter 4.

The view of Soviet psychologists such as Luria and Vygotsky has been that new properties of behaviour arise when human language is acquired. Luria has characterized learning as the formation of connections, and in animals he suggests the this is a gradual, difficult process and the results are inflexible and unstable, requiring frequent reinforcement. Whereas connections formed in humans via the second, verbal, system are seen as immediate, yet they are stable as well as easily altered. This is consistent with the underlying philosophy of dialectical materialism where new principles of explanation are required with increasingly complex organizations of matter. The phenomena of equivalence, arbitrary relational responding, and rule-governed behaviour seem to be examples of new properties of behaviour, belying attempts at simple conditioning explanations. Thus Chapter 5 provides a discussion of the Soviet analysis of language and thought.

The final introductory section (Chapter 6) illustrates how the theoretical developments given in the present work were developed to provide testable models of emergent behaviour, which then formed the basis of the subsequent experimental investigations.

Chapter 2: Skinner's classification of verbal behaviour.

The section which follows is a summary of the principle response classes that Skinner distinguishes in Verbal Behaviour (1957) and how they are defined. There are sections of his book Verbal Behaviour which are almost impenetrable upon a first reading, so this section provides a concise description of its verbal categories and the dynamics of their operation. Once these have been expounded then it will be possible to start to deal with its deficiencies and move towards a theoretical and experimental programme which begins to address these issues. Tables 2.1 and 2.2 provide an outline plan of the classification. The following section then goes into the details of each class. Its headings and orderings correspond to those of Tables 2.1 and 2.2 allowing quick reference between the two. There is an emphasis on autoclitic processes since these are less well understood and crucial to the link between his analysis and the relational behaviour typified by equivalence.

It should be noted that Skinner's definitions are functional, defined in terms of their antecedent and consequent controlling variables. One result of this is that both words and whole sequences of utterances may fall within his categories. Thus a mand may consist of a single word, e.g. "out!", or a whole sentence containing all the relevant autoclitic accompaniment, e.g. "would you please get out!", providing that the whole phrase covaries as a single unit; it is simply defined in terms of its controlling variables and effect upon the listener. Various extensions and redefinitions have been proposed for some of these (e.g. Place, 1981a, 1981b; Chase et al, 1985), but the aim here is to provide a concise statement of the original formulations as a platform for further analysis.

Table 2.1 Plan of Skinner's Classification of verbal behaviour

Primary operant classes:

MANDS

ECHOICS

TEXTUALS

TRANSCRIPTION

DICTATION

INTRAVERBALS

TACTS
- **GENERIC** extension — **NOMINATIVE** extension
- **METAPHORICAL** extension — **NOMINATIVE** extension
- **METONYMICAL** extension
- **SOLECISTIC** extension

Higher order, autoclitic, classes:

AUTOCLITICS
- **DESCRIPTIVE**
- **QUALIFYING**
  - **NEGATION**
  - **ASSERTION**
- **QUANTIFYING**
- **RELATIONAL**
- **MANIPULATIVE**

Table 2.2 Some additional processes in the control of verbal behaviour outlined by Skinner.

Multiple causation and supplementary stimulation

THEMATIC sources of strength
FORMAL sources of strength
FORMAL PROMPTS
THEMATIC PROMPTS
FORMAL PROBES
THEMATIC PROBES

Synopsis of principle categories, and their definitions.

i) Primary verbal operants

Type: **MANDS** e.g. "listen!", "stop!", "give me the gun", " can I have a drink?"

Stimulus control: The level of deprivation of a type of reinforcer; groups of mands will vary with the deprivation of a reinforcer they "enjoin "(call upon) the listener to provide. The likelihood of one utterance rather than another being emitted to mand a reinforcer will be a function of audience control; some responses are more effective with particular audiences. In general, though, little stimulus control is present in the emission of a pure mand. If the reinforcer specified is present then an additional contribution to the strength of an operant may be provided by a tact component.

Function upon the listener: Mands specify the nature of the reinforcement to be provided by the listener (including the withdrawal of aversive stimuli, providing negative reinforcement). i.e. mands specify their characteristic consequences (the latter being their "referents").

Type: **ECHOICS** e.g. a listener repeating a telephone number they have just heard.

Stimulus control: Prior auditory verbal stimulation acts to produce responses by the speaker bearing a formal resemblance to it. The accuracy is dependent on how fine the echoic operants are in the speakers repertoire, and on control exerted by the audience, a listener that has requested an impersonation of an accent requires a greater accuracy than when mere repetition is required.

Function upon the listener: generates non specific, or generalized, reinforcement by the listener.

Type: **TEXTUALS** e.g. reading a passage that is written down.

Stimulus control: As per the echoic but control is by prior written verbal stimuli (textual stimuli) there being a point to point correspondence between the two dimensional systems (textual - auditory).

Function upon the listener: generates non specific, or generalized, reinforcement by the listener.

Type: **TRANSCRIPTION** e.g. copying a written passage down.

Stimulus control: Prior textual stimuli evoke written responses bearing a formal resemblance by the writer (as opposed to the speaker). The accuracy depends upon how fine a degree of copying exists in the writers repertoire, and on audience control.

Function upon the listener (reader): generates non specific, or generalized, reinforcement by the reader (as opposed to the listener in an auditory dimension of responding).

Type: **DICTATION** e.g. writing down some information that is heard.

Stimulus control: As per transcription, but the control is by prior auditory verbal stimuli. There is a point to point correspondence between the two dimensions (auditory - textual) the degree of which depends on the fineness of the available repertoire, and on current audience control. (Catania (1979, pp236) adds this class to make clear the distinction between auditory - textual transfer and the textual - textual transfer of transcription)

Function upon the listener (reader): generates non specific, or generalized, reinforcement by the reader.

Type: **INTRAVERBALS** e.g. "Mary had a little lamb", " Big Bad Wolf", " To boldly go where no man has gone before."

Stimulus control: Prior verbal stimuli. Once evoked, consecutive responses act as stimuli evoking succeeding members of a verbal chain. i.e. they are standard (or "stock") phrases and sequences of verbal operants that may come to vary in strength as a single unit. Verbal stimuli may also act as formal or thematic prompts and probes evoking an intraverbal chain (see their definitions below). Members of such a chain may further prompt or probe other intraverbals as occurs in "free association" or a "flight of ideas". (The Additional Processes of Stimulus Control section provides further information on the prompting and probing of verbal operants).

Function upon the listener: generates non specific, or generalized, reinforcement by the listener.

Type: **TACTS** e.g. a child saying "doggy" in the presence of a dog.

"Jane is at the door" said to a third person upon answering the front door.

"This is a comfortable chair" after sitting down.

Stimulus control: From a given stimulus property, typically non-verbal. The archetypal tact is correlated with the presentation of generalized or non specific reinforcement that emphasises control by the stimulus property, freeing the tact behaviour from fluctuations in the deprivation of any particular reinforcement class. Such pure tacting which has no characteristic type of reinforcement is, however, rare. According to Skinner, impure tacting, where certain tacts tend to produce more reinforcers of a given and kind begin to obtain a mand function, reduce the objectivity of the speaker. The property tacted is subject to audience control. A tact can be said to "specify" a given stimulus property , i.e. its antecedents (the "referent"), as opposed to the mand which specifies the reinforcement class it is correlated with, i.e. its typical consequences.

Function upon the listener: generates non specific, or generalized, reinforcement by the listener.

Subclasses of Tact stimulus control and function.

Type: **GENERIC** tact extension e.g. the use of existing categories in describing a novel object such as a "chair" or a "cat"..

Stimulus control: Control is by some stimulus property across new objects, situations, or physical dimensions. i.e. abstraction of a given property from many variations in circumstance. Thus extension of the tact is to new members of a class having that property in common. It is consistent with the original reinforcing practice, which persists unchanged in the verbal community, even though the range of effective stimuli may be extended as more and more instances with new collateral properties are reinforced. This fails to deal adequately with what are termed "fuzzy" categories where transitive relations between the important stimulus properties and the label may be required. A detailed analysis of this issue has been worked out by Fields (1991).

Type: **METAPHORICAL** tact extension e.g. "John is a bright child", "she has a barbed tongue".

Stimulus control: Control is across some new object situation or dimension as in generic extension, but where as the latter respects the original reinforcing practice which persists unchanged in the verbal community, in metaphor new properties of nature are brought into the control of verbal behaviour. These become stabilized as standard tacts, themselves capable of further generic or metaphorical extension. For example "bright", as a tact of light, becomes a metaphor of intelligent and then acquires tact properties itself as the control from metaphorical extension wains, and it is reinforced as a simple tact to a person behaving cleverly. A similar transfer of stimulus control occurs in the word "leg", from a part of the body to vertical supports. Such extension is based on the geometrical and functional similarities, the common properties in all these instances acquire control of the response and are subsequently recognised by the verbal community. (Verbal Behaviour (VB), pp94).

However, Skinner suggests that most apparent metaphors are responses which have been independently reinforced as tacts; the metaphorical extension of the tact having occured in initial such usage of the tact - which is important in providing an account of its etymology.

Type: **METONYMICAL** tact extension e.g. "you haven't touched your dinner" when it is eating we are concerned with.

Stimulus control: The control is extended to some property merely accompanying the stimulus evoking the tact. Unlike generic and metaphorical extension, a purely accidental association of the stimuli occurs. Since this is more likely confuse the listener, only those extensions which do not lead to conflicting results are effective. An example of Skinner's will illustrate this: a speaker might say "the Whitehouse denied the rumor" although it was the president who spoke, but describing the refurbishing of the White house by saying that "the President received a new coat of paint" would not be effective upon the listener (VB, pp100). This class of tact extension is in need of further analysis and definition to elucidate its dynamic properties (as is solecistic extension). He suggests that most everyday examples, like metaphors, are responses which have been independently reinforced as tacts and thus established as functional units in their own right.

Type: **SOLECISTIC** tact extension e.g. saying "feasible" when an option is just "possible".

Stimulus control: Here the property gaining control of the tact response is only distantly related to the defining property upon which reinforcement is contingent, and may be similar for irrelevant reasons. Usually these extensions are confusing to the listener, though some may remain effective, e.g. use of the word "dilemma" when a situation is merely difficult, but cases such as " you go first and I'll precede you" can cause difficulty. It is also common when no other responses are currently available (e.g. under pressure for a response, such as when a child is asked something by an angry teacher). Some erroneous responses do enter the reinforcing practises of the verbal community, such as in the inappropriate use of a foreign term. In general, though, the practises of generating solecistic extensions is usually unreinforced or punished, being described with pejorative terms. The stimulus relations and controlling variables in such extension require further analysis.

Type: **NOMINATIVE** tact extension — e.g. calling a place with many homeless "Cardboard City", or calling a partner "sweetness", "Cherry Pie", "Honey" etc.,

Stimulus control: Tacts are frequently extended in their usage when a person or thing is given a name for the first time. Skinner gives the examples of a new-born child, a newly invented machine, a newly discovered flower, and a newly founded town, all of which are novel occasions where a standard tacts for this particular instance are lacking. For normally a proper name, one "which is characteristically reinforced only in the presence of a particular person or thing" (VB 103:1) would be more effective in identifying this instance of a class of stimuli.

He discusses the naming of children and suggests that this is often an example of generic or metaphorical extension, e.g. "a baby named for someone whom he actually resembles clearly exemplifies metaphor" (VB 103:3). He asserts that "some common emotional or other reaction engendered in the parent" (VB103:3) is the basis for the tact extension and that if the name is suggested by someone else, these common properties make it easier to apply that to the child and to accept the suggestion. Following on from this principle he states that names which have connotations with people who arouse incompatible emotional reactions are avoided, e.g. if that person is disliked. Clear examples of nominative tact extension occur in the choice of "Nicknames", e.g. calling a child "Nuisance", "Little accident", or "Sunshine", or calling a restaurant "Greasy Joe's" and a chip shop "Sweaty Bett's".

The processes of nominative extension thus appear to involve subclasses of tact extensions outlined in the previous sections, in particular metaphorical and generic extensions. The reverse operation is involved in the formation of mnemonic memory aids. For if a proper name shows metaphorical extension, or is similar in its form to some commonly used terms, then it can be extended in this direction, e.g. converting a person's name into a description of some of their features.

ii) Higher order, Autoclitic, behaviour

An introduction to **AUTOCLITICS**

Autoclitics modify the effect of accompanying verbal operants upon the listener. In that they depend upon, and act on, primary verbal operants I have termed them higher order verbal operants. Further details of their controlling variables and how they effect accompanying verbal operants are given under the individual headings of each.

Whilst similarities exist between Skinner's functional analysis of autoclitic processes and the structural analysis of syntax by linguists and grammarians, he discusses several distinctions between the two approaches. these can be summarized as follows:

Skinner's units of analysis are based on their function as response classes under the control of environmental contingencies, not the form, or structure, of terms in an expression. It is through the demonstration of covariation of verbal responses (perhaps phonemes/graphemes, words or whole phrases) under a single reinforcement contingency that suggests they function as a unitary response class. Frequently such a class of behaviour does not correspond to a lexical or grammatical unit. Thus Compound utterances consisting of a number of verbal operants may come to have a simple functional unity, covarying as a group, rather than as a collection of individual component responses, e.g. "on the table" or "in the oven" may have the same simple dynamic control as that by a basic tact. Since larger responses acquire functional unity one does not always have to speculate about the individual autoclitic function of any parts which have the same form as their individual operant counterparts. Recognition of this possibility is given in his notion of the autoclitic frame, where a group of responses, such as " ... means the same as ... ", that each have counterparts of the same form having an individual autoclitic function, are now under the control of a single reinforcement contingency. Such variation in function of identical forms is not recognized in a structural analysis.

Type: **DESCRIPTIVE** autoclitics e.g. "The newspaper reported a ...",
"I'm afraid to tell you that...", or
"I heard that ..."

Stimulus control: This is essentially self descriptive behaviour which describes other verbal behaviour that may be covert or overt in origin. It is distinguished from simple tacting by the special effect it has upon the listener - it modifies a listener's behaviour with respect to the verbal operants that accompany it. Such self description includes the description of a response one has made, is making, or will make, as well as the strength and controlling relations of such a response.

The verbal community arranges the contingencies necessary for such self descriptive behaviour, this being useful to the listener in many ways. An audience asking "did you see it, or did someone tell you?" is asking for more information about controlling relations; well developed verbal environments encourage the speaker to emit collateral responses describing them. Such responses, when associated with other verbal behaviour effective upon the same listener are termed "descriptive autoclitics" (VB, pp315)

Descriptive autoclitics may have a number of functions in modifying the listener's response to the verbal operants they accompany. They may inform the listener of the type of response, in some cases pointing to a response's original controlling variables, and if they are still present or not. That is whether the response is a textual, a mand, a tact, or if it is intraverbal, i.e. the nature of the original source. They may also inform of the state of strength of the response, e.g. "I guess" , "I hesitate to say", "I insist". Other examples of descriptive autoclitics include "I observe (that she/he is absent today)", "I call it (a shame)", I saw (an eagle last week), "the radio (forecast rain)".

Skinner's section on this fades directly into a more general discussion of autoclitics (VB, pp313-321) and the boundaries of the class are less than clear, for verbal operants belonging to other classes (e.g. relational and manipulative autoclitics) occur here. In summary, the descriptive autoclitic indicates something of the circumstances in which a response is emitted, or something of the condition of the speaker, including the strength of their verbal behaviour.

Type: **QUALIFYING** autocitics e.g. "It's not late",

"I never said that",

"You did break it",

"It is fresh"

Stimulus control: These qualify the verbal operant paired with them such that the intensity or direction of the listener's behaviour is modified. Skinner distinguishes between two opposing subclasses of the autoclitic, that of negation and assertion.

Qualifying autoclitics of **NEGATION**

In this case the qualifying autoclitics indicate that the proposition accompanying it is false, the certainty of which (i.e. the strength of the speaker's response) may be carried by additional descriptive autoclitics. Examples of qualifying autoclitics of negation include the use of "no" and its related forms "not", "never" and "nothing", as in "it's not raining". The emission of such forms is not merely dependent on the absence of the response they qualify (e.g. a lack of rain) for otherwise a flood of response under the control of the absence of thousands of other things would also be evoked.

The traditional solution is to assume that there must be some reason for making a response, before we negate it. According to Skinner, Russell (1949, discussed in VB 322:3) believed that the reason was always verbal, i.e. "negative propositions will arise when you are stimulated by a word, but not what stimulates the word, e.g. some one asks "is it raining" and we reply no it is not raining" (VB 322:3). Skinner's point, however, is that the stimulus that controls a response to which "no" or "not" is added is often non-verbal, e.g. the tendency to say "rain" may be a response to a similar stimulus such as a few drops of rain from a lawn sprinkler beyond a hedge. The tact "it's raining" is then an example of

generic or metaphorical extension. Or something which is frequently correlated with rain - say, a threatening sky - can evoke such a response, this an example of metonymy.
"No" or "not" may be added to other responses which are intraverbal. Other responses to which "no" or "not" is added may be intraverbal; some irrelevent contiguity of usage has strengthened a response which, if not qualified, would have an inappropriate effect upon the listener. In each instance a response of some strength is emitted, but is emitted under circumstances in which it is not reinforced as a tact (or intraverbal, etc.) by the verbal community and may even be punished. This additional condition acting upon the speaker is the occasion for adding a qualifying autoclitic.

A model of the acquisition of such negation in the speaker based on extension of the generalized punishing function of the word "no" to verbal behaviour is given, and the move from a stimulus which causes the cessation of ongoing behaviour to one which qualifies, by negation, accompanying behaviour is provided in Verbal Behaviour (pp324). Standard expressions that include qualifying autoclitics of negation may be acquired as unitary responses and may not indicate any such autoclitic activity, e.g. "you don't look well" may be simply be a tact of illness in a persons appearance.

Qualifying autoclitics of **ASSERTION**

This class of autoclitic calls upon the listener to to accept a particular state of affairs, e.g. the word "is" in "it is raining".
Any factor that might weaken the listener's response (e.g. a denial from someone else or a doubtful set of circumstances) intensifies the nature of the assertive autoclitic used by the speaker. These autoclitics increase the effect of accompanying verbal behaviour, that would obtain a reduced

effect upon the listener if emitted alone. The verbal operants which are usually qualified by assertive autoclitics are often limited to certain classes. According to Skinner, these autoclitics indicate that the response is emitted as a tact or, under certain circumstances, as an intraverbal. Other verbal operants are typically not asserted (see VB pp327, p2, for the reasons why). The assertive autoclitic also suggests the direction of stimulus control, e.g. "this is a wolf" implies that the response "wolf" is made to an actual animal or, possibly, to a television image or a verbal description of a wolf.

Words such as "probably", "surely", "may be", "undoubtedly", and "truly" often act as qualifying autoclitics as opposed to descriptive autoclitics. In one case the effect upon the listener is related to the speaker's inclinations (a descriptive autoclitic function) whilst in the other, the stimulus properties responsible for these inclinations (an assertive autoclitic function). The usage of the latter is extended to suggest the type or degree of extension of a tact. Skinner points out that when the speaker's response to a novel stimulus is under the control of some contingent property, but the stimulus is itself unusual, they can indicate this extension with autoclitics like "sort of" or "kind of", e.g "it's a kind of chair" or "it's a sort of brown". The terms "sort" and "kind" imply generic extension of the use of the tact (VB 328:2). These autoclitics assert that a property is present, such as the availability of a chair or the presence of the colour brown, but qualify the assertion so that the listener is prepared for the unusual instance.

Extension of the tact along a continuum of intensity or magnitude is indicated by the expressions "it's kind of hard" or "it's sort of heavy". Metaphorical extension is suggested by the use of words such as "as", "like" or the suffix "-like" or"-ly". For example, Skinner asserts that "a ghostlike apparition" suggests to the listener that the apparition isn't really a ghost. In "bright as the Sun", "as" acts to qualify the "Sun" but not "bright"; the thing described is bright but is merely like the Sun (VB, pp328, p2)

The use of qualifying autoclitics of assertion to directly suggest the nature and degree of the tact extension involved in using a response (whether generic, metaphorical etc.) gives the accompanying tact more predictable results upon the listener's behaviour. Here the tenuous nature of the stimulus control evokes such autoclitics of assertion in the speaker to strengthen the effect of accompanying verbal behaviour, which would be weaker if emitted alone.

Type: **QUANTIFYING** autoclitics e.g. "There is no such thing as a 'green' car"

"All polar bears are white"

"Some dogs are dangerous"

These indicate the extent of accompanying verbal responses; examples are "all", "some" and "no", e.g. "all swans are white". Two common quantifying autoclitics are the articles "a" and "the" which function to narrow the reaction of the listener by indicating the relation between a response and its controlling stimulus. The circumstances under which a speaker says "book" are different from those under which they might say "the book", and both differ from the circumstances under which they might say "a book". These differences may be important to a listener and are carried by such quantifying autoclitics. Where equivalent forms to these occur in standard phrases emitted as a single unit, no such quantifying function need be implied.

Skinner says nothing about the processes involved in the acquisition of quantifying autoclitics, his discussion simply deals with how they are used by a speaker once present in some strength. Little mention is made of how the controlling variables necessary for their acquisition and maintenance in the speaker, by the verbal community, might function.

Type: **RELATIONAL** autoclitics e.g. the final 's' in "the motor works" "... is a member of ..." "... is inside of ..."

The function of this autoclitic class is to evoke behaviour in the listener with respect to the primary verbal operants according to the relation carried by the additional autoclitic. That is, to indicate that they go together in some way and are not simply independent responses. This can be illustrated with a couple of examples; the relationship between them will depend on the nature of the relational autoclitic. These are conventional terms, or arrangements of responses, in a verbal community carrying various higher order functions that modify the effect of some primary verbal operants according to other primary verbal operants present, and the nature of the relationship carried by the relational autoclitics. For example, a previously neutral stimulus may acquire a discriminative function when placed in the relational autoclitic framework " ... means ... " with a primary verbal operant already possessing a discriminative function, e.g. the sentence "'wie heisst du?' means 'what is your name'" establishes the german phrase as an occasion for saying one's name.

Relational autoclitic function may be carried by the way in which verbal operants are ordered and grouped together, as well as by the use of special words carrying a relational function such as "means" in the above example. These orderings and groupings are similarly conventions within a verbal community which are made explicit when described as "rules" of grammer. Grammatical tagging is included in the relational autoclitic, e.g. the final 's' in "the boy runs" indicates "agreement" in number between the verb and the noun, as well as the possession of the property of running by the boy. The 's' also gains strength in functioning as a 'minimal' tact indicating action (i.e. multiple causation of strength) (VB, 333:2). This possession may also be carried by a propostional phrase as in "the gun of the boy".

Predication, what is said about the subject of the sentence is carried by autoclitics of assertion (a subclass of qualifying autoclitics; see heading above), combined with the subject which has a relational autoclitic added. In "good chocolate" the property of the subject is indicated by the word order, but adding autoclitics of assertion in "the chocolate is good", with additional relational autoclitics of word order, make the phrase a predication (VB 335:1) These two components of relational autoclitics and one of assertion are, Skinner says, both needed for predication. This example is a two- term predication, and word order may be reversed with only minor violations of standard order, e.g. "good is the chocolate", but relational autoclitics of grouping and ordering become especially important where predication involves three or more terms. For example, "the boy runs the store" cannot be rearranged as "the store runs the boy" and have the same effect upon the listener. This is because, in English, ordering and grouping are important indicators of the functions of verbal operants and the relationships between them. Skinner points out that changes in word order are not usually a problem in languages that use tagging rather than grouping and word order to carry relational autoclitic function.

He has little to say in his analysis about the origin of tenses other than the present. References to past events are treated as intraverbal sequences, and the factors involved in supplementary stimulation (see heading above) are important here. Future behaviour is treated much as in Science and Human Behaviour (1953) as a description of an already present tendency to engage in a piece of behaviour. More analysis is given to the role of planning ahead (i.e. engaging in verbal "problem solving" behaviour), and this is then developed in his Operant Analysis of Problem Solving paper (1966). However, the role of imaginal (or conditioned) seeing remains under explored throughout this and the whole of his work. The determinants of autoclitics of tense thus await further analysis.

Type: **MANIPULATIVE** autoclitics e.g. "recalling my lecture last week ...", "however ...", The role played by position in a systems chart, such as one describing the global nitrogen cycle or the manufacture of iron.

These are an extension of J.H. Tooke's analysis of words (1857: quoted in Skinner, 1957) into those necessary for communication and those which are abbreviations involved in "dispatch" (prompt communication), which Skinner gives an exposition of. These words also occur in complex situations enjoining, i.e. calling upon, the listener to react in an efficient way. Skinners analysis expands this so manipulative autoclitics consist of phrases as well as words. They enjoin the listener to react to the expanded form of an abbreviation, e.g. "this is for you and me " is reacted to as "this is for you and this is for me". In this case Skinner suggests that the speaker enjoins the listener to add to what has been said (i.e. convert it to an expanded form) and react appropriately. This proposed verbal expansion on the part of the listener does not always occur and it seems possible that manipulative autoclitics, when combined with primary verbal operants provide alternative stimulus control to the expanded form over the listener. Initially reconstruction of expanded equivalents probably occurs, but eventually the manipulative autoclitics gain similar control to the expanded forms and may be used in lieu of them.

This process occurs with manipulative autoclitic words, e.g. "but", "through" (Tooke was concerned with their etymology in providing the original expanded forms), and phrases, e.g. "but first", "to return to", as well as diagrammatic/spatial arrangements which, in addition to having a relational autoclitic function, also act as abbreviations for more long-winded descriptions and evoke more predictable and potentially more complicated behaviour in the listener/reader.

Manipulative autoclitics also connect remote responses, signal temporary digressions, picking up the threads of a discussion etc., e.g. "incidentally", "parenthetically", "to go back for a moment". Thus they allow the description of multidimensional information within the limits of a particular form of transmission such as in the case of describing visual properties in auditory form, e.g. the layout of the Periodic Table of elements (VB 354:3). They are highly important in allowing digression and the inter weaving of remote responses into a current point being made. Through these processes topics may be nested within one another and an overall hierarchy, or structure, of an argument built up. Without these, arguments would be much clumsier and more limited.

The contingencies generating manipulative autoclitics are seen by Skinner to arise from the consequences of rapid communication. This may be the inclusion of more material before a listener becomes bored and inattentive, or before the transmission becomes too expensive (by phone/telegram etc.). Manipulative autoclitics may produce more reliable or complex effects in the listener than would be possible with the verbally expanded equivalent. Audience control will affect the degree and form of manipulative autoclitic used, through the presence or absence of the corresponding classes in the listener. For these determine whether the speaker will be punished, ignored, or reinforced (by the increased efficiency at generating the listener's subsequent behaviour), e.g. young infants may not be able to deal effectively with diagrams and so their use may be ineffective.

iii) Some additional processes in the control of verbal behaviour.

Multiple Causation and Supplementary Stimulation.

This section deals with Skinner's distinction between "formal" and "thematic" sources of strength of a verbal operant, and with the notions of "prompting" and "probing" behaviour. When a response is already present in some strength, i.e. reasonably likely to occur, other variables may enter into its control in a form of multiple causation, where a number of variables interact to determine its final strength. These may act to raise the strength of the response above some threshold, allowing its emission and involvement in ongoing verbal behaviour. Skinner distinguishes between the two sources of strength mentioned above.

THEMATIC Sources of strength	e.g. the adjectives "dim", "dark" and gloomy, or the adverbs "quickly", "speedily" and "sharply".

A thematic group of responses covary in strength, to some degree, with a single variable - this being the thematic source. Such responses are termed thematic when they lack the point to point correspondence of echoics and textual (or of trancription/dictation) to the common stimulus component. When a piece of behaviour is ineffective in altering the circumstances responsible for its strength, one response may yield to another member of its thematic group in a sort of repetition with variation. Groups of responses under a common variable are recognized in the terms "attitude" or "opinion". When a measure of opinion is used to predict behaviour it is argued that because one response in a thematic group has been made, other responses in the same group are probable. (VB, pp228, p2)

Control by different audiences may affect the tendency to emit one member of a thematic group rather than another in the presence of a particular audience, though they all increase in probability when conditions require a member of the thematic group to be emitted. Thematic sources may include those of tacts, intraverbals and mands. These may raise the strength of one member of a group over the others, e.g. if a group of adjectives are available as tacts, such as "big", "large" "massive", then intraverbal sources may contribute to the emission of one of them, as in "big" to describe a wild dog, from the intraverbal chain "big bad wolf".

FORMAL Sources of Strength.

All members of a formal class have some minimal relationship, involving a point to point correspondence, to their source. This is termed a formal source and typically is echoic or textual, e.g. "cat", "fat", "sat" may all be members of a formal class under the control of the sound of the last syllable "at" either as an echoic fragment or a textual fragment. Transcriptive and dictation sources may also occur for some formal classes. Evidence for the strengthening of part of a synonym through a self echoic tendency of this sort appears in the frequent occurance of idiomatic pairs such as "wear and tear", "high and dry", or in proverbs such as "haste makes waste". This provides an account of their etymology, but typically they are emitted as "stock" phrases, each acting as a unitary response class.

In his analysis of supplementary Stimulation in Chapter 10 Skinner introduces the term "operator" where an operator is the person providing such antecedent stimulation to the speaker. If an operator can identify the response which is to be evoked (e.g. when the speaker has forgotten a word which the operator knows) the supplementary stimulus is termed a "**prompt**". The supplementary stimulus is called a **"probe"** when the response is not known to the operator even though it may be just as sharply specified by other circumstances (e.g. when a word is unknown to both the speaker and operator that, when discovered, will allow them both to find other information in a dictionary), (VB, pp255, p1).

Given the distinction between formal and thematic strengthening described above, Skinner distinguishes between these four types of supplementary stimulation: formal prompts, thematic prompts, formal probes and thematic probes.

FORMAL PROMPTS e.g. The use of Cockney rhyming slang as prompts such as "apple and pairs" for "stairs", and "trouble and strife" for "wife".

Here the prompter (or operator) supplies the speaker with a stimulus bearing formal similarity to that which is to be evoked. For example, when an actor forgets a line (the intraverbal connection being inadequate), the prompter provides them with a partial echoic stimulus. When the line is said by the actor, their behaviour obtains strength from the two main sources - the original intraverbal conditioning and the echoic form of supplementary stimulation. A speaker that, glances at their notes is making use of a textual prompt having the same effect as the echoic prompt in the example of the theatre. If a prompter says that a word sounds like "life" when it is, in fact, "strife" the formal prompt is carried by formal similarity at the level of the last syllable.

THEMATIC PROMPTS e.g. a person commenting on how tasty a meal is in order to prompt the offer of another helping of food, or the way in which one recollection can lead onto others in a "flood" of memories.

These may include the thematic sources of tacts, intraverbals and mands. Such a prompt is better known as a "hint". In Skinner's example, a hostess may be stimulated to ask "more tea?" through the examination of an empty cup, drinking the last drop, or by providing an intraverbal stimulus that contains responses such as "drink", "beverage", "coffee" etc. The assumption being that the response "more tea?", or something similar is present at some strength. Thematic prompts are often found in education. He suggests that this is the main way in which a teacher "directs" a discussion or encourages students to talk about a particular topic. Thematic prompts also occur accidently, e.g. when we are "reminded of a topic about which we had intended to speak", i.e. "behaviour which exists in some strength receives an accidental supplement from related thematic material".(VB 259:1)

Thematic prompts often operate in a similar fashion to formal prompts. Skinner illustrates this with the example of a coconspiritor who has agreed that they will bring up a topic at a committee meeting and has failed to do so, when we may begin prompting. Whereas a formal prompt might consist of a whispered word or a word scribbled on a pad, a thematic prompt would use verbal stimuli that typically evoke items in the current area of discussion as intraverbal responses. Thematic prompts are more easily concealed in other verbal behaviour than formal prompts, but are less specific in the behaviour of listener that they commonly evoke.

FORMAL PROBES e.g. when fragments of a text seen fleetingly are misconstrued, or mumbled speech is interpreted incorrectly.

These typically consist of echoic or textual probes, though they can occur in transcription and dictation. Echoic fragments, where an echoic stimulus is weak (e.g. where the auditory stimulus is unclear), raise the likelihood that other sources will be effective as supplementary sources of strength. The fragmentary echoic stimulation combines with some other variable to produce a verbal response which could not be evoked by either variable separately. Skinner gives examples of when one "hears" their name mentioned in a loud conversation when there was no such corresponding verbal stimulus, and when a proud parent hears many more words in their child's babbling than a sceptical neighbour, (VB, pp259, p3).

Skinner suggests that sound patterns which are impoverished as echoic stimuli may act as supplementary variables, in particular when repeated in a rhythmic fashion (VB:259:4). In this way non vocal auditory patterns (e.g. the lapping of waves, or the crying of a sea gull) can act as echoic verbal stimuli, and generate subsequent behaviour with respect to them. The same applies to verbal stimuli presented against a background of noise or if the person is preoccupied with other behaviour. Skinner proposes that "Since the weakness of the echoic stimulus must be matched by special strength from another source, examples of this kind are especially "revealing" of the source of strength"

(VB 259:4). A mechanical echoic probe based of this principle was developed by Skinner in his "verbal summator" for experimental investigation of these processes.

Textual probes act in similar fashion; written stimuli may be of reduced clarity if only caught in the peripheral vision, or read to quickly, or out of focus. Experimentally, fragmentary textual stimuli occur in rapid presentation with a tachistoscope.

After responses of this type have been emitted, self-echoic and self-intraverbal responses begin to occur, and these verbal responses may act as thematic and formal sources of stimulation for further ones.

THEMATIC PROBES e.g. the word-association test, or Roschach's "Ink Blot" test.

These typically involve tact or intraverbal sources and can be illustrated through examining three typical psychological manipulations. One example is Jung's word-association test in which a subject is given a number of verbal stimuli and requested to say the "first word they think of", though formal echoic tendencies probably occur, also. Intraverbal sequences common to their verbal community are sometimes emitted and may be of interest. In addition, collateral variables may be revealed by the actual responses (the "content" of the behaviour). According to the model, subjects give different responses presumably because of variations in their verbal history and current events.

The word-association experiment evokes intraverbal responses appropriate to the occasion, though tacts may serve a similar function. An example of this process given by Skinner is the Thematic Apperception test where a subject is required to tell a story about a picture or to write something concerning a given piece of music, odour, or flower etc. In comparison to the formal probe, the word-association test and Thematic

Apperception test begin with rather strong stimuli. He then discusses the Roschach Test. Here the "ink blots" are chosen because they do not evoke any consistent standard responses. It is an example of the use of multiple causation to probe behaviour. He asserts that this property can be attributed to the stimuli themselves, for many of these types of stimuli themselves have extended tact components with a subject tending to "see" patterns in a particular form.

These tests illustrate how thematic probing may be explicitly manipulated, but often they may occur in the course of reading a passage, as intraverbal sources evoke verbal responses in the manner of word-association. Similarly tact components may be evoked by a speaker looking out of a window, or to the less than clear visual stimuli that may occur in imaginal thought (i.e "conditioned seeing"). These processes are are especially likely when a response is not easily forthcoming, as sometimes occurs in creative writing or ongoing conversation.

In summary thematically related operants, typically under the control of some tact or intraverbal component, may be evoked when such fragments occur and some response is needed to satisfy a given set of circumstances. The form of the response is not previously known or expected, for that would constitute thematic prompting, and not the action of a probe. The Thesaurus is a classic example of material arranged according to thematic groupings which may be consulted to both prompt or probe responses already at strength in the speaker due to current conditions.

Chapter 3: A development of Skinner's model.

Autoclitics and the rapid transfer and modification of stimulus function

Autoclitics modify the effect of accompanying verbal operants upon the listener. They depend upon, and act on, primary verbal operants, and so I have termed them "higher order" verbal operants. Skinner distinguishes between a number of subclasses of the autoclitic. Details of their controlling variables, and how they effect accompanying verbal operants, were given earlier in the 'Summary of Skinner's Analysis of Verbal Behaviour', which also contains an introduction to autoclitics and how they differ from the structural analysis of syntax by linguists and grammarians. The discussion herein is an extension consistent with Skinner's model that attempts to highlight a number of inadequacies which have become clear with the work on equivalence in recent years. It is argued that, in order for autoclitics to work, corresponding higher order classes are required in the listener to allow the modification of accompanying verbal behaviour.

An important consideration is an area of behaviour that belies attempts at explanation in terms of simple conditioning accounts. This type of behaviour is referred to as "emergent" behaviour in that an organism never reinforced for its emission will display it consistently in test trials provided certain prerequisite experiences are provided. Such emergent behaviour is a characteristic of a number of uniquely human behaviours. Equivalence and other relational patterns of responding as well as much of rule-governed behaviour show this property. The purpose of this discussion is to suggest how how these might be reconciled with Skinner's attempt to provide an account of human language and thought using the response units of animal research, as expounded in his book Verbal Behavior (1957).

Equivalence is a subclass of relational responding that has received much attention by human operant researchers and this shall be presented as an illustrative example. Equivalence is usually demonstrated using a matching-to-sample arrangement and this is a simple instance of it:

[see Figure 3·1]

Here an equivalence class is established in a subject between the written words for "dog" in the English, German, and Greek languages. Given that one, say the English word, is already known, its functional properties will then transfer to the other two members. The arrows point from sample to correct comparison. Thus only two conditional relations need be taught, shown here by solid lines, for the untrained emergence of the remaining ones shown by dotted lines. Presenting "hund" as sample will result in "dog" being chosen as a correct comparison, for example, and "skili" (<- in Greek letters) as sample will result in "hund" being chosen, though in neither case has any direct training been given.

Equivalence is an example of an arbitrary relation between a group of stimuli in that responding in accordance with this relation is not, of necessity, dependent on any particular property of the stimuli. If, however, the subject were reinforced for responding to the larger of two pictures, where the relative dimensions of the two stimuli eventually gained control over responding, this would be an example of a non-arbitrary relation since stimuli cannot be otherwise arranged whilst remaining in accordance with the pattern characteristic of the relation.

It is generally accepted by researchers in the field that no unequivocal data has yet been obtained demonstrating equivalence

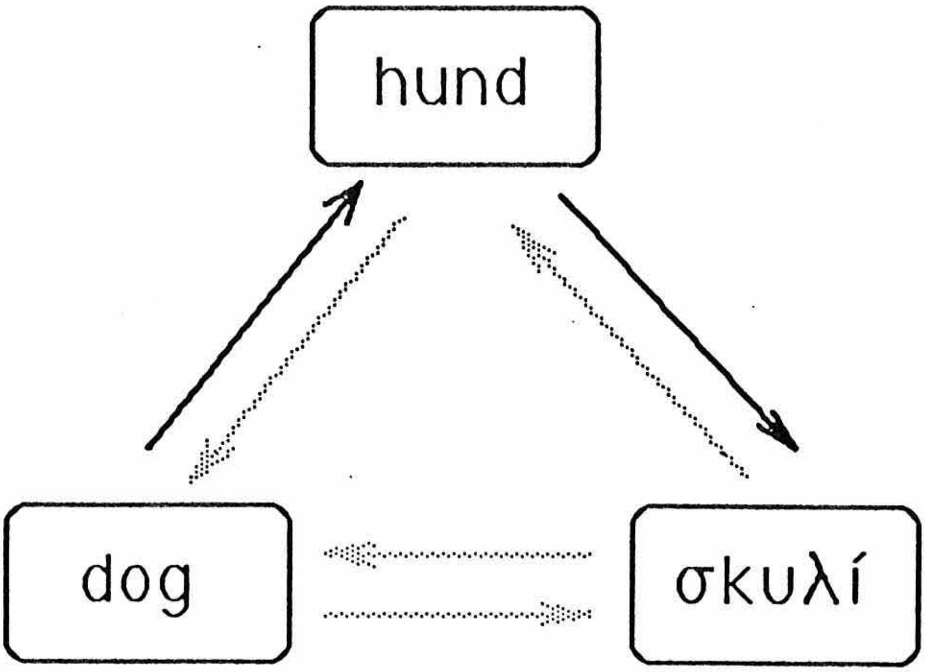
Figure 3·1 An equivalence class established between the written words for "dog" in the English, German, and Greek languages.

Figure 3·1 An equivalence class established between the written words for "dog" in the English, German, and Greek languages.

Key:

is a trained conditional relation.

is an emergent conditional relation.



responding in animals. Findings reported by Dugdale & Lowe (1990) and Lowe & Beasty (1987), as well as that of Devany, Hayes & Nelson (1987), suggest that equivalence responding in humans does not occur until a child has acquired a degree of verbal behaviour, at the very least an ability to produces names or labels for the stimuli involved. Hayes (in press) has suggested that the other classes of arbitrary relational responding are similarly intertwined with the acquisition of language. Rule-governed behaviour requires verbal behaviour as a prerequisite, by definition.

The emergent properties of equivalence responding, have been something of an enigma to researchers in the field. Most have treated such behaviour as lying outside the scope of the three term contingency and therefore Skinner's analysis of language in Verbal Behavior. Sidman (1986) has put forward the notion of a four term contingency as being necessary to account for these emergent properties, whilst Hayes (in press) has interpreted equivalence behaviour as but one of a number of arbitrary patterns of relational responding that he terms "relational frames". In the number of accounts of equivalence that have appeared in recent years, important material from Skinner's Verbal Behavior remains unexplored. Place (in press) as well as a joint paper presented by Place and the present author in 1987, suggested that equivalence and arbitrary relational behaviour can viewed within the framework of Skinner's class of verbal operant, the autoclitic. Similarly rule-governed behaviour can be discussed in these terms.

Consider this example of Skinner's: "That kind of mushroom is poisonous." (Skinner, 1957). Here, one alters the listener's subsequent behaviour by bringing under the control of a particular type of mushroom all the behaviour previously controlled by the word "poison", even after a long delay between instruction and the onset of the required condition. A clear example of the delayed effect would be: "watch the TV documentary at 8 o'clock tonight". The emission of phrases that modify the listener's future behaviour with respect to the referents is termed "instruction" by Skinner, and is characterized by the fact that such changes may be brought about with one occurrence, circumventing the laborious and time consuming processes of directly conditioning a response. This rapid transfer of properties across from one stimulus to another evoked by the relational autoclitics that pair them is similar to the transfer of stimulus properties that has been demonstrated by Wulfert & Hayes (1988), Catania, Horne & Lowe (1988), and Coelho de Rose et al (1982), when new members are entered into an equivalence class. In Hayes' experiment a conditioned reinforcing function was transferred to the new stimuli.

Skinner (1966) defines a rule as a discriminative stimulus that specifies a contingency. It has been further defined by Ullin Place, for example in a 1988 paper of his, and in the 1987 papers by Blakely & Schlinger, as a verbal expression that describes the relationship between two or more terms of the three term contingency. Thus a rule can be seen as a statement of a relation between components of the contingency, typically a conditional one. In considering an autoclitic account of rule-governed behaviour we have to distinguish between novel rules, which may specify new behaviour-environment relationships, or describe established relationships using new verbal arrangements, and "stock" rules that already have control over the listener's behaviour. It is the effect of a novel rule for a listener that is a sub class of instruction, as defined in Skinner's sense; which involves conditional tacts or conditional mands.

Stock rules already have good control over their behaviour, each acts as a single discriminative stimulus and the class of behaviour over which they have control varies as a single unit, as in intraverbal sequences, e.g. "haste makes waste", or "he who lives by the sword dies by the sword". However novel rules required analysis on the part of the listener, into the constituent verbal responses that comprise them. The term "analysis" is used to denote the counterpart of the composition of utterances that takes place when new phrases are emitted by the speaker. In this case the rule acts functionally as a number of discriminative stimuli involving the occasioning of several response classes in the listener. This might consist of a number of tacts or mands paired with relational autoclitics to link them, and an autoclitic of assertion to ensure a stronger response in the listener, e.g. telling the passengers on a ship what to do in the event of an emergency, or teaching a child trigonometry. In other words, stock rules act as wholes in emission and reception, whilst novel rules require composition and analysis. Now, complex rules may take longer before they begin to act functionally as stock rules, therefore in the early stages of repeated presentation to a listener they may still require treatment as novel instances in our analysis.

Schlinger and Blakely in the papers mentioned above give some discussion of the issues of rapid transfer and modification of stimulus function in the operation of rules. They see rules, that is, contingency specifying stimuli as acting differently to a discriminative stimulus. They state that:

> "Rather than evoking behavior due to a history of discriminative training, they alter the function of other stimuli, and therefore, the behavior relations involving those stimuli." (Blackely & Schlinger, 1987b,pp10,p1)

and

> "Discriminative stimuli do not establish, or alter, discriminative relations, they are part of such relations. Their effect is evocative not function altering" (Schlinger & Blakely,1987a,pp42,p3)

However, they provide no account of the origin or controlling variables for such a function altering effect by a contingency specifying stimulus.

The present analysis suggests, firstly that their points apply to the effect of novel rules upon a listener, and secondly, that it is not a rule acting as a single discriminative stimulus that has this effect, but rather the component relational autoclitics which comprise it. A novel rule can thus be seen as several discriminative stimuli controlling various lower order verbal operant classes combined with the autoclitics which modify their effects. The retention of the concept of a discriminative stimulus in Skinner's exposition of autoclitic action in his book Verbal Behaviour requires extension to its defining properties. Two routes to the establishment of the discriminative properties of a stimulus are provided for in a verbally competent human - a direct history of discrimination training may be given through differential reinforcement, or the previously neutral stimulus may be paired with a relational autoclitic which transfers the function of a second stimulus across. Skinner makes the assumption that a stimulus shaped up directly or established autoclitically will be functionally the same when subsequently under the same contingencies of reinforcement, which helps to justify his reference to them both as discriminative stimuli.

The feature that demarcates autoclitics from primary verbal operants is the rapid transference or modification of stimulus function in the listener. Primary verbal operants are either acquired through the patterns of shaping described in Verbal Behaviour (Skinner, 1957), or through pairing with relational autoclitics. The stimulation that arises from the emission of a primary verbal operant, for the listener, shall be termed a "primary verbal stimulus". Each such operant has some standard relationship to its antecedent stimuli or characteristic consequences, the nature of which is determined by the reinforcing practices of a verbal community. Thus such a verbal stimulus will have a standard effect upon a suitable listener. However, when autoclitics accompany primary verbal operants, they alter the latter's effect upon the listener. The listener's reaction may be specific to that utterance and its thematic equivalents, or the subsequent function of the primary verbal stimulus upon the listener may be changed.

The nature of such change will depend on the type of autoclitic. Qualifying autoclitics of assertion will act to intensify the effect of a verbal stimulus in its existing direction. Whereas a relational autoclitic will bring together verbal stimuli such that the listener behaves towards them according to the relationship carried by the autoclitic. This relationship may have a syntactic function, e.g what are the nouns, verbs, adjectives etc., in a sentence and what is the relationship of one to the other, such as possession. Additionally it may relate them at the level of "semantics" or "meaning" in some way, and the relationship itself may be stated explicitly, e.g. the relationship of (X) is the opposite of (Y), the subsequent behaviour of the listener being in accordance with the set of exp licit inferences that characterize it . In the case of opposition, if aRb & bRc, then a=c (where R is some relationship between the two stimuli).

The primary interest, here, is that of relational behaviour, in particular that concerning relations among arbitrary stimuli, but this is merely a subset of the whole problem of the rapid alteration of stimulus function by autoclitics, and it should be born in mind that similar problems exist in accounting for the action of all autoclitics.

Autoclitics are usually characterized as verbal operants that carry the autoclitic function, but Skinner (VB, pp345-355) also allows for the control by contextual stimuli that fall outside the realm of speech or written text. Thus he states that "tables, lists, charts, systems of indices, and so on, are all verbal devices in which autoclitic arrangements are carried out in space" (VB, pp354, p3) and gives the example of the Periodic Table of elements, where the relations among the elements are specified by their respective positions. He considers these spatial properties as verbal stimuli in that their arrangement is by a verbal organism, carrying a verbal function in modifying the effect of the primary verbal stimuli placed within them. Where a relational autoclitic is said to "specify" the relation it carries, nothing more is meant than that it provides a clear discriminative stimulus for reacting towards the primary verbal stimuli in the modified fashion characteristic of that relation.

It has been the assumption, by most researchers in the field (e.g. Sidman, 1986, Catania, 1979), that Skinner's account failed to deal with equivalence and the relational inferences involved in Hayes' 'relational frames'. This control by contextual stimuli over autoclitics, however, provides a framework to deal with these phenomena that is merely an extension of Verbal Behaviour, and has the advantage of shifting the attention back towards Skinner's analysis which has so far been excluded from work on equivalence.

Multiple causation occurs in autoclitic function, and so the effect of an autoclitic stimulus should not be decided on the basis of form alone. In addition to the fact that a collection of verbal stimuli may act as a unitary whole in an intraverbal chain or autoclitic frame, or act separately, it is also the case that an autoclitic verbal stimulus may have more than one autoclitic effect. For example, some manipulative autoclitics also have a qualifying function in qualifying the source of a response, e.g. "as I said earlier", and "as Skinner (1957) has argued". Here, remote responses are both brought into an argument and qualified as to their source. Other autoclitics, such as those describing relationships in words, or a diagram, also may carry the manipulative function of drawing in remote responses.

For want of a mechanism to account for how such autoclitic modification occurs in a suitably disposed listener I have decided to invoke the notion of particular higher order response classes that allow this to take place. In the case of the rapid transference of function the notion of a "transference class" is needed. Other types of rapid alteration of stimulus function will require some further such classes to deal with the remaining forms of autoclitic action.

Thus the hypothesis throughout this analysis is that underlying the function of equivalence, relational frames and autoclitics is the operation of a class of responding, that rapidly 'transfers' the function of one stimulus to that of another stimulus placed in a "standard arrangement" with a further discriminative stimulus that evokes the action of the tranference class. This occurs through the process of what Skinner terms "instruction" (1957,pp356-367) where autoclitics paired with other verbal operants produced by a speaker have their effect on the future behavior of the listener; typically relational autoclitics are involved.

A standard arrangement is established through exposure to verbal contingencies and may be part of a verbal phrase (such as position in an autoclitic frame) and it may be temporal (as in spoken language), or spatial (as in written text, tables, diagrams etc.). Since it can consist of some spatial property, it can be nonverbal, e.g. position of items on blackboard. The discriminative stimulus evoking a tranference class is itself established through exposure to verbal contingencies. So nonverbal stimulus properties can also gain control over tranference classes;

Skinner would argue that these would then have acquired verbal properties and act autoclitically (see above). Transfer of the function from autoclitic stimuli that themselves evoke transference classes can also occur, when such a stimulus is itself entered into a further autoclitic arrangement with a previously neutral stimulus. For example, this would occur when a translation for the phrase "... is the same as ..." is established using the autoclitic "... means ..." to some equivalent phrase in a foreign language. The new phrase could then be used as a relational autoclitic by the speaker when talking to an audience who spoke that language.

Skinner deals with transference in his section headed "conditioning the behaviour of the listener" where relational autoclitics and autoclitic frames emitted by the speaker evoke this tranference function. For reasons which are unclear he states that no special analysis of listener behaviour is necessary, and that the simple processes found in animal behaviour of Pavlovian and operant conditioning are sufficient. This is baffling since it is the properties described as "instruction" that truly distinguish human verbal behaviour from that of infrahumans and nonverbal infants.

Given that a special analysis of listener behaviour is necessary, the question arises as to the ontogeny and mechanism of transference classes. The analysis so far assumes the presence of some such rudimentary classes in the listener's repertoire; exposure to verbal contingencies introduces further stimulus control and allows the construction of more complex classes as they are compounded through the process of instruction (using relational autoclitics) by an appropriate speaker. This process may eventually occur with the listener as their own speaker, as they engage in the self-instruction and problem solving analysed in Skinner (1966).

As stated above, it is the change brought about in a listener's future behaviour with respect to a given occasion that Skinner terms "instruction". In education "the student comes to emit certain kinds of responses, both verbal and nonverbal, because of verbal stimuli occuring under specific circumstances. Lectures, demonstrations, texts, and experiments all increase the verbal and nonverbal repertoires of the listener or observer through processes of this sort" (VB, pp362, p2). Conditional statements affect the listener's future behaviour yet may have little or no current effect. An example of this is the autoclitic frame "when ..., then ...". The autoclitic enjoins the listener to respond in a certain way as the given circumstances arise. This is especially clear in the case of the "conditional mand", e.g. "when I call your name out, answer 'present'", which is a mand comparable to "say 'present'" except there is the requirement that the listener withholds the response until the condition in the "when" clause is satisfied. This cannot occur until such clauses have become effective in the verbal behaviour of the listener.

The "conditional tact" operates through the same process. The verbal stimulus "when the light is on, the door is unlocked" affects the listener by bringing behaviour appropriate to an unlocked door under the control of a light as a discriminative stimulus. It is the function of predication (see the section headed 'Skinners classification of verbal behaviour', on relational autoclitics) "to facilitate the transfer of responses from one term to another or from one object to another."(VB, pp361, p4). For example, the sign on a telephone reading "out of order" has a simple effect upon the reader: they do not use the phone. If they are told (when the telephone is not present) "the telephone is out of order", this pairing of the two verbal stimuli "telephone" and "out of order" with the autoclitic "is" has the same effect. Note that here "out of order" is treated as a single stimulus in that it functions as a unitary response class.

The autoclitic function of such predication could easily be assigned to some visual property such as position in a table, e.g. "all those items listed in the left hand column need repairing". This instruction would operate on future occasions with the addition of a phrase such as "whenever you see Form XYZ ...".

The possiblity of autoclitic function being carried by contextual variables provides a possible explanation for equivalence responding on matching-to-sample tasks. So long as the properties of relative ordering, grouping, and position are close enough to that experienced previously, a transference class may be evoked in the subject providing the appropriate relational behaviour on future occasions, i.e. on the test trials. Note that inadequate specification of the higher order response class to be evoked in the listener may result in a statistical likelihood of one relation rather than another being followed, perhaps with one class more likely to be the 'default' that is evoked.The long periods required to reach baseline criterion may be due to the gross dissimilarity in the task to previous experiences of the relation, as evidenced in the failure of some verbally competent adults on the task (Dugdale, personal communication). Hayes' 'relational frames' also are seen as explicable within this model. It can be seen that the origin of transference classes and the conditional control over them, in the listener, is of paramount importance to the model; it is this area that most needs further analysis and investigation.

Transference classes also underly rule-governed behaviour. Autoclitic processes involved in grammar establish the "rules" for such construction and analysis, but these are present as contingency-shaped behaviour established by the verbal community rather than as rules in the sense of verbally mediated behaviour (Skinner, 1966).

The essential difference between the behaviour of verbal and nonverbal organisms, as here conceived, is the presence of higher order response classes that allow the rapid alteration of the function of stimuli to Pavlovian conditional stimuli, discriminative stimuli, reinforcers, and aversive stimuli, that normally occurs through the processes of respondent and operant conditioning, to be brought under conditional control. This takes place on a much shorter time scale in every day language, typically one presentation of the accompanying autoclitics and verbal operants is sufficient. Such rapid, conditional, alteration in stimulus function is characterized by the tranference of stimulus function between stimuli placed in an appropriate relational autoclitic framework, which may be as complicated as a sentence frame or as simple as adjacent position in a bilingual dictionary.

The next section of this analysis will go into some of these issues in more detail, clarifying Hayes' notion of the relational frame and discussing how it differs and may need modification in the light of the current discussion. The emphasis will be on experimental implications, in particular that of relational behaviour, since this is the area of Skinner's analysis which most needs development.

As previously mentioned Hayes (in press) has interpreted equivalence behaviour as but one of a number of arbitrary patterns of relational responding. This he terms his "relational control theory of stimulus equivalence" (in press, pp33, p2) and puts forward the notion of the existence of a "relational frame" for each of the various basic types of arbitrary relational responding . The term relational frame does not refer to a thing in itself, either in the person or the stimuli, but is merely shorthand for "arbitrary relational responding". The frame is a metaphor for the contextual stimuli which evoke the relational patterns of inference to stimuli correlated with, or "placed within", it.

He offers no account of the acquisition of relational frames, other than that a history of relational responding with appropriate contextual cues be provided. Language is seen to be in some way intertwined with relational responding, but no further detail of how is given. He mentions the case of equivalence:

"Equivalence has been shown to be language related. Humans without any spontaneous productive use of signs or symbols do not demonstrate equivalence relations, even when the underlying conditional discriminations are thoroughly learned (Devany et al, 1986)" (Hayes, in press, pp4, p4).

Hayes discusses some of the properties of arbitrary relational responding (mutual entailment, combinatory mutual entailment, and transfer of function) which comprise these patterns of inference and thus tries to provide a common basis for them, but little regard is given to acquisition or their controlling variables.

"Mutual entailment" refers to the bidirectional nature of relational responding that occurs between two stimuli, e.g. in the case of equivalence this will be one of symmetry, whilst other relationships may be characterized by two reciprocal relations depending on the particular direction being considered (e.g. A "is the teacher of" B, and B "is the pupil of" A). "Combinatorial mutual entailment" refers to the patterns of inference that follow from the pairing, by some relation, of stimuli that are already related to other stimuli in some way, i.e. the wider inferences that follow from this additional relation. The familiar example of this is the case of transitivity where A = B and C = D collapse to one class of equivalent members when the two pairs are then related by equality in some way, such as B = C. The nature of the additional relations among the stimuli that result from relating the pairs of stimuli will be a product of the relationships present, but as Hayes points out (in press, pp7 ,p4) the nature of the new relations may be indeterminate when certain relations are combined as in the case of difference: if 'A is different from B' and

'B is different from C', the relation between A and C remains uncertain without additional information. "Transfer of function" refers to the rapid transference of stimulus function that characterizes a particular type of relational responding, and which is under contextual control (as discussed above).

He states that transfer of function follows as a consequence of mutual entailment and combinatorial mutual entailment. However the latter two can be seen as properties of the pattern of rapid transference of stimulus function - they need not in any way precede or underly such transfer. The view arising from the present discussion of relational behaviour is that a relation is defined in terms of the subsequent change in the listener's behaviour with respect to the stimuli paired with the verbal (or "contextual") stimulus that carries (or "specifies"/occasions) this pattern of change in stimulus function. The importance of the contextual control over the relational responding is emphasized by Hayes when he saysthat:

"Relational responding must be under conditional control ... if relational responding can be applied arbitrarily, and if it is not under conditional control, nothing would prevent all types of relational responding from occuring with regard to all events." (in press, pp12, p3).

He also suggests that which of many stimulus functions transfer must be limited by contextual stimuli:

"a given stimulus always has many functions. If all functions of a stimulus transferred to another, there would no longer be two separate stimuli in a psychological sense, by defintion. Distinction between stimuli require distinct functions in at least some areas. Thus which functions transfer must also be under contextual control." (in press, pp13, p1).

It can be shown that for any arbitrary relational pattern of responding reflexivity is required. This is so that subsequent alterations in the occurrence of two stimuli brought into some relation, such as changes in order of presentation, position, and whether other alternative choices are present, do not effect the functions of the stimuli upon the listener. In the case of a matching-to-sample test, a sample may appear as comparison and vice versa. In a relational sentence a subject would agree that, for example, if "'hund' means 'dog'" then "'dog' means 'hund' rather than 'pferd'" when comparing English and German words. Thus reflexivity is a prerequisite to arbitrary relational responding, but whether it should be included in the definition of such relations is a matter for discussion; Hayes feels it should not be whilst Sidman (e.g. 1986) includes it in his definition of equivalence.

With regard to non-arbitrary relational responding Hayes states that there is no need for the metaphor of a frame, because the relation is not "empty", there being no evidence of a relation distinguishable from the characteristics of the particular stimuli involved - the stimuli themselves specify the relation. This dichotomy between non-arbitrary relations and arbritary relations is rather simplistic since contextual variables undoubtedly play a role in determining whether a person will respond according to a non-arbitrary relation on a certain occasion or not, or to one versus many other possible such relations, e.g. if two toy cars are present, one larger than the other and both red in colour, how else will the subject be able to decide whether to respond according to some relation of size, colour, or shape, than by additional verbal or contextual stimuli that inform them of which one is required. He suggests that for the acquisition of some arbitrary relations it may be important that similar non-arbitrary relations are trained, some relations such as largeness having both arbitrary and non-arbitrary forms.

To avoid confusion arising from reifying relational frames as in some way underlying the relational patterns of behaviour they are abstracted from, it is preferable to stick to discussion of the latter, exploring their origins and controlling variables. Discussing relational responding within an autoclitic framework emphasizes the functional usage of the contextual cues as verbal stimuli.

Contextual stimuli responsible for the transfer of stimulus function are seen as verbal stimuli having an autoclitic effect upon the listener. A Rule may act as a single discriminative stimulus when an utterance acts as a unitary whole upon the listener, or may act as a number of discriminative stimuli, acting as both primary verbal operants and accompanying autoclitics which modify the effect of these, such as when the rule is unfamiliar to the listener and requires analysis paralleling that of the speaker engaged in the composition of novel utterances.

Thus we can be more specific than Blakely and Schlinger, it is not contingency specifying stimuli as a whole that alter the subsequent function of stimuli, but the autoclitics that comprise them. These act as discriminative stimuli, as do the primary verbal operants, but occasion the corresponding higher order response classes in the listener having the function altering effect upon the accompanying primary verbal stimuli. There are some problems in dealing with a stimulus that shows no effect until the future behaviour is finally shown, but this does not mean that such a stimulus is not acting as a discriminative stimulus, for the change in function may be immediate, but will not be apparent until the now modified primary verbal stimuli actually occur.

As a result findings of the type mentioned above indicating the importance of verbal behaviour and language experience in the ability of a subject to pass equivalence tests, Dugdale & Lowe (1990) have argued that it is the symmetrical relationship between a name, or label, and the stimulus that is its referent which is a prerequisite for equivalence to appear. This seems a possible requirement for the ability to respond to according to arbitrary relations in general, especially when a word occuring as a verbal stimulus is then used instrumentally by the listener, e.g. as a tact or mand. In the latter case identity between the initial verbal stimulus and that arising fromthe listener's own emission may provide important feedback, when appropriate echoic classes of behaviour are also present. Additionally such identity might act as a contextual cue for the response to be brought under alternative controlling variables. A word acquired through reinforcement as a mand might then be present in the listener as a tact to the appearance of the stimulus, which here acts as an discriminative stimulus rather than as the reinforcer in the case of the initial mand.

The type of observational learning involved in the acquisition of an operant through observation of its emission and controlling variables in another organism provides a more rapid possibility of acquiring an operant than differential reinforcement, and an alternative route to the rapid acquisition of stimulus function using relational autoclitics - the form of response and its controlling variables are observed directly rather than being described in a relational sentence. The latter might be accounted for within the framework of some observational class, in the manner of the echoic. In addition to these alternative methods of rapidly changing the function of stimuli over the listener, there is the case mentioned above of the rapid acquisition of speaker behaviour through observational means. The processes underlying these types of observational learning, important in the hypothesis of behaviour-stimulus symmetry of naming suggested by Dugdale, need further discussion to explore various models which can be constructed including those involving relational classes of responding.

A initial examination of the role of relational classes in naming

Various authors have proposed that naming and equivalence are in some way interrelated (e.g. Catania, Lowe & Horne, 1990, and Fields 1991) whilst Dugdale & Lowe(1990), as mentioned above, have suggested that it is the behaviour - stimulus symmetry between a name and its referent that is an essential component of naming. This naming is proposed to underly the responding shown on matching-to-sample tests of equivalence. The purpose of the current analysis is to explore these suggestions from an autoclitic viewpoint. The term "label" is used throughout it in place of "name" since the latter may carry implications of other properties or processes than those discussed. Once a self-consistent account is obtained within the narrow limits of those presently discussed the additional properties involved in naming can then be considered.

Within this discussion the referent of a label is defined as the stimulus to which it is bidirectionally related. The symmetry between a stimulus and the label used to refer to it is expressed in Figure3a which suggests how equivalence may follow from the proposed symmetrical relationship. This shows the basic bidirectionality between a label and its referent; since symmetry is defined in this way: if aRb, then bRa, the relationship R of the label to its referent is identical to that of the referent to its label, i.e. in the inverse direction. However, whilst it is recognized that bidirectionality is a necessary property in the usage of a label, an alternative relational class of responding may more adequately describe this, namely that of reciprocity.

Reciprocity is defined in the following way: if aR^1b, then bR^2a. In this relational class acquisition of aR^1b leads to the untrained emergence of bR^2a, thus if R^1 operates in the a → b direction, a listener will

Figure 3·2 The relational network suggested by a symmetry model of labelling

Figure 3·3 The relational network suggested by a reciprocity model of labelling

Key:- → is a trained conditional relation.

⇢ is an emergent conditional relation.

R^n denotes relational class n.

O is an object or stimulus property

Figure 3.2
Relational network suggested by a symmetry model of labelling.

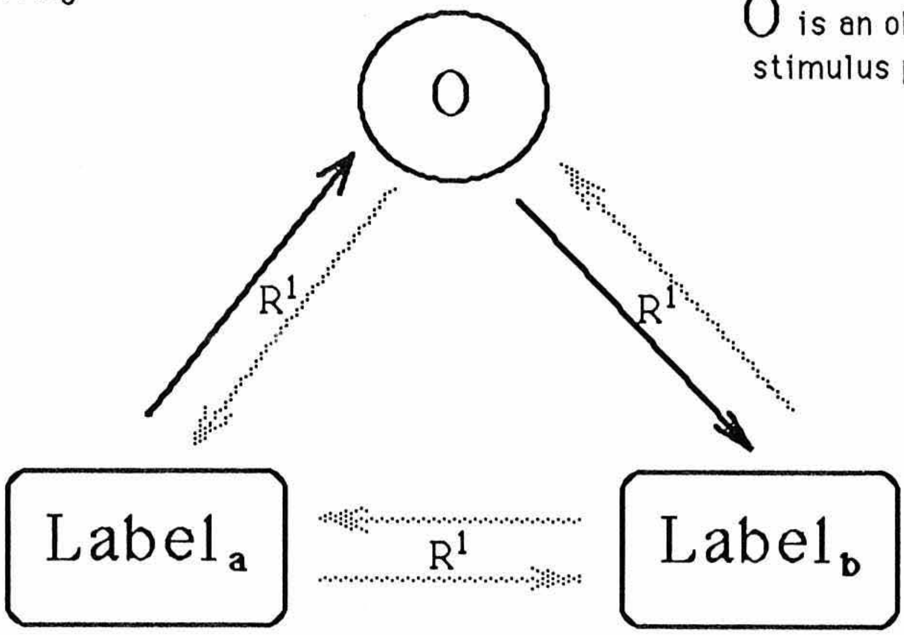
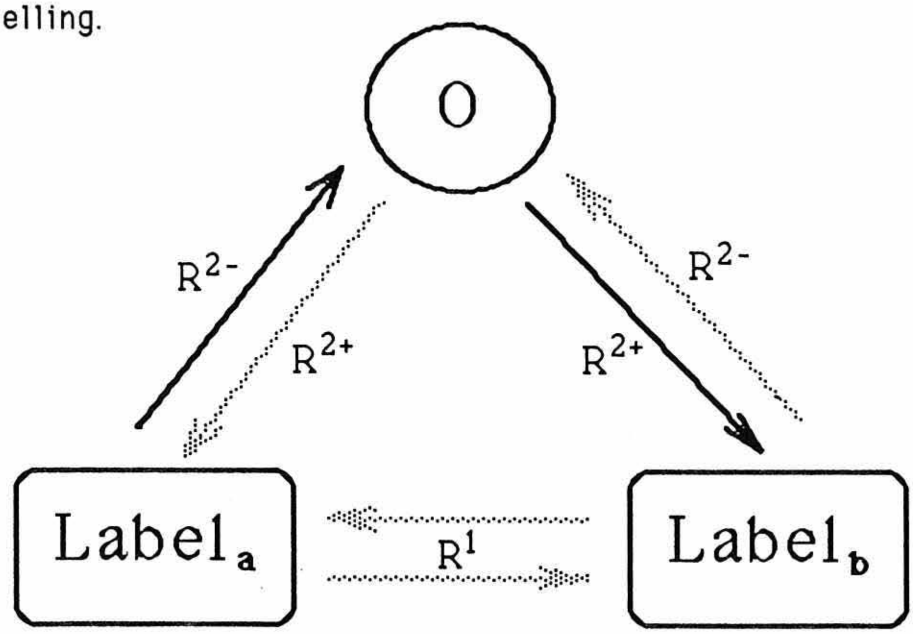


Figure 3.3
Relational network suggested by a reciprocity model of labelling.



respond according to R^2 in the b $\rightarrow$ a direction when tested in extinction. Since this is an arbitrary relation, additional contextual accompaniment is required to evoke the R^1_R^2 class as opposed to one of the alternative arbitrary relational classes that may exist in the listener, such as opposition, symmetry, or other reciprocity relations (e.g. greater than/less than). The R^1_R^2 relational class is written in this way to denote that they are part of a unitary response class, later in the discussion other numbers are used for this, but the properties of reciprocity still apply, e.g. R2-_R2+. The reciprocity account of the use of labels is illustrated in Figure 33. The change of symbols to R2- and R2+ is to avoid confusion with the R^1 that denotes the symmetrical relation in Figure 32, and to accommodate the further discussion of reciprocity below.

It is possible that the functional usage of a label by a listener might require an account of acquisition by observation of its use by another speaker. However once acquired one would still expect the relations R2- and R2+ to apply to the label and stimulus. Now, were both directions of the label - stimulus relations observed, the presence of the two of them in the listener would require no emergent behaviour for their account, but as often may happen, if only one direction is observed then the other could emerge in an human of appropriate verbal ability. Since in the latter case only one component of the reciprocity class is observed, there must be additional contextual support. That is, some stimulus usually associated with this reciprocity class is also present to evoke it rather than alternative relational classes. The nature of the observed autoclitics that accompany the label and its referent (e.g. "pass me the ..." followed by action manded) may also be important, even though they might not be aimed at the current listener.

All these cases constitute verbal instruction in Skinner's (1957) sense, even though the behaviour observed is not directed towards the listener, or for the purpose of such instruction (it may be a television show which is being watched). Since contextual accompaniment is necessary in this case, it appears that observational learning of labels may fall within an autoclitic account, the distinction previously drawn between acquisition through observation and that through instruction not being necessary if the same underlying processes are in operation. Although in the observational case instruction of the listener by the speaker may be unwitting, no separate account need be required. More effective relational autoclitics are typically chosen when the desired consequence for the speaker is to bring about such change in the future behaviour of the listener. Additional qualifying autoclitics of assertion, e.g. "undoubtedly", "definitely" etc., may also be added thereby increasing the strength and predictability of the listener's behaviour with respect to the accompanying stimuli. The possibility does remain, however, that observational learning involves a more complex type of scenario involving self talk and relational autoclitics, or some separate treatment.

One important point that arises from viewing instruction as a rapid alternative to direct shaping of behaviour is that a conditional relation need not be established through the laborious process involved in direct shaping, instead an instruction containing an appropriate relational autoclitic may be emitted by speaker. The desired behaviour characteristic of this conditional relation then becoming present in a suitably disposed listener. The additional, emergent, arising as a result, given the presence of a suitable autoclitic or contextual cue evoking the arbitrary relational response class. Note that here to "establish" a conditional relation simply refers to the process of shaping, instruction, or observation, by which the conditional relation becomes a part of the listener's behaviour. The usage of this term differs from that of Michael (1982). A conditional relation indicated by a solid arrow in the figures means that this component of an arbitrary relational class is taught, or instructed, rather than emergent. But such an establishing operation is not a defining property of a particular component relation, since the relation could equally arise emergently, e.g. through establishment of its reciprocal counterpart in the case of R2- and R2+.

In Figure 3.2 the introduction of a second label related to the object or property by a conditional relation results in both labels becoming related by R^1 through transitivity. Thus the stimulus and its two labels form a three member equivalence class. When a stimulus and its label are related through reciprocity a different relational network emerges. Figure 3.3 shows the case of an object or stimulus property with two labels established through training of conditional relations or through instruction. In one case [Label.a R2- O] is trained or instructed and in the other [O R2+ label.b] is established, where R2- and R2+ are inverse, or reciprocal, relations, e.g. "dog" → [real dog], and [real dog] → "Hund" establish the English and German words for a dog. Through the emergent relations shown the stimulus and its labels form a class in a similar manner to the way an equivalence class forms as a result of certain minimum conditional relations amongst its members. The relation R^1 emerges as a result of an inference that is the counterpart of transitivity in equivalence. Equivalence relations will apply at the level of relations between labels that are defined to the same stimulus property through R2- (or R2+), or established to another label, thus defined, by R^1. Single verbal utterances and stock phrases having the same function upon the listener will enter into equivalence relations when the necessary conditional relations between them have been established, e.g., synonymic words and phrases, foreign language equivalents, and also autoclitic stimuli that have the same function altering effect.

Figure3.4 has the autoclitic accompaniment of each relation shown, which may consist of a number of stimulus properties correlated with reinforcement for responding according to the particular class in question, though the diagram is simplified by grouping them all together with a single symbol per relational class. Each autoclitic symbol in the figure corresponds to the establishment of a particular relation, e.g. S^{A1} evokes R^{1}. A further label has been added through instruction or training to illustrate that labels thus related enter into an equivalence class with one another, though remain defined to their referent through reciprocity which is their anchor to some stimulus property. For example, having already established the links between the labels "dog" and "hund" to their referent we can add a new label with the phrase "'chien' is the french word for a dog". In addition to the formation of a three member equivalence class, the label "chein" becomes a label for a dog. Without the original definition of one of the referents in terms of the stimulus property or object, the labels would be "meaningless" - lacking any function upon the listener as verbal stimuli other than as members of the equivalence class. Subjects would show the appropriate emergent behaviour with respect to the various labels on matching-to-sample tests, but other than this the labels would have no function upon the listener to enable their use in discourse or instruction. This lack of function by the arbitrary stimuli used for labels that remain undefined may be another factor in the difficulty shown by young subjects on typical matching-to-sample tests and the sometimes unpredictable nature of adult performance on these tests, in addition to the poor autoclitic/contextual accompaniment described earlier. The task of relating undefined arbitrary stimuli is not one that children, or even many adults, have much experience of and the task may thus seem meaningless, the behaviour required of them obscure.

Figure 3.4 The relational network suggested by a reciprocity model of labelling that arises upon adding a further label. The appropriate autoclitics are shown.

Figure 3·4
Relational network suggested by a reciprocity model of labelling that arises upon adding a further label.
The appropriate autoclitics are shown.

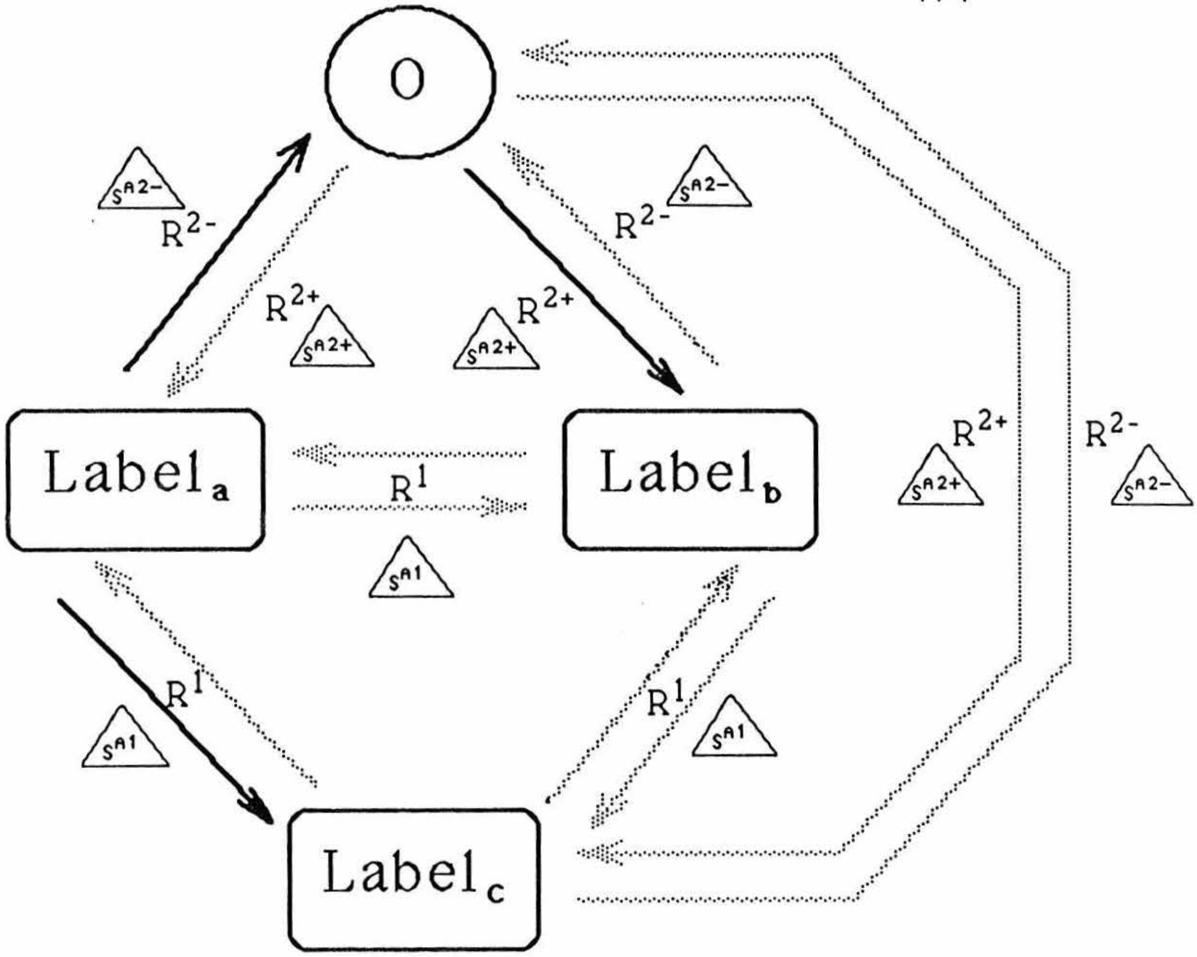
Key:- → is a trained conditional relation.

⇢ is an emergent conditional relation.

rl^n denotes relational class n.

O is an object or stimulus property.

△ S^{An} is an autoclitic stimulus evoking rl^n.



Examples of autoclitics having a defining function in the direction of [Label R2- O] are "... stands for this", "... is the name of that", "... represents...", "... refers to that", whilst the inverse, or reciprocal relations [O R2+ label] of these could be "This is stood for by ...", "the name of this is a ...", "this is represented by ...", "this is referred to by the word ...". All these examples are of groups of autoclitics acting together to have a relational autoclitic function - they alter the function of the stimuli placed in them in the manner characteristic of the relational response evoked by this autoclitic arrangement, one of definition. The hypothesis is that contextual stimuli having an autoclitic function may also act in this fashion. Autoclitics as accompanying utterances by the speaker may act by supplementing the effect of other contextual cues adding to their effect and strengthening the result. When a listener also has the ability to emit autoclitic utterances these may be partly controlled by the additional contextual cues, resulting in self prompting of subsequent behaviour with respect to the stimuli associated in this fashion.

One thing that becomes apparent is that, when the relational autoclitic linking of a label and its referent is carried by a verbal utterance, there appears to be a common root indicating that the relationship is one of definition e.g. "name", "refer". Which of the component relations, R2- or R2+, and the direction that each applies between the two stimuli is carried by further autoclitic tagging and accompaniment. Thus we get "... refers to this" and "this is referred to by ...". The case of "stand" is slightly different though the common relationship of each variant to its "root" is still present, i.e. "... stands for this" and "this is stood for by ...". An experimental analog of this would be to establish R2- to an arbitrary shape against a background of one colour, and R2+ to the same shape against a different colour background. By consistently using these coloured backgrounds for [Label R2- O] and [O R2+ Label] with various labels and their referents the colours would become autoclitic tags of roots drawn on them. Each colour indicates the direction of the component relations of the R2-_R2+ class which the root autoclitic (i.e. the picture itself) evokes.

The common roots in the pairs of relational autoclitics considered above which describe the relation between a label and its referent are the reason why I have chosen to denote the component relations they evoke by inverse symbols around a common part R2, i.e. R2- and R2+, rather than simply R2 and R3 which implies two independent relations. Place (personal communication, 1988) has pointed out that experiments involving analogs of autoclitics such as the shape described above may be parasitic upon an already present ability to construct such sentences. For this reason it is necessary to ensure that subjects are sufficiently young for the task, showing no spontaneous emission of relevant sentence construction, and that they fail adequate tests for the presence of relevant relational autoclitic activity. Whether such autoclitic analogs can then be constructed is an empirical question.

One question which arises with regard to relational autoclitics involved in the definition of a label is whether they act only on verbal stimuli or whether the referent stimuli themselves are somehow directly included - how do such words as "this", "that", "it" etc., allow the stimulus described to enter into the autoclitic modification of a previously neutral label? In what way does a sentence such as "the telephone is out of order" act differently from "it's out of order (accompanied by a head nod, pointing, or merely said to someone obviously heading for the phone). Both alter the listener's subsequent behaviour towards the telephone. Some verbal stimulus, be it vocal or gestural, directing the listener to the stimulus which constitutes the referent of the label, seems to be required. In which case the autoclitic seems adequately defined as a higher order verbal stimulus, dependent on the presence of other verbal stimuli for its effect upon the listener, but the action of pronouns needs further analysis.

Lowe (personal communication, 1988) has suggested that objects or stimulus properties (i.e. the referents) may themselves be related by an equivalence relation whilst remaining tied to some common label for them through the reciprocity relations in its definition. Figure 3.5 illustrates the case with three objects. Here conditional relations connecting O1 to O2, O2 to O3, and Label to O1, are established through training or instruction then all others emerge as a result of the already present relational response classes in the listener. Note how the reciprocal defining relation between the label and O2 emerges without training as a result of the emergent counterpart to transitivity in this relational response class. Such a case of a number of physically different objects or stimulus properties being arbitrarily related through equivalence would be the case of membership in an arbitrary set, some examples being "domestic animals", "tools", "toys" etc. In a parallel development, an analysis along similar lines involving just the concepts of primary generalization and equivalence classes has recently been expounded by Fields (1991).

Figures 3.6 and 3.7 are schematic representations of an experimental paradigm outlined Chapter 6. In order to retain clarity they do not show any additional retraining or instruction that may be required to return a behaviour previously at criterion back to this strength, should an event such as going from one stage to another disrupt performance. Figure 3.6 shows the paradigm for establishing the reciprocity between a label and its referent, whilst Figure 3.7 shows the case for equivalence between synonymic labels. The case of set membership between objects or stimulus properties given a common label would follow some

Figure35 The relational network suggested by a reciprocity model of common labelling. The appropriate autoclitics are shown.

Key:- → is a trained conditional relation.

⇢ is an emergent conditional relation.

rl^n denotes relational class n.

O is an object or stimulus property.

$\triangle S^{An}$ is an autoclitic stimulus evoking rl^n.

<u>Figure 3.5</u>
Relational network suggested by a reciprocity model of common labelling.
The appropriate autoclitics are shown.

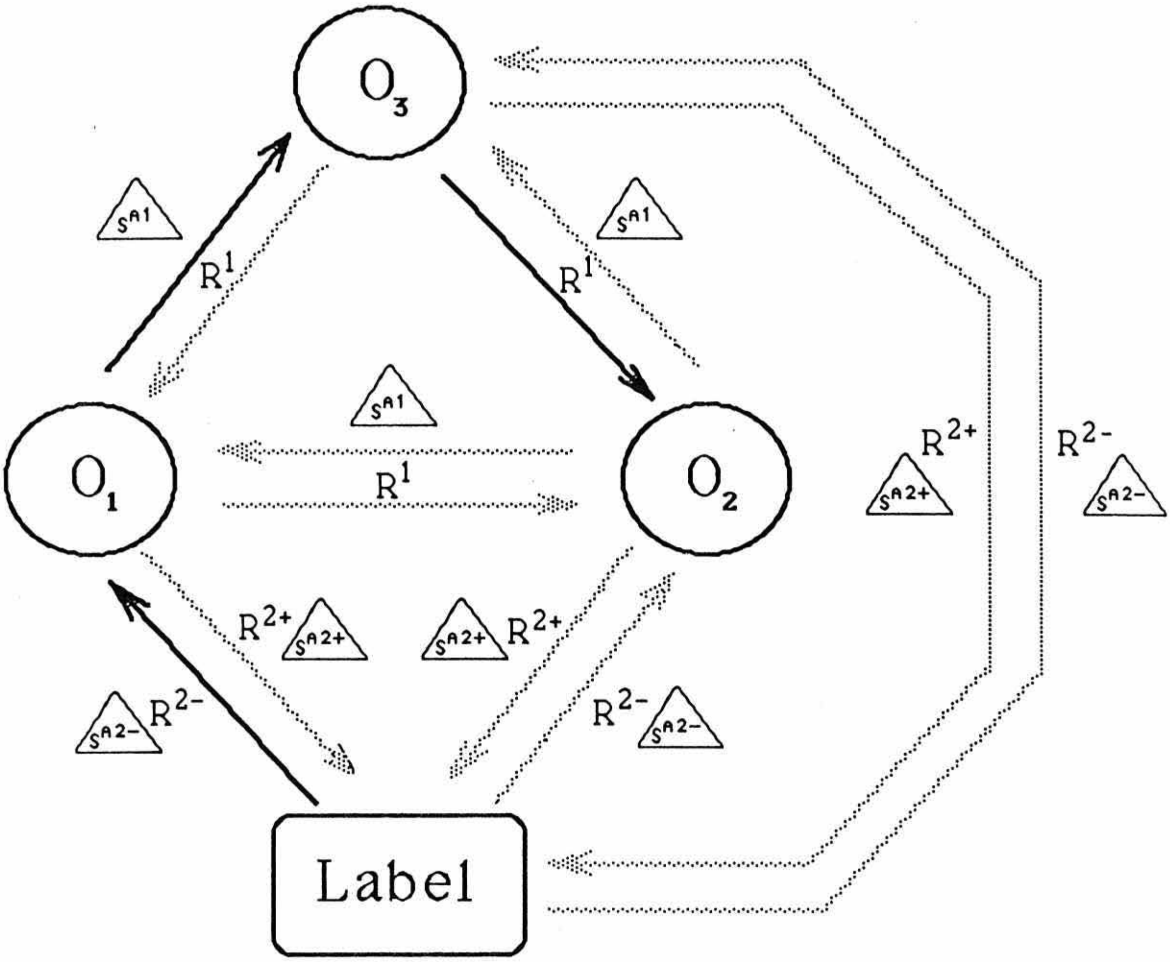


Figure 3.6 A schematic representation of the experimental paradigm for establishing conditional control over the R^1 and R^2 relational class.

Figure 3.6
Schematic representation of experimental paradigm for establishing conditional control over R^{2-} and R^{2+} and the $R^{2+}\_R^{2-}$ relational class.

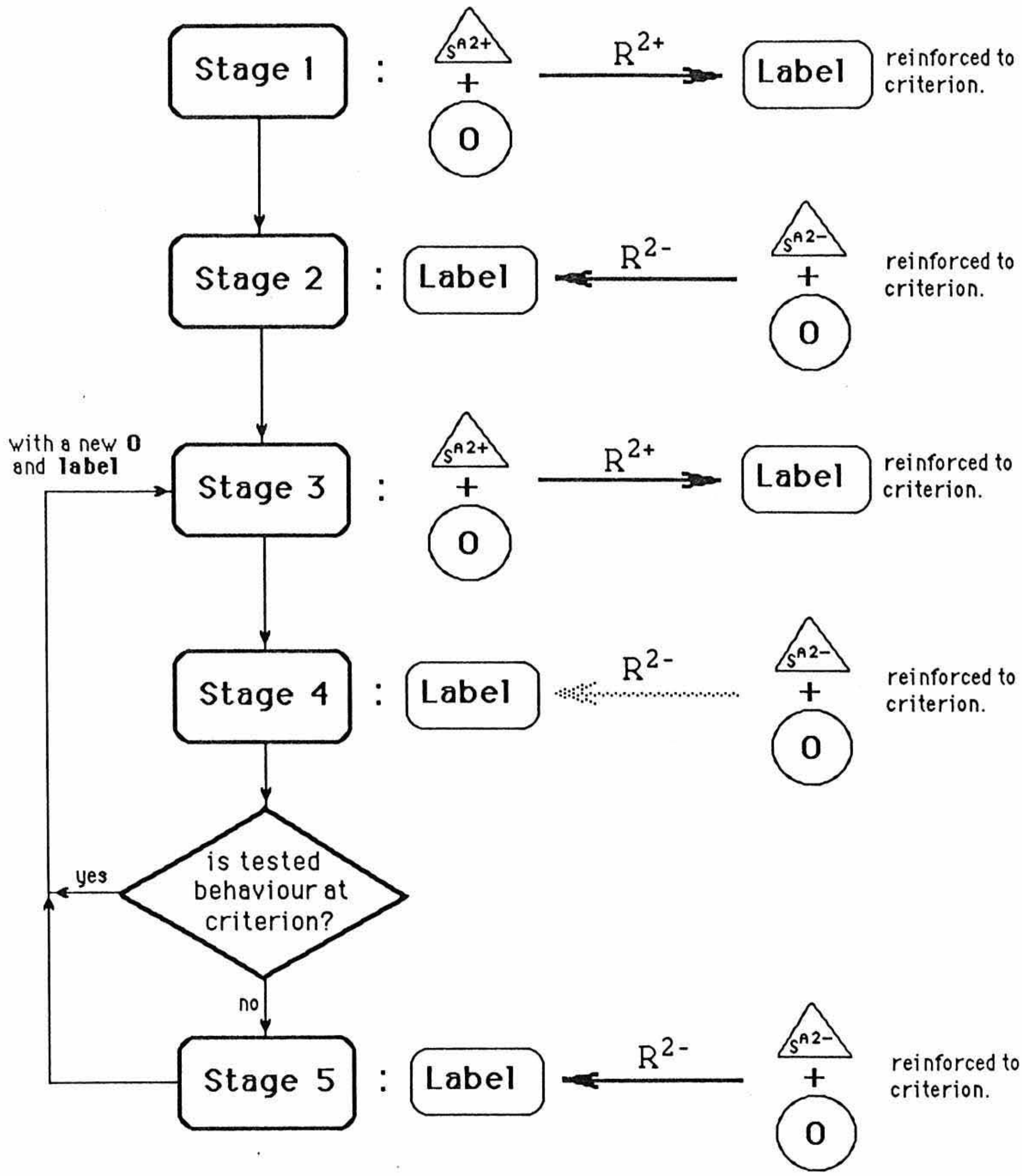
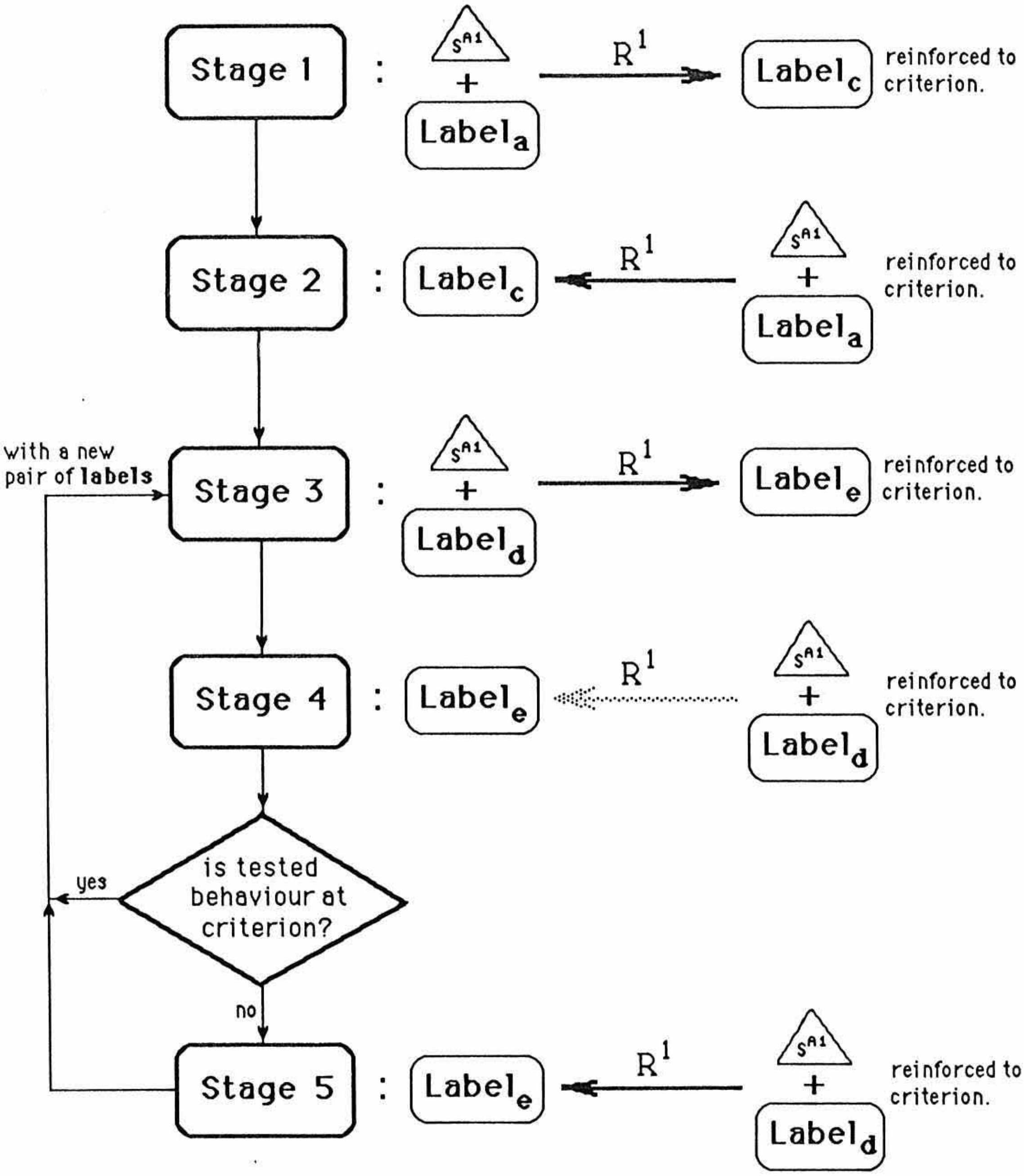


Figure37. A schematic representation of the experimental paradigm for establishing conditional control over the R^1 symmetrical relational class.

Figure 37.
Schematic representation of experimental paradigm for establishing conditional control over the R^1 symmetrical relational class.



combination of the two, as would the three and four member classes of Figures32 to35.

The main aim of the current research was to answer the question of "how does the rapid transfer or modification of the function of stimuli occur when a conditional stimulus evoking this is presented?", i.e. one that is autoclitic. The issue of naming is secondary but necessary for a complete account. A label reciprocally related to its referent stimulus property provides the verbal stimulus (referent → label relation) which an autoclitic may be paired with in production by a speaker. for example, "the *dog* bit a stranger" emitted as a tact to an event, and it also provides the referent of a label when a listener hears the verbal utterance (label → referent relation), as in reacting to the agent in the above description (the dog) with anxiety and prudent behaviour when it is actually encountered. An account such as that of the reciprocity between a label and its referent is necessary if an autoclitic is going to have any thing to act upon. This account of labelling is based on the more general model of autoclitic action covering the contextual control of emergent relations that arose in the earlier parts.

The final suggestion is that such autoclitics act upon the label and a pronoun in establishing a referent through instruction, e.g. in the case of "this is an apple", this operation of pronouns in combination, being an interesting phenomenon. It is also postulated that observational learning of a label might be accounted for in a similar fashion, the autoclitic action being carried by contextual aspects of the situation, and the function of the pronoun being provided byeye movement, pointing, or the appearance of the stimulus in question.

This constitutes merely one possible model of reciprocity. It is also proposed that some observational class not involving such contextual specification of the relationship might be involved instead. The important question, however, is that given the existence of the reciprocity class such that the bidirectionality is present, how do autoclitics act in modifying the subsequent behaviour of the listener with respect to the referents of the primary verbal stimuli accompanying them? Both the phenomenon of establishing label-referent relations, and that of autoclitic modification of accompanying verbal stimuli, involve unusual response classes whose origins and controlling variables are not obvious, but it is the latter that is of interest, here, since it provides some important implications for the verbally mediated behaviour in rules and instruction.

It is possible that reciprocity might be present as part of a verbal organism's repertoire at birth, merely lacking stimulus control. However this is an empirical question since an organism <u>is</u> born with response classes that contain already present structure, some of which are modifiable through environment changes. The task of psychology is to demonstrate the phylogenic contribution to behaviour, as well as how behaviour present at some operant level, can then be shaped and compounded to produce more complex responses, i.e. what is there to start off with in an organism's repertoire that may subsequently be modified by environmental contingencies. The phylogenic component includes sensitivity to certain classes of antecedent and consequent stimuli and the feedback functions relating them to resultant increments and decrements in response strength. This area of study is completely open, the origin of reciprocity as well as the adequacy of the account is indeterminate based on current knowledge.

Since a rule can be defined as a verbal expression that describes the relationship between two or more terms of the three term contingency (e.g. Place, 1988; Blakely & Schlinger 1987), the effect of a <u>novel</u> rule (for a listener) is a sub class of instruction, as defined in the above sense, involving conditional tacts or conditional mands. Already existent rules may merely act as single discriminative stimuli for the behaviour concerned, with no instructional effect. As pointed out earlier, where the relational autoclitics consist of stock phrases such as "if ... then ..." this is termed an autoclitic frame. It acts as a unitary response class rather than as a construction involving the constituents "if" and "then".

The aim of the experiments in this study was to give a clear demonstration of the experimental establishment and control of autoclitic processes in the listener, namely those of instruction, and in particular the pairing of two or more labels by a relational autoclitic. A label may be a mand or a tact, but is distinguished from them by the presence of both listener and speaker components in its definition, i.e. the reciprocal relation to its referent. The experimental establishment of autoclitic processes must be demonstrated in children who lack the ability to construct adult expressions describing either the relationship or any functionally equivalent utterances of their own and which can be examined through a correlative strategy, noting the child's utterances with respect to the stimuli.

It is these processes that are central to the emergent properties of human verbal behaviour, and a clear experimental paradigm for demonstrating their establishment and control would help bring home the essential differences to animal researchers, and provide them with the challenge of attempting similar procedures with infra-humans.

Chapter 4: French Structuralism and its relevance to an analysis of language, thought, and social behaviour.

The body of psychological and linguistic knowledge which arose in Soviet Union this century has followed a development of the philosophy of Dialectical Materialism. Post-war France, on the other hand, saw a powerful attempt to restate marxism in terms of an analysis derived from idealist French philosophy. This is of direct relevance to an account of social and verbal behaviour both at the individual and societal level because of the antimaterialist line that pervades this viewpoint, which undermines attempts to develop an analysis that is congruent with the Natural sciences. Any attempt to build a thorough analysis of language, thought, and society in terms of a behavioural, functional and/or dialectical account will ultimately have to deal with these issues. A good overview of the Parisian influence is given in Callinicos' 1982 book 'Is there a future for marxism' which treats the analysis of language and thought as of a core importance in the understanding of the wider processes which are often advocated as agents of social change such as economic determinism and historical materialism, and which are important in establishing the status of theoretical discourse.

The crux of the matter is aptly explained in this passage where Callinicos begins by quoting from Eugene Jolas:

> "The real metaphysical problem is the word. The epoch when the writer photographed the life about him with the mechanics of words redolent of the daguerrotype, is happily drawing to a close. The new artist of the word has recognised the autonomy of language and, aware of the twentieth-century current towards universality, attempts to hammer out a verbal vision that destroys time and space."

"These words were written by Eugene Jolas in 1929 in an article entitled 'the revolution of language and James Joyce'. They are applicable to one of the most striking phenomena of western intellectual culture in this century - the manner in which language has somehow folded back onto itself, its nature defined, not by the relation between words and things, discourse and a reality that exists independently of and prior to it, but by its own inner structure. Language, in much of western philosophy and literature, has broken loose from reality and become an autonomous, self-referential process extending to infinity in all directions." Callinicos (1982,pp25,p1)

The traditional conception of language as espoused in seventeenth century discussions such as Locke's 'Essay Concerning Human Understanding' has two components. Firstly, it is suggested that a word's meaning consists of the aspect lying outside language which it refers to. i.e. 'the sense of a word is its reference' (Callinicos, 1982, pp26,p2). Language is thus thought of as a collection of signs which depend on a relation with the components that lie outside language. Secondly how does this relationship remain reliable, i.e. consistent, - what is it that ensures that a particular word is applied correctly to a certain set of things or 'ideas'. According this viewpoint it is the human speaker and listener who with a pre-existing consciousness is held to assign meanings to words and to ensure their accurate usage. It holds the person as the 'self-defining' origin from where an ordering of thought and the external world through language arises. Thus "language becomes a simple receptacle for the contents of consciousness - essential from the point of view of convenience as a store of information and a means of communication, but subordinate to and dependent upon the intuitive relation between the subject and his ideas and impressions." (Callinicos, 1982,pp26,p1)

An alternative conception of language occurs in the writings of Ferdinand de Sausseure. He put forward a number of critisisms of the traditional view, insisting that 'the linguistic sign unites, not a thing and a name, but a concept and its sound-image'. (Callinicos,1982pp27,p2). His ideas were later adapted in Luria's development of the Vygotskian analysis of language and thought. A sign is held to be composed of two elements - the *signifie* or signified (the concept) and the *significant* or signifier (the sound image). He held that a sound such as 'cat' is paired to the concept of a cat rather than the components in the world that are encompassed by this concept. Signification consists of the movement from sound-image to concept and back, i.e. the movement to and from signifier to signified.

The novel component of this analysis was the 'possibility of signification' - of one thing standing for something else. He suggested that the relationship between the signifier and signified is a purely conventional one, i.e. that linguistic signs are arbitrary, involving no resemblance or other association between the sound image and the concept for which it stands. This is in contrast to Skinner who offer both the possibility of arbitrary or non arbitrary relations between a verbal operant and its referent. Saussure held that signification is dependent on the relations between the units that make up a language. He introduced the concept of linguistic value as a way of designating these relations using and analogy with exchange-value:

> "To determine what a five-franc piece is worth one must therefore know: (1) that it can be exchanged for a fixed quantity of a different thing, e.g. bread; and (2) that it can be compared with a similar value of the same system, e.g. a one-franc piece, or with coins of another system (a dollar, etc.). In the same way a word can be exchanged for something dissimilar, an idea; besides, it can be compared with something of the same nature, another word. Its value is therefore not fixed so long as one simply states that it can be 'exchanged' for a given concept, i.e. that it has this or that signification: one must also compare it with similar values, with other words that stand in opposition to it. Its content is really fixed by the concurrence of everything that exists outside it. Being part of a system, it is endowed not only with a signification but also especially with a value, and this is something quite different." (quoted in Callinicos ,1982,28:1)

He suggests that signification is <u>dependent</u> upon value, that the relation between sound-images and concepts relies on the relations within the two groups of the signifier and the signified. Thus initially a concept is merely a value determined by its relationship with other values. Without these these would be no signification. In addition:

> The conceptual side of value is made up solely of relations and differences with respect to the other terms of the language, and the same can be said of its material side [i.e. the signifiers -AC]. The important thing in the word is not the sound alone but the phonic differences that make it possible to distinguish this word from all others, for differences carry signification." (Quoted in Callinicos ,1982,28:2)

Callinicos elucidates this theme when he states that value does not just consist in the relations between words and concepts,but in the *differences* between them. He gives the example of the French word 'mouton' which is not substitutable for the English word 'sheep' in all contexts, because there are two English words 'sheep' and 'mutton' to which 'mouton' actually corresponds. Whilst the terms 'a' and 'b' are incapable of of independent cognition, it is the 'a'/'b' difference which one is conscious of. Thus:

> "Language ... for Saussure, consists in two parallel and interdependent series, the signifiers and the signified. Each series is constituted by the relations between its elements, sounds and concepts respectively. These relations and the elements themselves are produced by difference. One can see here the starting point for some of Saussure's most well known themes - notably his insistence on the priority of *langue* , 'the whole set of linguistic habits which allow an individual to understand and to be understood', over *parole* , its usage in speech, and of synchrony, the relations constituting *langue* at any one time, over diachrony, the evolution of language. It is this sense that Saussure is called the father of 'structuralism'." (Callinicos ,1982, 29:1)

A number of conceptual implications arise from this view of language. Firstly language has been 'lifted off' reality, for now the sense of a word or sentence is not its reference to some entity external to language. A quotation of Frederic Jameson given by Callinicos puts this theory in the clearest terms:

> "The lines of flight in his system are lateral, from one sign to another, rather than frontal, from word to thing, a movement already absorbed and interiorised in the sign itself as the movement from signifier to signified. Thus, implicitly the terminology of the sign tends to affirm the internal coherence and comprehensibility, the autonomy of the system of signs itself, rather than the constant movement outside the symbol-system towards the things symbolized." (Callinicos ,1982,30:1)

Thus language according to this view is seen as an autonomous, self contained system. Rather than lying with individual words or sentences, meaning depends upon the relations that constitute language - 'Sense always results from the 'combination of elements' which are not in themselves significant'. (Deleuze quoted in Callinicos,1982,30:2) It is difference that constitutes such a 'combination of elements'. This view removes the Cartesian notion of the subject (person) as the source of meaning, ensuring the relation between word and object. The subject was therefore 'decentred' from being the foundation of thought and the world (and therefore language), becoming, instead, merely a consequence of relationships that were prior to and went beyond it.

In Saussure's conception of language there is no order of priority between signifiers and signified (sound-images and concepts), both are indissolubly linked, as he asserts - like two sides of a piece of paper, yet they are both parallel series each constitued by internal differential relations. Jacques Lacan and Claude Levi-Strauss both introduced developments that insisted on the primacy of the signifier over the signified. Callinicos suggests that this led to the denial that the process by which meaning is produced is consistent with a signified external to language, through the philosophies of Deleuze and Derrida. It is in the production of *new* meanings that this assertion is held to be of relevance. Levi-Straus argues that the production of new meanings is explicable with the assertion of the primacy of signifier over the signified in the sense that there is 'a superabundance of signifiers, relative to the signified', 'a surplus of signification'. This separation between the two series that comprise language comes from this situation:

> Whatever the moment and the circumstances of its appearance in the scale of animal life, language could only be born all at once. Things could only be made to signify all at once. ... But, this apparently banal remark is important because this radical change is without counterpart in the domain of knowledge which develops slowly and progressively. In other words, at the moment when the entire Universe, at one blow, has become *significant* , it has not become thereby any better *known* . ... What results from this? That the two categories of signifier and of signified were constituted together and simultaneously, as two complementary blocs; but knowledge ... only got under very slowly. (Quoted in Callinicos,1982, 34:1)

From this he goes on to say:

> "Man from his origin disposes of an internal system of signifiers which he must allocate to a signified, given as such without being known. There is always a discrepancy between the two, which could be resolved only by the divine understanding, and which results in the existence of a superabundance of the signifier, relative to the signified on which it can pose itself." (Quoted in Callinicos ,1982,34:2)

This supposedly explains the presence of terms such as 'mana' in certain primitive cultures, as well as 'oomph' and 'pazzaz' in western popular culture:

> "Always and everywhere, these types of notions intervene, a little like algebraic symbols, to represent an undetermined value of signification, in itself devoid of sense and therefore susceptible to receive any sense, whose unique function is to overcome a gap between signifier and signified." (Quoted in Callinicos ,1982, 35:1)

These notions he termed 'floating signifiers' which act as 'the servitude of all finite thought (but also the guage of all art, all poetry, all mythical and aesthetic invention)' It is the 'superabundance of the signifier' that provides the possibility of generating new meanings.Callinicos suggests that this notion that the signifier has priority over the signified is a reflection of Levi-Strauss' view of society as a 'symbolic order governed by the laws of language', where the social activity is an autonomous reality with the symbols more real than the things that they symbolize.

Lacan's work involved the extension of structural linguistics in the area of his modification of psychoanalysis. He also asserts that:

> "...the signifier and signified are no longer two parallel series whose relation to each other (as essential, remember, as that between two sides of a piece of paper) is determined in each case by the differential relations between its elements. Instead, the signifier has been mapped onto the Saussurian concepts of *langue* [language - N.S.] and synchrony, and the signified onto those of *parole* and diachrony. The signified no longer represents the concept towards which the signifier points, but instead the concrete uses towards which the the differential relations constitutive of language (=*langue* = the signifier) are put." (Callinicos,1982,39:5)

Drawing on the work of Saussure and Jakobson, he suggests that there are two dimensions in language. The first makes possible the *substitution* of one word for another and is 'paradigmatic' or 'associative'. The second allows the *combination* of words in the formation of sentences or chains of sentences, this is the 'syntagmatic'. Jakobson had previously used the two notions of metaphor, the substitution of a word or phrase by a similar one, and metonymy, where a component of the referent is made to stand for the whole thing (an example of his from Tolstoy's War and Peace is where women at a ball are referred to as 'bare shoulders' (Callinicos,1982,40:1)) Lacan then synthesizes his analysis of language with his revision of freudian psychoanalysis:

> "(he) now identifies the two poles of language with the two mechanisms through which the freudian dream-work operates to transform the latent content of the dream (repressed thoughts) into quite different manifest content. Condensation, the process through which different meanings are fused in order to occult a censored thought, is assimilated to the pole of paradigm/association/substitution/metaphor; displacement, the transportation of one term for another with syntagm/combination/metonymy" (Callinicos,1982, 40:1)

This transforms language into what Callinicos calls 'an endless play of substitutions and combinations of signifiers in which safe anchorage in a signifier outside this play is never reached' for according to Lacan 'No signification can be sustained other than by reference to another signification.

> "'We can say that it is in the chain of the signifier that the meaning "insists" but that none of its elements "consists" in the signification of which it is at that moment capable'. Meaning is produced not through the signifier pointing to the signified, but in the production of meanings other than its own through the signifier's metaphorical and metonymic relations with other signifiers. 'What this structure of the signifying chain discloses is the possibility I have ... to use it to signify *something quite other* than what it says'. This 'notion of the incessant sliding of the signified under the signifier' recalls Levi-Strauss' concept of the 'floating signifier', of a 'surplus of signification' which renders possible re-orderings of the relations between signifiers and the production of new meanings." (Callinicos,1982, 40:2)

This disjunction of language and reality provided a far more radical suggestion of the autonomous and self-referential nature of language than that of Saussure for 'Signifiers in their different metaphoric and metonymic dimensions spread across the surface of things to infinity' (Callinicos,1982,412). In addition Lacan removed the subject from the central role it had represented in the Cartesian model:

> "The existence of the subject as autonomous and self-certain pertains, according to Lacan, to the imaginary order, the register conceptually and chronologically prior to the individual's entry

into the symbolic order in which thought takes the form of images rather than words. To this order corresponds the mirror-stage, the early months of life in which the child, totally dependent on others, comes to view his body, initially as a collection of fragments, then as a totality corresponding to the bodies he observes - his mother, other children, his own image in the mirror. The child imagines himself to be a whole and the world to be an extension of his needs and demands; he is incapable of engaging in genuine inter-subjective relationships. The autonomy of the subject is a phantasy produced within the imaginary. Only when the child enters the symbolic order can he relate to other self-consciousnesses, and here he is caught up in a new form of alienation - subordination to the signifying chain." (Callinicos,1982,42:2)

In the traditional model of language writing is subordinated to speech and Derrida calls this phonologism. For example, Descartes' view was that the subject is 'a self-present substance, conscious and certain of itself at the moment of its relationship to itself' - with it having direct access to the contents of consciousness. This is known as the 'metaphysics of presence'. This presence passes outside itself when words are used in communicating with other people.

This subordination of writing to speech is a reflection of the closer contact of the latter to conscious self, shown in a person hearing themself speak - known as 'auto-affection'. 'Language as such is the deferral of presence, its interruption by a web of signs: speech, however, is the point at which this deferral nears zero, at which the production of signs remains closest to the circle of self-consciousness. ' (Callinicos, 1982)

Derrida was attempting to breakdown this metaphysics of presence through a reverse view of the order of speech and writing. Writing interrupts this presence through its spatial organization of 'material inscriptions' in the markings on a page. The external nature of written text means that it can never be recaptured by this presence and return to its inner unity.

The inversion of the relation between speech and writing allowed Derrida to extend 'the thesis of *difference* as the source of linguistic value' of Saussure. It is difference that brings together both presence and absence. The signifying chain intrinsically references absent terms regardless of whether they occur in language's 'vertical' paradigmatic dimension (the metaphorical substitution of terms), or in it 'horizontal' syntagmatic dimension (the metonymic combination of terms). He introduces the concept of trace to highlight the interaction between presence and absence inherent in difference:

> "(the) concepts - writing, hinge, difference, trace, play - (and there are others, necessarily, since deconstruction itself involves the constant substitution and displacement of meanings) enable Derrida to think through much more rigourously than Lacan or Levi-Strauss the primacy of the signifier. The distinction between signifier and signified, he argues"
>
> > "leaves open in principle the possibility of thinking a *concept which is meaningful in itself* (un *concept signifie' en lui-meme*), in its simple presence to thought, in its independence of language, that is of a system of signifiers. ... Beginning from the moment, on the contrary, when one puts in question the possibility of such a transcendental signified and when one recognises that every signified is also in position of the signifier, the distinction between signified and signifier - the sign - becomes fundamentally problematic." (Quoted in Callinicos ,1982,45:3)

Language attains the truly autonomous self-referential nature where every signified is also a signifier, ad infinitum.

> " *There is nothing outside the text.* ... There have never been anything but supplements, substitutive significations, which could only come forth in a chain of differential references, the 'real' supervening and being added only while taking on meaning from a trace and from an invocation of the supplement, etc. And thus to infinity. (Quoted in Callinicos ,1982,46:2)

This alternative analysis of the sign undermines the orthodox concepts of science and truth that rely on the assumption of an external reality that is independent of discourse. For example, Descartes, Locke and Russell, all believed in a subject who has direct, immediate, access to the contents of their consciousness ('self-present' in Derrida's terminology), and out of this rudimentary 'knowledge by acquaintance' their knowledge about the world in built up - with no midpoint in the contact of subject and object Derrida wanted to reverse this, with the suggestion that all knowledge is a knowledge by description. The human relationship with the world is held to be one that is necessarily discursive, and he makes the bold assertion that one cannot have access to the contents of consciousness prior to discourse. However, in espousing the position that there is no meaning prior to the formation of the relations among signifiers, separating discourse and reality, Callinicos suggests that this rejection of knowledge by acquaintance puts into the doubt the possibility of *knowledge* itself. For 'Derrida seems to set us adrift in the place of presence and absence, in the endless proliferation of signifiers'.

So the analysis of language evolved by this school of language appears to have undermined the notion of *truth* in addition to *meaning* . It therefore presents difficulties for materialist theories of social behaviour due to its assertions in the area of epistemology. Lenin, for example, stated that 'it is this sole unconditional recognition of nature's *existence* outside the mind and perception of man that distinguishes dialectical materialism from relativist agnosticism and idealism' (Quoted in Callinicos ,1982,175:2). Causality typically suggests a serial relationship between two stable objects or events, A and B, where A acts upon, or gives rise to B. However states Callinicos 'the stability possessed by the two series of signifiers is only temporary and relative; it exists only so long as their opposition is not displaced by a new one arising from the transformation of signified into signifier, or vice versa.' (1982)

Thus, discourse is not held to lie midway in some way between thought and reality, it is within discourse that thought takes place. Wittgenstein argued that any description of a person's private events (consciousness) necessitates the presence of a public language held by the community. This notion is explicit in Skinner's 1945 paper entitled 'The operational analysis of psychological terms'. A full discussion of the gap between experience and knowledge, along with the epistemological problems that arise and of the status of 'objective knowledge', lies outside the scope of the present writing. However what needs to be pursued further is the contradiction between the notion of language as an autonomous self-referential process, and socio-historical materialist conceptions of behaviour, characteristic of Skinnerian and Vygotskian analysis. The work of Luria begins to deal with some of these issues from a materialist perspective and will be outlined in the section that follows.

So far little attempt has been made by behavioural authors to make constructive contact between the Skinnerian model of language and the developments in French structuralism. However, material in the discussion section of the present work will draw together some of these topics in the light of the experimental findings to be described.

Chapter 5: The Soviet analysis of language and thought.

The Soviet tradition arises out of an attempt to develop the basic tenets of Marxism. Whilst there is great diversity in the manner in which this has been implemented in theory and subsequent experiment by the many researchers involved in this enterprise, there is a strong tradition deriving from the early attempts at this by Vygotsky. There is an emphasis on the historical method of study with the implication that psychological phenomena can only be dealt with in an adequate fashion when viewed in their processes of change:

> "Up to this time, many people are tempted to present the idea of historical psychology in wrong ways. They equate history with the past. For them, to study something historically immediately means to study one or another of the facts of the past. That is why there exists a naive understanding that there is an insurmountable boundary between the study of historical and present forms. According to this, historical study simply means the application of the category of development to the study of phenomena. To study something historically means to study it in its movement. That is the main requirement of the dialectical method. To grasp in investigation the process of development of something in all of its phases and changes - from it emergence to the end of its existence - is the essence of revealing its nature, since 'it is only in movement that a body shows what it is'. Thus, the historical study of behaviour is not an addition to the theoretical study, instead it constitutes the core of the latter.
>
> In this sense one can study historically both the present, existing, as well as previous forms. The historical understanding extends also to general psychology. P. Blonski expressed it in the general statement: 'Behaviour can be understood only as the history of behaviour'.This is the truly dialectical viewpoint in psychology ... (Vygotsky, 1960, pp89, quoted in Valsiner, 1988, pp124:4)

The Marxist perspective emphasises human beings as active participants in their interaction with the environment, whilst the

Vygotskian methodology has an open ended nature since the process of the construction of higher psychological functions can always lead to novel psychological phenomena. It derives form the dialectical relationship between quantity and quality where changes in the quantitative aspects of a phenomenon give rise to qualitative change. According to Vygotsky, in development the integration of different psychological systems gives rise to the emergence of qualitatively new states in a person's behaviour. For example he held that higher psychological processes emerged from previously existing structures, gaining a new quality in themselves - the 'lower' processes of *involuntary* attention, memory and thinking are turned into their *voluntary* counterparts. The previously separate lines of development of a child's actions and speech *intersect* in the transformation of lower into higher processes. He believed that children below two years of age demonstrated *parallel* lines of development in the areas of action and speech, but when these lines are integrated and speech attains a controlling function with respect to actions, the higher processes involving cognitive planning occur. Eventually this integration may disappear, in the divergence between inner speech and social speech.

A contemporary of Vygotski's was Mikhail Basov who, like the former, saw an integration of overt-behavioural and cognitive-affective components of psychological phenomena as a crucial requirement for the adequate development of psychology. He placed an emphasis on the notion of minimal units which preserve the systemic functioning nature of the whole from which the unit is derived while abstracting from many concrete aspects of the original phenomenon. He placed an emphasis on analysing and then resynthesizing observable events in the course of active agents interacting with their environment. A useful synopsis of his work is given by Valsiner (1988) since there is only one English language translation of his work currently available. His work contains some striking similarities with those of Skinner - "Structures do not exist as always ready givens, but are constructed and dissipate in our full view, under the conditions of organism-environment transaction" (Basov, 1975, pp764, quoted in Valsiner, 1988, pp189,p2). This enabled him to transcend the static view of structures (or a tendency towards some static equilibrium) that Gestalt psychology supported. His structuralism is developmental in nature in that structures of psychological processes arise as the person actively interacts with the environment, and lead to the emergence of new structures. 'Higher' structural forms are built on 'lower' forms and combine into the new hierarchical structure of behaviour.

The various strands of Soviet psychology differ in many ways, but Valsiner provides the following summary of their main commonalities:

> All the different approaches to cognitive development in the USSR share a number of general features, even if the authors of these approaches may be in recurrent disagreement with one another. These features are: (1) a qualitative-structural, rather than quantitative perspective on cognitive phenomena; (2) the view that development results from the child's *active* influence on the environment, and the feedback of the latter on the child; (3) the emergence of cognitive processes in the context of action; and (4) the active formation of the cognitive functions of the child by purposeful educators (adults). finally (5), children's speech development has been viewed in Soviet developmental psychology as the highest mediator (organizer) of other psychological processes, This perspective emerges form different standpoints whether Vygotskian, Luria's, or neo-Pavlovian (Bekhterevian)." (Valsiner,1988,pp239,p2).

In considering the individual contributions of Soviet psychologists Valsiner sums up the spirit of the emergence of these ideas in a fashion that would lie entirely comfortably in the Skinnerian paradigm:

> "A thinker is always embedded in his environment and develops in interaction with it - so overlooking that environment may lead us to attribute credit for the ideas to the individual, rather than to individual-environment relationships." Valsiner,1988,pp334,p2).

The work of A. R. Luria represents a mature development of the ideas of Vygotsky which included important findings in western psychology and linguistics in the course of its development. It is especially interesting given the input from neurological findings, which the social-developmental model of language from behaviourists has generally eschewed. Thus he provides a well rounded analysis of language and thought that is useful in helping to fill some of the gaps in the behavioural model.

He made use of the categories of phylogenetic and ontogenetic change, but included and additional category of 'microgenetic' change. "Microgenesis" signifies the process of occurrence of a single psychological act that typically takes place over a period of seconds or milliseconds. He felt this was of particular importance in understanding speech production and comprehension. His analysis of these processes relies on a series of successive stages involved in the production or comprehension of single utterances.

The notion that we must seek the origins of conscious activity and "categorical" behaviour in the 'external processes of social life, in the social and historical forms of human existence' derives form the work of Marx and Engels on the foundation of human behaviour in social labour. For the latter involve indirect behaviour generating social as well as biological stimuli, often with a consequence which is deferred and may be counter to immediate biological gains, e.g. in scattering seeds instead of eating them now. Socio-biologists might well counter this with explanations that point to increments in the reproductive likelihood of any gene contributing to such behaviour, as per the models Dawkins provided in the analysis in his books 'The Selfish Gene' (1976) and 'The Extended Phenotype' (1982), and that of Wilson's 'Sociobiology' (1975). However the role of labour in conquering problems that beset a community seems an important one. Luria presents the position of Marxist psychology as follows:

> "During the initial stages ... language was closely tied to gestures, and an inarticulate sound could mean either "be careful!' or "pull harder!". The exact meaning of such a sound depended on factors such as the situation in which it was used, the action needed, the gesture accompanying it, and the tone in which it was uttered. The birth of language led to the gradual appearance of a whole system of codes signifying objects and actions. This system of codes later began to differentiate signs, acts and relationships, and finally led to the formation of complex codes of sentences that could be used to form complex utterances.
>
> That system of codes came to assume a decisive importance for the further development of human conscious activity. Language, at first, was very closely connected with practical activity, i.e., it had a "sympractical character." Gradually it began to become separated from practise and constitute a system of codes adequate for expressing any information . ... Language, in the course of social history, became the decisive instrument which helped humans transcend the boundaries of sensory experience, to assign symbols, and to formulate certain generalizations or categories. Thus, if humans had not possessed the capacity and had not had language, they would not have developed abstract, "categorical" thinking. That is why we should not seek the origins of abstract thinking and categorical behaviour, which mark a sharp change from the sensory to the rational, within human consciousness or within the human

brain. Rather, we should seek these origins in the social forms of human historical existence. Only in this way (which differs radically from all the teachings of traditional psychology) can we explain the appearance of complex forms of conscious behaviour that are uniquely human."
(Luria,1982,pp27,p1,p2&p3).

He criticizes the notion that development simply involves the systematic extension of babbling in infancy, arguing instead that in order to learn sounds from the linguistic system a child must *inhibit* the sounds of babbling. He compares this with voluntary movement of the hand (a cortical act) versus the grasping reflex (a subcortical act). In discussing the concept of a word, he states that words don't merely substitute for things, they also analyse them through an introduction of these things into a system of complex associations and relations. This abstracting and generalizing function comprises meaning.

He offers an interesting discussion of 'lexical connections' that parallels Skinner's concepts of the intraverbal and aspects of the autoclitic and the notion of 'Supplementary stimulation', i.e. thematic and formal prompting and probing in a section entitled 'Lexical functions and the valency of words' (Luria,1982,pp39). Whilst a distinction is drawn between meaning and sense - "if meaning is an objective reflection of a system of relations and associations, sense is a transformation of meaning, a selection from among all possible meanings of those which interest the person at a given moment." (Luria, 1982, pp44,p6). He discusses an experiment by Kol'tsova, in 1958, who studied a child from 6 months to 2 years and found that early stages of object reference (understanding the meaning of the word and relating it to the corresponding object of action) are contextually bound - demonstrating that words do not have a stable object reference from the very beginning of a child's development. Instead it develops during the middle or end of a child's second year. In this initial stages of development, the affective component of a word predominates, in the next stage concrete memory representations are held to play a major role, whilst in the last stage a child starts to comprehend the complex systems of 'verbal-logical' relations occuring from the action of a word.

He discusses an interesting experiment by Khomskaya, in 1952, which provides an early demonstration of the action of conditional tacts:

> the "concern was the extent to which these [experimental] conditions were able to change the character of the involuntary autonomic responses.
>
> This study showed that a consciously accepted change in situation can alter the structure of an involuntarily constructed semantic field in a very specific way. When a subject was told that there would be an electric shock when a word close to the word "zdanie" (building) occurred, the range of words evoking orienting responses expanded considerably. This was reflected in the average curve of autonomic responses. Specific (painful) autonomic responses continued to be evoked by the same words which caused them in the previous experiment, but an entire series of new words also began to elicit non specific orienting responses.
>
> ... Autonomic responses to all the words ceased only when subjects were told that we were completely canceling the conditions of the experiment ("There will be no more shock."). The autonomic responses continued only in response to the word (building) which had been presented earlier. It continued to elicit specific (pain) and nonspecific (orienting) responses. (Luria,1982,pp81,p7).

In addition he describes an experiment illustrating the contextual control of relations among words:

> "We found that it is possible to control the system of associations by introducing the given word into a new context. If the test word was "skripka" (violin), the word "truba" (pipe, trumpet, chimney) may or may not evoke a

> response, depending upon the context in which it is used. If subject is given the series of words "skripka" - (violin, the test word), "violonchel" (cello), "kontrabas" (double bass), "forte-piano" (piano), "fagot" (bassoon), "truba" (trumpet), the word "truba" is understood as a musical instrument and elicits responses similar to the test word. However, if after test word "skripka" subject is given a new set of words - "dom" (house), "stena" (wall), "pechka" (stove), "krysha" (roof), and "truba" (chimney) - the word "truba" is understood in a different semantic context and does not elicit the same responses as the test word. Consequently it is possible to control the perception of a word by introducing it into different contexts." (Luria,1982,pp79,p5)

From the 'objective study of semantic field' he makes a number of relevant points. A word does not just act as a basic, indivisible signifier of some object, action, or property, for it doesn't merely have a single, unchanging meaning. A word has a multiplicity of associations. Connections of meaning (situational or conceptual) typically predominate, but this can alter depending on the nature of the task which a subject is faced with. When associations of meaning are predominant, there is held to be inhibition of phonetic connections. Such selectivity can be lost when the brain is damaged, in these cases the selectivity required form normal speech may be replaced by the occurrence of any kind of association in equal probability.

Several methods are described that allow the investigation of the loss of selectivity, important among these is the method of the 'objective investigation of semantic fields', he suggests. The physiological mechanism of selectivity is modelled by the 'law of strength', derived from Pavlov, this states that strong (or important) stimuli and their traces elicit strong responses, and that weak (or nonessential) stimuli and their traces elicit weak responses - the normal state of the cortex. When the cortex is in a pathological state (inhibiting or phasic conditions), the law of strength no longer applies with the result that all stimuli become equal in status and there is an equal probability of their traces surfacing, or weak stimuli can result in an even stronger response than strong stimuli. This inhibitory or phasic condition happens to the general population at various times, such as when sleepy, but can occur in a more permanent fashion in certain types of damage to the brain. This analysis emphasises the important role played by the concept of inhibition in Soviet models of behaviour in addition to that by excitation, which is absent from all but a small section of Skinner's analysis - in the area on 'self-control' such as in biting one's lip to prevent the emission of an embarrassing laugh.

He presents a discussion of the ontogenesis of voluntary action. This starts with the action that the child engages in as a response to an adult's command. In the stage that follows this the child starts to use their own external speech, initially along side the act, then later preceeding it. Ultimately, in later stages, this external speech becomes "internalized", turning into inner speech that takes over the role of regulating behaviour. So the role of the initial social interaction of two people, the adult and child, is eventually taken on by the child alone. He criticises the mentalistic tendencies of some researchers, calling upon them to end the search for the origins of voluntary behaviour inside the brain or "spiritual life" and instead to examine the relationship between children and adults, beginning with the breakdown of the essential form of children's activity and how they communicate with adults.

He discusses some research on the regulative function of speech which is of relevance to the ideas developed in this thesis. In one study he and his colleagues found that inertia of actions prevents switching between two instructions "put it on" and "take it off", with a 14-16 month old child using a ring and rod to build a toy pyramid. A coin and goblet experiment along similar lines also found such inertia. They observed such inertia to previous action in children of up to 18 months - by 2.5 years old they were able to carry out the commands correctly. However if visual cues, other than the coin being put in the goblet, were removed 2 to 2.5 year olds were unable to do the task solely relying on the experimenter's verbal commands.

They found problems in children dealing with visual imitations when there was a conflict in the verbal command up until 3.5 years old, e.g. "you put up your finger" (when the experimenter raises a fist). A similar study was carried out by Subbotskii (described in Luria, 1982) using objects and conditional instructions. Here the experimenter lifted two objects (e.g. a pencil and a pair of eyeglasses) during which two different objects were put in front of the child (e.g. a toy fish and chicken). The experimenter gave the child the instruction "When I pick up the pencil, you pick up the fish, and when I pick up the eyeglasses, you pick up the rooster." After a few trials the children could follow these instructions reasonable well, illustrating a relatively firm connection between 'agreed upon meanings' had been established. A different result occurred, though, if the procedure was altered such that the experimenter raised a fish and a chicken and also gave the child a fish and chicken, saying to the child "when I pick up the fish, you pick up the chicken, and when I pick up the chicken you pick up the fish", the children could not follow the instruction." He states that the 'emancipation' from the effect of direct experience and the attainment of the regulative action of adult speech only reach stability when a child reaches around 3.5 years old. Which also happens to be the age when the anterior sections of the brain reach maturity.

An extended series of experimentshave been carried out by him and his co-workers, which are of interest, using a small rubber bulb where pressure on it was registered on a remote revolving drum. The most basic procedure involves a child immediately executing the command from an adult, e.g. "press!", "press!", "press!". Children of around 20 to 22 months of age can do the task, but cannot stop once it has begun. "When the child is told to press, a wave of movement occurs, and if we then tell him/her to stop, this wave continues even more strongly" (Luria,1982,pp97,p3). An adult can elicit an impulse in this period, but cannot inhibit it. So, the stimulating effect of speech appears to be present earlier than its inhibitory effect.

Luria tests for this in a development of that procedure, but complicates the issue unnecessarily, by using conditional forms of the instruction, e.g. "when the light is on, press, but don't press when it is off!". Here a 2 year old who is capable of the direct command has considerable difficulty in mastering the more complex conditional command. 2.5 year olds who can memorize the command still find great difficulty when trying to execute it. It is only around 3 years old that this ability to coordinate both the conditioning signal and their behaviour is stable.

Additional increments in complexity involved commands such as "when you see the red light, press, and when you see the green light, don't press". In addition interventions such as asking the child to say "yes" after the red light and "no" after the green light prior a response were tried without the bulb. For children of the younger group, around 2 years 4 months old, these verbal responses still showed inertia, e.g. they frequently emitted "Yes!" or "No!" irrespective of the color of the light. 3 year olds, however, showed little of such inertia and were able to respond appropriately to light stimuli. finally the bulb was added and the child required to say "Yes!" and squeeze the bulb in the presence of the red light, and to say "No!" and refrain from squeezing the bulb in the presence of the green light. In this stage the younger children often gave a correct answer, but produced a motor response in all cases. When saying "No!" or "Don't squeeze", they frequently did not stop, often continuing to squeeze the bulb even harder. 'A functional system in which the verbal response regulates the motor response did not exits. Children around age 3 showed a different pattern, their movements came under the control of the meaning of words spoken, rather than merely the impulsive excitatory effect of these verbal responses - thus motor responses after the inhibitory word did not intensify, but were inhibited.

Whilst it does not make the problem of analysing the content of inner speech any easier, there has been work by Sokolov (1972) that corroborates its occurrence. Through the use of electrodes placed on childrens' larynxes and lips he found that weak electromyographic responses in the speech organs occurred when they were thinking about solving some problem.

Luria highlights the difference between inner and public speech in the following fashion:

> "... it is quite incorrect to view inner speech simply as speech addressed to oneself. That is how psychologists thought of this phenomenon for many decades. One often comes across the assertion that inner speech is the same thing as external speech except for the fact that it has no overt behavioural form, that

it is "talking to oneself" with speech that has the same lexical, syntactic, and semiotic rules as external speech. This is an erroneous view, because talking to oneself this way would have no functional significance. It would involve performing double the amount of work that seems necessary. Mental acts, such as decision making and identifying the correct solution to a problem, occur much faster, often in a fraction of a second. In such a short period of time, it is impossible to produce for oneself a complete sentence, much less a complete discussion. Inner speech, with its directive or planning role, has an altogether different, abbreviated structure." (Luria,1982,pp105,p4).

The change in structure has been analysed by Luria and colleagues by following external speech during its gradual alteration into inner speech. There is an evolution from audible to whispered to inner speech. In addition it takes on an abbreviated character, expanded speech turning into fragmentary and condensed speech. Which suggests that the structure of inner speech is very different from external speech. In one problem setting this occurred in the following manner, initially phrases like "But the paper is slipping, what can I do so it doesn't slip? Where can I get a thumb tack? Maybe I should lick the paper and wet it so that it won't slip?", then at a later age "but the paper ... it's slipping ... what can I do? ... where can I get a tack? ...", until it showed extreme abbreviation as in "paper, tack, how can I?"

He analysed the combination of words in sentences and phrases, which is relevant to the autoclitic account given by Skinner, in particular the distinction between use of syntagmatic and paradigmatic organization:

"The communication of relationships differs from the communication of events in grammatical construction as well as content. The communication of relationships as a rule, involves comprehension of units which require transformations that convert this form of communication into simpler communications of events and therefore provide

> concrete support, facilitating comprehension. In the communication of relationships, the mere juxtaposition of individual elements of a message (parataxis) is no longer adequate. Other, more complex types of grammatical structure are needed, which allows one to develop an entire hierarchy of mutually subordinate components customarily called hypotaxis. These structures allow governance of some groups of words by other's. ... With some qualifications, we can say that syntagmatic and paradigmatic organization differ not only in their grammatical structure, but also in their origin. Syntagmatic forms of an utterance are most clearly seen in the communication of events. Paradigmatic forms of an utterance, on the other hand, are manifested most clearly in the communication of relationships. These forms involve complex codes and the transformation of successive links of an utterance into patterns. ... Of course this division of the two systems of speech processes is only theoretical. In actual practice, syntagmatic and paradigmatic organizational principles are both involved in complex utterances. (Luria,1982,pp130-131).

The terms, "syntagmatic" and "paradigmatic" originated from Saussure, and were then developed by Jakobson in his discussion of them and development of the two modes of arrangement in speech - combination and selection. The latter, in particular, provided an important source for Luria's ideas in this area.

Chapter 6: Developing Testable models of emergent behaviour

In the standard equivalence paradigm training in certain conditional relations to criterion is given, then the subject is tested in extinction for the emergence of other conditional relations predicted from the change in stimulus function characteristic of this arbitrary relational class. For example, train A → B and B → C then test for the presence of B → A and A → C. This assumes the presence or absence of the relational patterns of responding encompassed by the definition of equivalence. Their absence results in failure for an organism to demonstrate the emergent conditional relations in the testing phases. It allows for various verbal manipulations of the subject during the training phase, such as encouraging tacting of the stimuli and the use of these in choosing between comparisons, or various autoclitic manipulations relating sample and comparison. Monitoring of the subject's verbal behaviour, whilst sometimes difficult methodologically, is necessary to take into account any mediating role it may have in performing the task. If this is already in progress, the step from correlational work on self-generated verbal behaviour to its direct manipulation by the experimenter is a small one. The latter type of intervention then tries to bring pre-existing relational response classes already under verbal control into the experimental task.

A problem that arises with the paradigm occurs when the relational classes of responding it requires are not present in the subject in any form, as no reinforcement for responding according to the relation prior to testing is provided. Yet the acquisition of the response class would seem to require either shaping of the class, or if it is merely present but lacks appropriate stimulus control, it would require differential reinforcement to establish control in the context of the experiment. Since a clear test for equivalence responding would require the tested relations be unreinforced, this suggests that once it is found that equivalence is not present in the subject, training be given which includes reinforcement of the emergent conditional relations and then a new set of stimuli be tried with the standard equivalence paradigm. If the subject fails, the relational reinforcement is repeated this time for these stimuli followed by standard training and testing with a further set of stimuli. This program is repeated until the point where equivalence responding is shown, or the experiment abandoned. This specific reinforcement of the relational responding would sharpen the control over the relation by contextual stimuli in the experiment, removing the tenuous stimulus control that occurs simply by the generalization from situations in which relational responding is characteristically reinforced.

A more economical design is suggested in this variation: the subject is given the standard paradigm for a set of stimuli, if failure is shown after a suitable number of test trials then they are reinforced to criterion on that aspect of the relation. A new set of stimuli is introduced and these stages repeated. Thus the standard rigour of the equivalence paradigm is embodied, but the pattern of acquisition of the emergent relations is monitored across succeeding sets of stimuli; patterns of savings from repeated acquisition could be observed as the subject approaches relational responding on the initial component with each set of stimuli. Additional manipulations involving verbal instruction or training in other tasks could be given to the subject, and their effect on subsequent acquisition investigated.

Demonstration of contextual control over relational classes could be shown by establishing one relation to criterion on testing trials, and then introducing another, the operation of each being signalled by different contextual cues. Differential reinforcement of the new relation would continue until performance on testing trials also reached criterion. Periods of reinforcement for the original relation could also be introduced when performance fell below a suitable learning criterion (as the new relation had a disrupting effect). The establishment of stimulus control over the relation may be of importance in trying to evoke relational behaviour in subsequent experimental manipulations.

Hayes (in press) suggests that experience of certain non-arbitrary relations may facilitate the acquisition of corresponding arbitrary relational classes. From the discussion above, contextual stimuli seem necessary for this to occur. An example of this possible facilitation would be the case of applying the relation "larger" to mathematical symbols, e.g $A > B > C$ therefore $A > C$. An experimental paradigm for this would be to bring the non-arbitrary relation under stimulus control and then in some way introducing trials with the arbitrary relation. The manner in which such trials are introduced and any additional operations facilitating it are possible manipulations to experimentally elucidate the generalization to, or facilitation of, performance of the arbitrary relational class, by a prior history of reinforcement of particular non-arbitrary relational response classes.

One suggestion arising earlier in the discussion was that the function of autoclitics could themselves be transferred to neutral stimuli by pairing with an appropriate relational autoclitic. This transfer of the higher order verbal function of stimuli has implications for the issue of the rapid acquisition and productivity in the functional usage of language and a clear demonstration of such tranference would be useful useful in testing the model. As autoclitics may be transferred and altered by other already present autoclitics, it can be seen that only a relatively small number of primary and autoclitic verbal operants need be acquired by the slower direct shaping through differential reinforcement, before a point is reached when autoclitic modes of acquisition begin to function and acquisition, plus alteration, of stimulus function can proceed at the new order of magnitude characteristic of verbal human subjects.

In order to engage in exploratory investigation of these phenomena, it is proposed that initial work be done on a one-to-one level with a child, in the manner of a game, foregoing control for experimenter cuing until useful manipulations are discovered which can then be investigated under the tighter control of an automated experimental set up. Similarly, it may be advantageous to establish contextual control over a relational class in a naturalistic setting where relational responses may be at a higher operant level, and then introduce an automated setting, making use of the contextual control which is now present. In the typical matching-to-sample setup it generally takes a long time for children to reach criterion (e.g. of the order of months Lowe & Beasty, 1987) limiting its use with young infants, e.g. those under two years of age, who are of most interest being at an early stage of verbal competence, yet who rapidly become tired and distracted during the typical twenty-minute session.

Problems arise when using adults in investigating relational behaviour, for the self-generated verbal behaviour which underlies much of adult problem solving is evoked, and the task becomes one of interpretation, inference and then rule generation by the subject, as some conclusion is reached about the experimental contingencies. No longer will simply presenting the data obtained by automated matching-to - sample apparatus be sufficient; this preselection of data leads to the reductionistic accounts seen in the majority of work on equivalence. Such an epistemological stance of ignoring, or failing to deal adequately with, accompanying verbal behaviour (either covert or overt) is inconsistent with the framework of Skinner's (1957) analysis, and treats the relational behaviour as constrained by the experimental manipulations in the manner of the contingency-shaped behaviour of laboratory animals. The explanation seemingly to be sought in terms of these operations, as opposed to the mediating behaviour that arises from being a member of a verbal community and which is brought to bear upon encountering such problem situations. Adult experiments on equivalence therefore require a more careful treatment and refined methodology than work on young children whose primary means of problem solving may be through overt behaviour, either verbal or contingency-shaped. Yet even relatively young children may need probing to establish possible covert verbal mediation, care being needed not to contaminate it in doing so.

In considering the origin of arbitrary relational classes, difficulties arise in distinguishing between the sharpening of stimulus control in an already present response class, versus its actual shaping up. Structural constraints in language acquisition, e.g. already present tendencies to pick out and emit syntactic regularities might facilitate the acquisition of relational classes, perhaps providing the rudimentary means by which such transfer and modification can occur. This possibility needs further consideration with the current model of relational behaviour, so that its theoretical and experimental implications may be explored.

A useful initial start might be to present a range of tasks in which a particular relational response is required to find subjects who consistently fail on that relation, even with verbal manipulations or prompting. These subjects can then be used to begin a systematic exploration of the acquisition and contextual control of relational classes.

Some prerequisites for a model of the acquisition of relational response classes.

These models are part of an attempt to refine and extend Skinner's original exercise in the interpretation of language and thought using the three term contingency, to provide testable assertions about the acquisition of emergent behaviour.

A network of arbitrary relational responding involves a number of component inferences which are brought under the control of a particular spatio-temporal pattern of stimulation. These basic types of inferences have been classed as "inference types" in Place & Sofroniou (1987). Examples of these include the following:

(N.B. a relation, R, between two stimuli that are verbal or physical, s_1 and s_2, is represented in this way: Rs_1s_2).

Reflexivity : Raa is true.
Symmetry : if Rab, then Rba.
Reciprocity : if R^1ab, then $R^{-1}ba$. (Where $^{-1}$ denotes the operation of the inverse counterpart of relation R^1).
Transitivity : if Rab & Rbc, then Rac.

Other inference types exist in addition to these, for example definitions for Asymmetry, Antisymmetry, Irreflexivity, and Connectedness are given in Flew (1979,pp280/1). These component inferences are characterized by the emergent pattens of behaviour that a listener shows with respect to physical or primary verbal stimuli when they are paired by the appropriate relational autoclitic. These components may be brought under the control of a single higher order verbal stimulus resulting in a more complex pattern of resultant emergent behaviour. One example is the case of equivalence, where the component inferences of reflexivity, symmetry and transitivity are brought under the control of a relational autoclitic that brings together two pairs of stimuli, e.g. Rab and Rac. In addition to equivalence, the various subclasses of ordering relations can be constructed in this manner, i.e. Partial ordering, Simple ordering, and Well ordering. An ordered relation R imposes some order on the members of a set X (Flew, 1979, pp240 & 280/1); its control upon a listener is demonstrated by the presence of appropriate emergent behaviour following the initial pairing of primary verbal operants by the relational autoclitic of ordering.

The use of formal definitions such as these above, brings the control of the subsequent inferences under the control of the formal terms alone, minimizing any interference from extraneous sources of strength. Skinner discusses this in his analysis of logical and scientific verbal behaviour in his book Verbal Behaviour, Chapter 18, for example:

> "The logical and scientific community eliminates intraverbal responses which interfere with a "logical train of thought", ... A special vocabulary (used within a given "universe of discourse") is relatively free of responses under other sorts of stimulus control - that is, of superfluous intraverbal relations. The symbols which appear so often in logical and scientific behaviour (often as replacements for terms in the lay vocabulary) are especially important in eliminating unwanted echoic, textual and intraverbal responses." (Skinner,1957,pp421,p3)

These practises also act to reduce the effect of spurious sources of strength from irrelevant thematic and formal prompts and probes through multiple causation (these sources of strength are described in Skinner,1957,Chapter 9). It is a mistake to explain the emergent behaviour resulting from using relational autoclitics, in terms of "logic". The attempt to describe in a formal manner how various inferences follow from certain initial conditions helps clarify patterns of stimulus control in the absence of the extraneous, irrelevant, sources of strength. Skinner's analysis, and the developments proposed in the present work, provide a means of beginning to analyse such processes behaviourally. Using the general model for the acquisition of an autoclitic response class in the listener, models can be drawn up for each of the component inference types. If these are validated experimentally than we have the basic building blocks for a number of more complex arbitrary relations. Bringing several component inference types under the control of a single relational autoclitic will result in the more complex patterns of emergent behaviour characterizing an arbitrary relation composed of these. What this approach provides us with is the possibility of encompassing the areas of logic and set theory in terms of a model that ultimately derives its source of productivity and emergent order from the selection of behaviour by its consequences, embodied in the three term contingency.

In the following sections attempts will be made to elucidate the details of how such component inference types might be established. Hayes' (in press) suggestion that experience with non arbitrary versions of some relations might facilitate the learning of their non arbitrary equivalents is an important one. I have begun by trying to see if these component inference types might by established in isolation, on paper, though in practise his suggestion might prove useful or necessary for their establishment. Similarly the heterogeneous mixture of the shaping of higher order verbal operants that everyday responding involves may be important - with possibly different effects to the generally successive models proposed, here.

This section is an attempt to dissect out conceptually the various shaping processes which are, no doubt, far less isolated in everyday life. (These ideas are developed later in the discussion section, in the light of the data obtained in the experiments). A synergistic interaction amongst the concurrently shaped classes may facilitate, or be a prerequisite for acquiring control by more complex autoclitics.

General model for the acquisition of autoclitic response classes in the listener.

Stage:

i) Appropriate listener behaviour to relevant primary order verbal operants is shaped up through differential reinforcement. (This term will be used to cover the contingent use of both reinforcers and aversive stimuli). The question of whether the production of labels by the listener is a necessary prerequisite, or if the mere presence of the necessary receptive behaviour is sufficient, has not yet been investigated. So the model may need modification when more data on this aspect is obtained.

ii) The speaker introduces instances of the primary verbal operant(s) paired with a particular autoclitic. The listener is reinforced for engaging in behaviour deemed in accordance with the preceding autoclitic phrase, and punished for behaviour that lies outside these limits. This is continued until the learning criterion is met on autoclitically modified instances, whilst maintained when the primary verbal operants are presented alone.

iii) stages i) and ii) are repeated for the pairing of the autoclitic with a new primary verbal operant of the same type as in the previous phrase, until the learning criterion is met on instances of the autoclitic phrase as well as the new primary verbal operant alone.

As this is repeated for successive new pairings of this autoclitic, the number of trials to criterion becomes smaller, until the point comes where no reinforced trials are required for the listener to respond correctly to the autoclitic phrase involving any member of this type of primary verbal operant.

At this point we can say that the response class has become generalized and is under the stimulus control of the speaker's autoclitic. At this point the emergent behaviour characteristic of all autoclitic classes is shown - a finite number of reinforced instances results in the response class becoming open ended, modifying the listener's response without their previous experience of the novel combination.

<u>Model for negation of mands</u>.

e.g. "Don't pick up the knife"

<u>Stage</u>:

i) listener behaviour to the mand alone is shaped up through differential reinforcement.

ii) The speaker introduces instances of the mand paired with "don't", and the listener is reinforced for withholding the response, and punished for engaging in it. This is carried on until the learning criterion is met on the negated mands, whilst performance is maintained on the mands when they are presented on their own.

iii) stages i) and ii) are repeated for a new mand until criterion is met on both mand and negated mand instances.

It is carried out for successive new negated mands, the number of trials to criterion becomes smaller, until the point is reached where no reinforced trials are required for the listener to respond correctly to negation of any novel mand.Then one can say that the response class for generalized negated manding has been acquired and is under the stimulus control of the speaker's autoclitic.

<u>Model for conditional mands</u>.

i.e. "when (condition occurs) then (mand)", e.g. "when I say "now", then put your hand up".

The aim being to rapidly transfer the discriminative properties of the mand to the situation specified by the condition.

Stage:

i) appropriate listener behaviour to the mand alone (in this example, a mand phrase) and the verbal operant specifying the condition alone is shaped up through differential reinforcement, independent of one another.

ii) The speaker introduces instances of the mand paired with the relational autoclitic frame, "when..., then...", during this stage the verbal operant specifying the condition remains invariant. What we are initially establishing is this component of the frame:

"when I say "now",then (mand)".

Following presentation of the conditional mand phrase for a particular mand, the listener is reinforced for withholding the response, and punished for engaging in it, up until the time when the specified condition occurs, at this point the contingencies reverse and they are reinforced for engaging in the activity. When the conditions end, the contingencies revert to the initial ones, i.e. punishment occurs for engaging in the response. This is continued until the learning criterion is met for the behaviour specified by this conditional mand, whilst performance is maintained on the mand when they are presented alone, and with other phrases where the verbal operant specifying the condition is used, i.e. both primary verbal operants are maintained at strength.

iii) stages i) and ii) are repeated for a new mand until criterion is met on conditional mand instances, whilst usage of the primary verbal operants in other phrases, and alone is maintained.

When presented with successive new mands involved in this particular conditional relational autoclitic frame, the number of trials to criterion becomes smaller, until the point is reached where no reinforced trials are required for the listener to respond correctly to its usage with any novel mand. It now constitutes an autoclitic frame because the components of the relational autoclitic phrase are invariant and thus come to act a single autoclitic stimulus, rather than a collection modifying each other's function prior to that of the primary verbal stimuli paired with them - this also applies to the test autoclitic phrase. Varying the mand phrase components of the test instruction, and the spectrum of its usage would reduce the frame manner of functioning, bringing control under the relational autoclitic component. One can then assert that the response class to this component of the relational autoclitic has generalized, i.e. "when I say "now", then (any mand)", and is under the stimulus control of the speaker's autoclitic.

iv) stages i) to iii) are repeated for a new primary verbal operant, specifying a condition, inserted as the conditional part of the relational autoclitic frame. When the learning criterion is met, a further such new conditional part is used.

As repetition of successive new condition parts occurs, the number of trials for the function of any mand, paired with it by the relational autoclitic, to transfer to the specified situation becomes smaller, until eventually no reinforced trials are required for the listener to respond correctly to negation of any novel mand. Then it can be stated that the response class to both components of the relational autoclitic has generalized, i.e. "when (any condition), then (any mand)", and is under the stimulus control of the speaker's relational autoclitic frame "when..., then...".

In this model of acquisition the mand component was varied first, and the condition part second, but the reverse could easily have been the case, i.e. "when (vary condition), then (constant mand)"

later "when (any condition), then (vary mand),

until "when (any condition), then (any mand)"

controls a generalized, emergent response class for control by conditional mands.

Further restrictive conditions could then be imposed, and established using this general model of acquisition, e.g. indicating duration of the required pattern of responding - that the conditional mand is a temporary requirement ("watch the documentary on BBC1 at 8pm,tonight"), or a requirement for the continuing future ("make sure your bicycle lights are on after dark"), or that some long delay is due before the requisite condition will occur ("send a card to your grandfather this Christmas"). In these examples the relational autoclitics are different to above, but similar models can be constructed.

Model for reflexivity

This is a modification of the paradigm typically used in testing for the presence of generalized identity matching.

Stage:

i) To aid testing of the emergent behaviour, appropriate listener behaviour to mands for indicative responses such as "point to", "show me", or "touch the" are shaped up through differential reinforcement. In order to bring the listener's behaviour under control of particular stimuli, responding to tacts labelling them, or to demonstrative pronouns such as "this" or "that", also need to be shaped up.

ii) The speaker introduces instances where a stimulus, perhaps a picture of a cat, is presented along with some accompanying relational autoclitic phrase such as "which one is the same as this?" and preceded by a mand such as "show me" that form a conditional mand phrase together; the listener having access to a number of stimuli which they might point to or indicate their choice in some manner (perhaps themselves emitting a tact or demonstrative pronoun). The listener is reinforced for choices in accordance with the preceding phrase, i.e. choosing a stimulus the same, and punished or extinguished for other responses. This is continued until the learning criterion is met for this stimulus.

iii) stage ii) is repeated for a new stimulus of this type.

Given successive new pairings of this autoclitic, the number of trials to criterion becomes smaller, until the point comes where no reinforced trials are required for the listener to respond correctly to the autoclitic phrase with any such stimulus. At this point we can say that generalized reflexive responding (or identity matching) has been acquired and is under the control of the speaker's autoclitic. The model outlined applies to visual stimuli, a slightly, modified arrangement would allow the use of auditory stimuli as referents of the primary verbal stimuli modified by the relational autoclitic frame. Reducing the disparity between various successive stimuli in the shaping phase may make the generalization from one stimulus to another greater. Control by the relational autoclitic "different" may be acquired through a reversal of the reinforcement contingencies. The acquisition of control by both relations through presenting a mixture of the two autoclitic phrases and their reinforcement contingencies at some stage in the shaping procedure may sharpen their stimulus control, and facilitate acquisition.

Model for symmetry

In instructing a listener about a symmetrical relation between two primary verbal stimuli the speaker can arbitrarily choose which way round they are inserted into the phrase. This is because the relation between them is reversible. Using the relational autoclitic frame from our formal definition we see that Rab and Rba both suggest the same relation R between ab and ba. Which primary verbal stimulus is actually emitted first probably simply depends on a relative greater source of strength rather than involving any reasoning about the matter as to which way round might be more effective upon the listener.

Stage:

i) Control by the primary verbal stimuli, e.g. tacts or demonstrative pronouns (such as "this" or "that"), is shaped up through differential reinforcement, as is the control by mands for indicative responses in the listener, e.g. "point to" or "show me".

ii) Given the instruction for Rab or Rba the listener is then presented with either of the primary verbal stimuli (say the sample-correct comparison order follows that of the instruction for simplicity's sake) and differentially reinforced for choosing the correct stimulus to the sample indicated by the instruction. This is done to criterion. Then the previous correct comparison is made the sample in the instruction and the listener is reinforced for choosing the appropriate stimulus from those available. This is repeated till criterion is reached.

Next, this process is repeated for a new pair of stimuli until criterion with both a sample and correct comparison has been met. As this is repeated for successive new symmetry pairs, the number of trials to criterion on both parts becomes fewer, until the point is reached where no reinforced trials are required for the listener to show the correct behaviour to the stimuli as sample and comparison. At this point we can say that the response class to both directions of the symmetry relation has generalized (i.e. either may be presented as sample or comparison) and is under the control of the speaker's relational autoclitic frame.

This model is of this form:
Rab, given a - pick b, to criterion,
then given b - pick a,to criterion,
repeat with Rcd, Ref etc.

another alternative is:
Rab, given a - pick b, to criterion,
then given c - pick d, to criterion,
then given e - pick f, to criterion,
... until no reinforced trials are needed for criterion to be met then, for any given pair x,y now at criterion for given x, pick y, when instructed with Rxy, the reversal is reinforced to criterion, Rxy,

given y - pick x, whilst the non reversal behaviour is maintained at criterion, for other pairs of stimuli interspersed, given that the reversal behaviour on the preceding set of stimuli has reached criterion. As the number of reversal sets of stimulus trials reaching criterion increases, the number of trials to criterion for each new set becomes smaller, until the point is reached where no reinforced trials are required. At this point the emergent non reversal responding has been maintained, and the emergent reversal behaviour has been obtained, thus the response class to both components has generalized and is under the stimulus control of the speaker's relational autoclitic.

Model for transitivity.

In instructing a listener to form a transitive relation between three primary verbal stimuli, two setting instructions are required, e.g. for Rab, Rbc; thus two sub-relations are specified. It does not matter whether the listener is told of Rab before Rbc, or vice versa; the speaker can arbitrarily choose which way round they are presented. If symmetry is already present and under the control of the same relational autoclitic the primary verbal stimulus order in each setting instruction can be either way round. Otherwise only certain primary verbal stimulus orders will work and the transitive inference will only appear in one direction,

> e.g. if Rab and Rbc, then Rca emerges, but Rac cannot appear.
> However if symmetry is present, then if Rab and Rcb,
> both Rca, and Rac can appear.

It doesn't matter whether the listener is told of Rab before Rbc, or vice versa.

Stage:

i) Control by the primary verbal stimuli, e.g. tacts or demonstrative pronouns, is shaped up through differential reinforcement, as are indicative responses to mands like "show me" and "point to".

ii) Responding to the relations described by the setting instructions is shaped up. This can be done in this fashion: instruct Rab, train Rab responding to criterion, continue so that any primary verbal stimulus pair are correctly matched by the listener, given their pairing by this instruction. (See the more detailed description of this procedure in the model of symmetry acquisition). Introduce the ab pair to be involved in the transitive relation.

iii) Instruct Rbc. The listener's Rbc matching emerges at criterion on testing from the stage ii) higher order response class. Then the listener's pairing of a, when asked for the stimuli related to R by c, is differentially reinforced, until the listener's behaviour reaches the learning criterion. Giving the two setting instructions at the beginning of each trial might be required in the early stages. In addition, trials may need to be interspersed for the relational classes described by the setting instructions, to keep these at criterion.

iii) Instruct Rbc. The listener's Rbc matching emerges at criterion on testing from the stage ii) higher order response class. Then the listener's pairing of a, when asked for the stimuli related by R to c, is differentially reinforced, until the listener's behaviour reaches the learning criterion. Giving the two setting instructions at the beginning of each trial might be required in the early stages. In addition, trials for the relational classes described by the setting instructions may need to be interspersed, to keep these at criterion.

iv) Stages ii) and iii) are repeated for each new triplet of stimuli. The two instructed relations emerge and are at criterion, whilst the uninstructed, transitive, relation is reinforced to criterion.
This model is of the form:

Instruct Rab, given a - pick b, to criterion, for any ab pair.
Instruct with R-- the ab pair to enter the transitive relation.
then instruct Rbc; given b - pick c emerges at criterion,
then given c - pick a is reinforced to criterion.

This is continued for successive new triplets of stimuli, the number of trails to criterion decreases, until the point is reached when no reinforced trials are required, for the listener respond correctly to the two relational autoclitic frames, with all with all three relational patterns of responding emergent, for any stimulus triplet of this type of primary verbal operant (and the stimuli refered to by them.). Then it can be said that the response class for all three parts of the transitive relation has generalized, and is under the control of the speaker's relational autoclitic frame, R--. To obtain emergent Rac matching, a symmetry relational class needs to be established in the listener and brought under the control of the same relational autoclitic as is used in the transitivity setting instruction.

These schematic outlines form the initial stages of developing models of each of these types of emergent behaviour. In the light of the experimental findings they required modification. But rather than rewrite them in a retrospective fashion, it provides a more accurate view of the development and the feedback between theory and experimentation to show them in their initial form - based as they were on the theoretical analysis and limited experimental findings available at the time. In the discussion section the integration of the present experimental findings and their implications for both these models and future ones will be entered into in some detail.

Chapter 7: Experiment 1: An initial exploration of the action of negated mands upon preschool aged children.

Introduction

A model presented in the introductory chapters dealt specifically with the acquisition of listener responding to novel negated mands. It suggested this began with the listener's behaviour to a mand alone being shaped up by differential reinforcement. Then the speaker would introduce cases of the mand paired with the negation, e.g. "don't ...", after which the listener was reinforced for withholding the response and punished for its emission. This was repeated until the listener's behaviour became accurate enough to satisfy the speaker; whilst, at the same time, the responding to mands alone was maintained. This whole sequence was then repeated for successive new instances of mand and negated mands. The hypothesised pattern of acquisition was that of a gradual improvement where the number of trials to needed to reach the learning criterion became smaller with each new instance. Eventually responding to novel mands accompanied by the autoclitic of negation would reach criterion without the need for reinforced trials, when the listener could then be said to have gained the response class for generalized negated manding. The aim of this study was to investigate the validity of the model, whilst remaining able to explore unexpected phenomena of relevence that might arise during its course - especially as there was so little history of experiments of this form.

Design

The model of acquisition and training strategy proposed earlier suggested that the procedure would fall in the class of irreversible procedures outlined by Barlow & Hersen (1984). Therefore an ABCD... single subject design with direct replications across five subjects was originally planned (the ellipsis denotes an indeterminate number of manipulations, and that no repetition of a stage at some later point was planned, though in practise this was necessary with one subject who required a greater degree of procedural simplification than the other subjects). This main features of this design are illustrated in Figure 7.1. It was felt to offer flexibility in looking further at the behaviour of individual subjects of interest since the stages were not so constrained by the conditions of the other subjects as they would be in a multiple baseline design. Since this type of behavioural investigation of negation had not been carried out before, considerable leeway was needed to deal with possible variations in the subjects' patterns of acquisition and responding. The model of the learning of responses to negated mands suggested earlier in the introductory chapter was the basis of the plan for intervention.

The ABCD... stages of the experiment were planned to be the following: Stage 'A' being a check for the function of the mands to be used in the later stages, in this case a request for the subject to touch particular pictures presented by the experimenter. This behaviour would be reinforced to establish responding in the experimental setting, and control by the experimenter's instructions. Stage 'B' would consist of negated mand training trials with the same picture stimuli as stage 'A', interspersed with the mand trials of stage 'A'. Stages 'C' and 'D' would consist of generalization tests with the negated mands using novel picture

Figure 7.1 : A simplified schematic diagram of the main procedure used in the negation studies.

Figure 7.1

<u>Simplified Schematic Diagram of the main procedure for the negation studies</u>

1 Check to ensure the presence of the mand function.

2 Test and train with a mixture of mands and negated mands, with feedback.

3 Test with a mixture of mands and negated mands, without feedback.

4 Generalization tests for just negated mands using novel stimuli, without feedback.

5 Generalization tests for a mixture of mands and negated mands using novel stimuli, without feedback.

stimuli for each stage, under conditions of extinction, i.e. no feedback. Finally stage 'E' would be a generalization test of negated mands interspersed with mand instructions using a further set of novel picture stimuli. Performance on stages 'C', 'D', and 'E' to a predetermined learning criterion, would provide strong evidence for the presence of negated mand listener behaviour for this type of mand in a particular subject.

If a slow steady pattern of acquisition were shown across these stages then this would suggest discrimination learning of the class might be occurring, although further study with more controls, such as a multiple baseline design would be needed. Since some subjects required considerable extension of the general design to accommodate individual variations, the order of stages and letters used to represent them does not always correspond to those given in this outline design (see the individual descriptions for more details).

The learning criterion was set to 7/8 correct responses for each of the trial types involved. This value corresponding to an 87.5% criterion, helping to reduce the possibility of a chance performance on a block of trials being misinterpreted as a significant pattern of responding. Where one instruction and four stimuli were involved in a manipulation, 4 X 8 trials would thus be required for a complete combination of all instructions with all picture stimuli, equal to 32 trials. With two instructions and 4 stimuli the figure works out at 64 trials. Thus a single data point for each trial type requires a considerable number of trials. Given the limited amount of time a young child can spend in any one session, this can give rise to studies of an extended duration, and the associated problems of controlling for maturational factors as the subject ages, both in the form of socio-linguistic and physiological changes This suggested that at some point a further degree of control would have to be introduced, possibly in the form of a multiple baseline design across subjects, to try and deal with this confounding factor.

Method

Subjects

Five children aged 2years, 6months to 3years, 1 month at the start of the experiment. 4 were from mainly English speaking backgrounds, and the fifth came from a bilingual background where the mother spoke Welsh and the Father (now living separately) spoke English, see table7·1 for further details. They came from a variety of socioeconomic backgrounds, and had no known intellectual difficulties, similarly, no hearing or visual disabilities were present. The subjects where recruited from personal contacts with experimenter, and acquantances of those mothers' already taking part. They all came from the village Rhiwlas, in N. Wales, where the experiments were carried out. None of the children had previously participated in psychology experiments.

Apparatus

The experiments were conducted in a room in the experimenter's house across a table .5m square, with the subject seated opposite the experimenter, with the mother usually beside them. The stimuli consisted of a series of colored pictures of familiar objects 7cm X 7cm, placed upwards facing the subject, e.g. a cat, house, cup, flag, tree, boat. A randomized order of stimuli was produced on A4 paper by an IBM AT compatible computer; these sheets were used to record the subjects responses. A video camera recorded the majority of sessions, providing information about the subject's verbal responses and their interaction with the experimenter. The position of the choice (comparison) stimuli was randomized during the sessions by a Hewlett Packard HP28S programmable calculator. Material reinforcers consisted of toys, and books valued between £0.50 - £3.50, plus colorful stickers.

Procedure

Pretest

Subjects came for an initial play session with their mothers to the experimental room.This acted to acclimatise them to the experimenter and situation. Each session consisted of about 10-15 minutes play with toys, the choice of a prize to be given, 15-20 minutes spent on the experimental session, followed by the presentation of the prize to the child.

An initial pretest was given, that consisted of presenting the 30 pictures to be used in the experiment to the child in order to assess how many were familiar and might therefore be suitable for use with them in the main experiments. This pretest was usually split into two or three sessions. Each subject was given a set of 30 stimuli, 4 present on each trial, and asked to place one in a nearby plastic bag, using the instruction "put the ... in the bag", e.g. "put the bucket in the bag", a new group of four was then presented and another picture requested. This continued until all pictures were used in the instruction once. Minimal feedback was given - just enough to keep the child engaging in the task (some praise following about 6 of the stimuli). This was to minimize the influence of the pretest upon the later interventions. Any instructions that were incorrectly followed were tried once again later in the test, since the child does not always listen to the instruction, being usually quite distractible in the initial sessions of the experiments. The pictures correctly chosen then formed a pool of stimuli of known familiarity for use in later experiments.

Reynell Developmental Language Scale Assesment

The children were also tested upon the Reynell Developmental Language Scale (Reynell, 1977) to try and obtain a rough estimate of their current linguistic abilities. In order to avoid contamination by the extended experimental intervention, the Reynell test was given in the early stages of the experiment.

Main Experiment

The remaining sessions consisted of the main experimental phases. These followed the general outline given in the design section. Verbal reinforcers, e.g. "that's good", "yes", "good girl", and mild punishers, e.g. "No", "Not that one", "No, you mustn't" were given during the conditions of the experiment where each trial was followed by feedback from the experimenter.

Initial Check for Mand Function

The first stage, designed to check the function of the mand phrases, consisted of the autoclitic frame "Touch the..." used with the names of the four picture stimuli. Two pictures were used on each trial - one the correct stimulus corresponding to the mand phrase, the other an incorrect stimulus from the remaining three stimuli. It was continued until the subjects behaviour reached criterion, i.e. 7/8 correct responses, - usually after the first block of trials. One instruction and four stimuli gave a block length of 32 trials to obtain one data point per trial type. An introductory instruction was given on the first occasion to direct the childrens' behaviour toward the stimuli. This was "I want you to touch the picture I say".

Negated Mand Baseline Trials

The second stage, the negated mand training trials consisted of mixed blocks of trials with "Don't Touch the..." as well as "Touch the ..." instructions for the previous set of four stimuli. A prompt following a "Don't ..." instruction was often given in the early stages since the children were generally unsure about the action required. This was usually "which one are you going to touch?" or "Pick one", sometimes with the addition of the experimenter moving a hand towards them palm upwards ready to receive a picture. This was faded out as the children became more competent at the task. Verbal Feedback was given.

Training and testing stages

This arrangement was used for successive blocks of trials until the subject reached criterion. Two instructions and four stimuli gave a block length of 64 trials to produce one data point per trial type. An overall instruction on the first occasion was given to try and reduce the childrens' anxiety about being told "don't touch..." and yet being expected to then touch one of the pictures. This was "Some times I'll say touch one of the pictures, other times I'll say don't touch a picture, you have to touch one of the others". It is doubtful whether the child understood all of the instruction, but it increased their cooperation with the trials that followed.

If the subject seemed to have some difficulty with the last trial block, but still reached criterion, then a block of just "Don't touch the..."

instructions was given with the last set of stimuli (block length 32 trials), with no feedback to lead them into the next stage.

Generalization Tests

This was the first generalization test of the negated mands using novel picture stimuli consisting of just the "Don't ..." instruction with a new set of four stimuli and NO feedback. Block length was 32 trials. With these 'no feedback' blocks of trials the subject was given an overall instruction that said "This time I'm not going to say how you do during the game; I'll tell you at the end". Again it is unlikely that the instruction was fully understood, but it served to reduce bafflement, and any tendency to assume that silence following a response meant that it was incorrect.

Another set of 4 stimuli with just the "Don't ..." instruction and NO feedback followed. This formed a second consecutive block of generalization trials. Block length was 32 trials. Finally a third set of stimuli using both the "Touch ..." and "Don't touch" instructions, with NO feedback given. This formed the third generalization block, with the addition of a mixture of both types of instructions to check whether the degree of stimulus control is sufficient to keep performance at criterion for all the trial types involved. Two instructions and four picture stimuli gave a block length of 64 trials. If the subject passed this stage then the negated mand class was assumed to be present at some strength.

If at any stage a generalization blocks failed to reach criterion, then subsequent training blocks using the same stimuli with feedback were introduced and finally a block with NO feedback, before proceeding with a new set of stimuli under NO feedback conditions. It was in repeating this for different sets of stimuli that a pattern of acquisition might be revealed if a subject failed initially and then showed a steady improvement across successive sets of pictures - until generalization could finally occur without reinforcement. Throughout the study, a reluctant child was prompted after the instruction. This initially consisted of the experimenter saying "which one are you going to touch?", faded into "touch one", until in later sessions a gentle tap on the table was all that was given. Occasionally the reintroduction of a verbal prompt was needed.

Variations to this general scheme were necessary with some of the subjects, especially the child who was more competent in Welsh than English. Details of these are given in the individual subject's sections, below.

Videotape recordings of the subjects provided a record of their spontaneous verbal and nonverbal behaviour. The analysis of this was restricted to those aspects which were directly related to the subject's performance on the task, e.g. self directed guiding verbal behaviour involving naming or reference to the stimuli, consistent relating of the stimulus names together. Simple tacts of the stimuli and loosely connected sentences, such as subject recounting what they had done since we had last met, were not transcribed from the videotapes.

As this study was partly exploratory in nature, involving both a new procedure and the study of a relatively unresearched aspect of child language development, it was necessary to depart from this general scheme as individual variations in the pattern of acquisition were obtained. This sometimes involved successive simplifications of the task, a phase of increased frequency of reinforcement, and repetition of some of the stages involved. I shall, therefore describe the procedural variations for each subject in turn.

Owen

He was the first subject so I began by determining how many stimuli to present in each trial. Therefore, the first stage of the main experiment involved two blocks of trials in his case. The rest of his procedure followed the general procedural description for this experiment given earlier.

Niall, Duane & Dominic

All of their procedures followed that given in the general procedure section for this experiment.

Sheila

She came from a background which had a larger component of Welsh spoken so it was decided to try the initial mand/negated mand training trial blocks in Welsh if she did badly on the English version. This was done by the experimenter first giving the instruction in English and the child's mother immediately following this with the Welsh equivalent. The purpose of this stage was to see if the ability was present in any strength when instructed in Welsh since any rapid acquisition in English might have been due to an already present response class coming under new stimulus control, and not involving the acquisition of the class itself. Once the child's performance in both languages had been established, the rest of the experiment was carried out in English only.

Following 9 successive blocks of trials in which she failed to show any acquisition of the correct response class, the task was simplified to two stimuli, only one of which was used with the "don't touch" instruction during that trial block. This gave 8 trials per block.After a couple of trial blocks reached criterion, the other stimulus of the pair was used with the instruction. Then a series of trial blocks followed in which a mixture of both instructions was used which gave 16 trials per block. After 6 such trial blocks she was still at chance level, so the single instruction version was reintroduced. As the subject reached criterion on one, the other instruction was used. At the point where she reached criterion on this her mother terminated the experiment due to personal difficulties. The manipulations and data from this, however, served as a prototype for experiment 2, using younger children than in this group who encountered similar difficulties to Sheila.

Results

Mean values for each trial type performance were calculated for all the trial blocks and these are plotted graphically in Figures 7.2 to 7.6 and are shown in numerical form in the Appendix which provides the most detailed description of the successive experimental manipulations and also the raw data. The mean calculated is the arithmetic mean, and the term "mean" used throughout the thesis refers to this quantity. Where a mean value of 7/8 or greater is obtained, but one of the original values upon whom the mean is based lay beneath 7/8 I have indicated this with the accompanying (-) symbol. This represents the fact that one or more of the original values was beneath the 7/8 learning criterion and serves to counter the misleading nature of the mean value taken in isolation.

Tables of data are provided for the following information:
7.1) Initial picture vocabulary pretest results, subject ages, study duration, and total number of trials, during the study,

7.2) Parental estimate of English versus Welsh language backgound.
7.3) Reynell Developmental Language Scale Data.

Owen

Owen's mean level of performance throughout the study is shown in figure 7.2. As stated in the procedure, his two first trial blocks were used to determine the optimal pattern of presenting the stimuli, to be used as a basis for experimenting with the remaining subjects. Initially all four stimuli were presented simultaneously, but in the second trial block it was found that presenting two trial types chosen in a pseudo-random fashion from the four current trial types at each trial reduced the subjects distractibility and oriented them more efficiently towards the task stimuli. This was desirable since it has been found (Donaldson, 1978) that the number of pictures which a child can successfully deal with increases with age. Thus using two trial types on each occasion provided a better chance of using the procedure with younger children in the later studies. There have been reservations from some researchers about using only two choices (e.g. Sidman, 1987), but because in the present procedure they were to be taken from a pool of 4 trial types this was felt to be adequate.

No errors were made in the initial check for the function of the mands "touch the..." (pig, bus, fork, tent), in trial block 2. Initial exposure to a mixture of the "touch the..." and the "don't touch the..." instruction, resulted in the former remaining at the high level shown before of 8/8 mean correct trials, but the latter, its negation, fell below the 7/8 learning criterion. Since it was quite close at 6.75/8, the trial block with feedback was repeated. Here, trial block 4, both reached

EXPERIMENT 1

Table 7.1

Initial Picture Vocabulary Pretest results, subject ages, study duration, and total number of trials, during the study

SUBJECT	INITIAL PICTURE VOCABULARY TEST: Number of Picture Words Correct.	AGES DURING STUDY: Start (years, months)	Finish (years, months)	STUDY DURATION (months)	TOTAL NUMBER OF TRIALS
Owen	30	3, 00	3, 02	2	320
Niall	30	2, 10	3, 01	2	224
Duane	29	3, 01	3, 09	8	832
Dominic	29	2, 08	3, 02	6	448
Sheila	14	2, 07	3, 01	6	952

Table 7.2

Parental estimate of English versus Welsh Language background.

SUBJECT	ENGLISH & WELSH LANGUAGE BACKGROUND
Owen	English only.
Niall	English only.
Duane	Mainly English, Very little Welsh.
Dominic	Mainly English, Very little Welsh.
Sheila	More Welsh than English, speaks Welsh with her mother and sisters, but English with her father.

Table 7.3

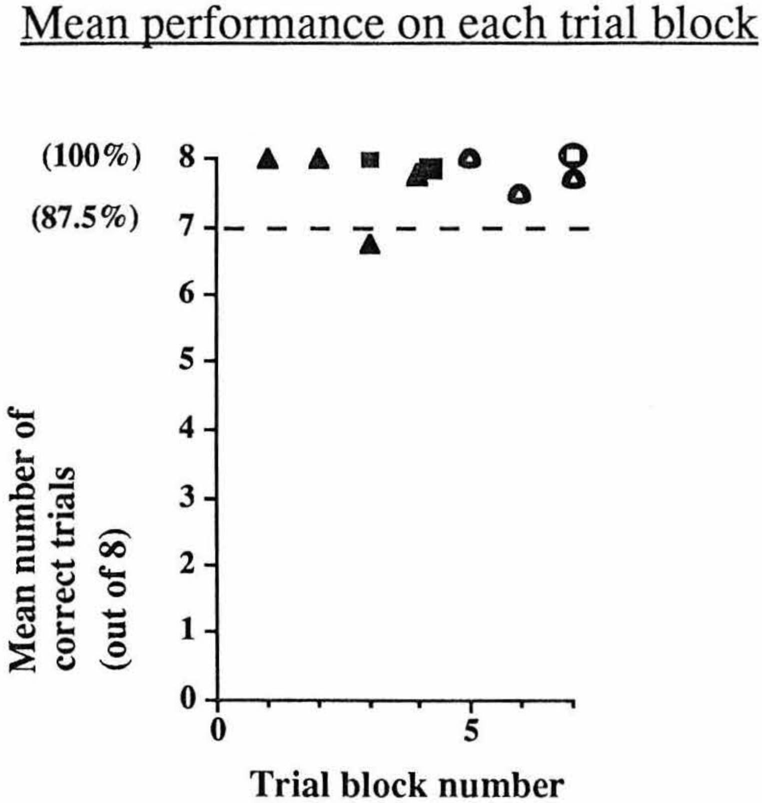
Reynell Developmental Language Scale Data.

SUBJECT	ACTUAL AGE (years, months)	RAW SCORE	EQUIVALENT AGE (years, months)	STANDARD SCORE
Owen				
Expressive Language total	3	34	2,08	-0.6
Verbal Comprehension A	3	52	4,01 - 4,02	1.5
Niall				
Expressive Language total	2,10	37	2,11	0.3
Verbal Comprehension A	2,10	48	3,09	1.6
Duane				
Expressive Language total	3	29	2,04	-1.3
Verbal Comprehension A	3	31	2,07	-0.8
Dominic				
Expressive Language total	2,03	22	2	-0.6
Verbal Comprehension A	2,03	14	1,07	-1.2
Sheila				
Expressive Language total	2,06	15	1,07	-2.1
Verbal Comprehension A	2,06	11	1,05	-2.1

Figure 7.2 : Data for Owen. Mean number of correct trials (out of 8) plotted against the trial block number, for each trial block.

Figure 7.2

Owen



Key

	+ Feedback	Generalization	
	4	4	No. of trial types
"Touch ..."	■	◘	
"Don't Touch ..."	▲	◬	

criterion at 7.75/8. The first generalization test involving only the "don't touch the..." negated mands with novel stimuli produced responding at the 8/8 maximum level. The second generalization block, also involving only the negated version of the mand with the next set of novel stimuli, passed criterion at 7.5/8. Finally the generalization test involving both the mand and negated mand instructions with a further set of new stimuli both reached criterion at 8/8 and 7.75/8 respectively, illustrating that the subject showed generalized behaviour in responding to novel stimulus combinations, in the present autoclitic frames used in the instructions. No task-relevant verbal utterances were emitted during the study.

Niall

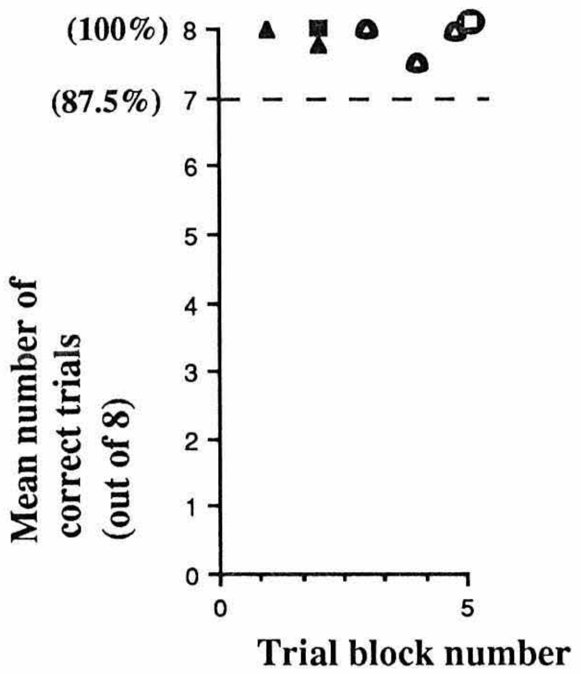
His performance is shown in fig 7.3. Niall showed a similar pattern of behaviour to that of Owen, though made fewer errors and needed none of the trial blocks repeated. He made no errors in the initial check for the function of the "touch the..." mands. The first exposure to a mixture of this and its negation "don't touch the..." using the same four stimuli produced behaviour that passed the criterion at 8/8 and 7.75/8 respectively. The first generalization block using only the "don't touch the..." negated mands with four novel stimuli produced no errors, and the second generalization block also using only the negated mands with a further set of stimuli also reached criterion at 7.5/8. The last generalization test which involved both the "touch the..." mand and its negation, with another novel set of stimuli gave a high performance which reached criterion with no errors. As with Owen, Niall said nothing of apparent relevance to the task.

Figure 7.3 : Data for Niall. Mean number of correct trials (out of 8) plotted against the trial block number, for each trial block.

Figure 7·3

Niall

Mean performance on each trial block



Key

	+ Feedback	Generalization	
	4	4	No. of trial types
"Touch ..."	■	○	
"Don't Touch ..."	▲	⊗	

Duane

See Figure 7.4 for a graph of his behavior. Duane reached criterion on the initial block which tested the function of the mands "touch the..." upon him. He passed the mixture of the mand and its negation with the same set of stimuli shown in trial block two, but because his behaviour on the negation trial types was near the border line, his first block of negation instructions only was given with the same stimuli, but without feedback, prior to moving onto the generalization tests. He passed both the first generalization test and the second, both of which used only the negated mand instructions with a novel set of stimuli for each trial block. However the next generalization test which used a mixture of both the "touch the..." mands and their negations resulted in means of 3.5/8 and 5/8 respectively. Thus he failed to reach criterion on both types of instruction. This trial block was repeated without feedback, and resulted in improvements with 5.25/8 on the mand instructions and 7.75/8 on the negated mands. To improve his performance further prior to additional generalization tests the same task was repeated with feedback, for a further four trial blocks until both types of instruction yielded behaviour at criterion. After this feedback was withdrawn and the trial blocks repeated twice more until the subject's performance reached criterion with means of 7.75/8 for both types of instruction. His responding at criterion on first one set of novel stimuli with a mixture of both types of instructions and then a further set of stimuli (trial blocks 14 & 15) confirmed that generalization of the responses class had taken place.

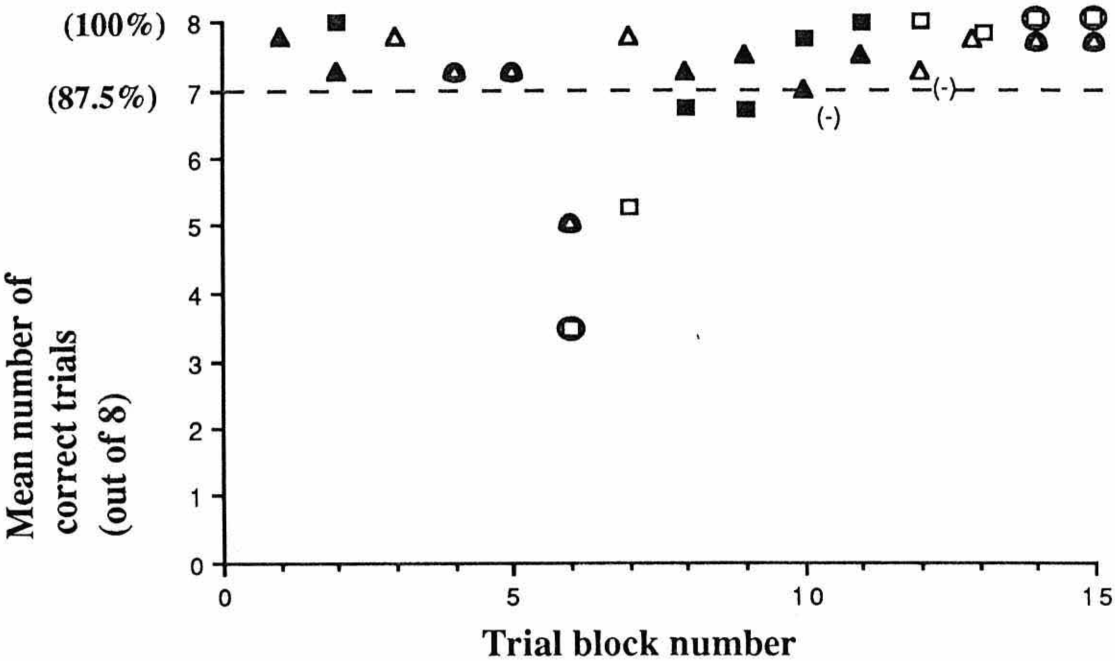
Dominic

Figure 7.4 : Data for Duane. Mean number of correct trials (out of 8) plotted against the trial block number, for each trial block.

Figure 7.4

Duane

Mean performance on each trial block



Key

	+ Feedback	- Feedback	Generalization	
	4	4	4	No. of trial types
"Touch ..."	■	□	O	
"Don't Touch ..."	▲	△	⊚	

(-) indicates that at least 1 trial type in that block fell below 7/8

Figure 7.5 shows his mean level of performance on each trial block. The check for the function of the "touch the..." mands reached criterion at 7.75/8, as did the mixed version of the task involving the mands and their negated versions at 8/8 and 7.25/8 respectively. As with Duane, his performance on the negated mand trial types was borderline so a block of negated mands only, using the same stimuli without feedback, was given and produced no errors. The first generalization test (trial block 5), with only negated mands and novel stimuli, failed to reach criterion as the mean was 7/8 but one of the constituent trial types had only reached 6/8. A further trial block without feedback showed a deterioration in performance to 5.75/8. Then the repetition of the trial block with feedback resulted in an improvement over the next four trial blocks till the subject made no errors. A Final repetition of this trial block followed without feedback that also yielded no errors prior to testing for generalization. This second generalization test (trial block 11) used only negated mand trials and a novel set of stimuli and yielded behaviour that reached criterion at 7.75/8. Finally the last generalization test used a mixture of the "touch the..." mands and their negated counterparts with novel stimuli. It yielded no errors suggesting strong generalization of the subjects higher order response classes to novel stimuli inserted in the instructions autoclitic frames. Dominic was very quiet throughout the sessions, requiring short sessions and a lot of social reinforcement to get him to take part in the early sessions. He said nothing of any relevance to the task.

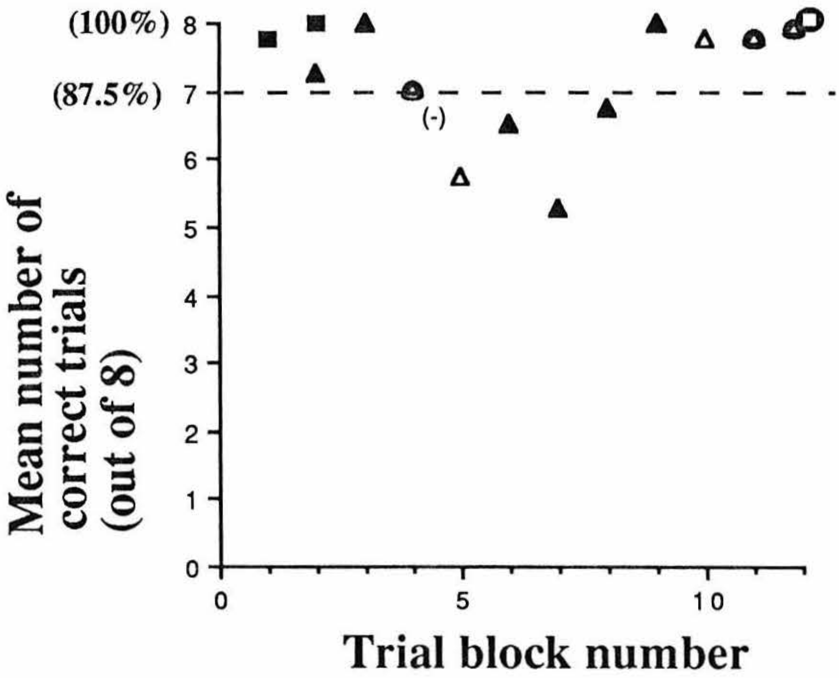
<u>Sheila</u>

Figure 7.5 : Data for Dominic. Mean number of correct trials (out of 8) plotted against the trial block number, for each trial block.

Figure 7.5

<u>Dominic</u>

Mean performance on each trial block



Key

	+ Feedback	- Feedback	Generalization	
	4	4	4	No. of trial types
"Touch ..."	■	□	○	
"Don't Touch ..."	▲	△	⊘	

(-) indicates that at least 1 trial type in that block fell below 7/8

This subject's performance is shown in Figure 7.6. Note that at the positions for trial blocks 15 and 22 simplified interventions took place which are not appropriately covered by a single mean value, so these portions of the data are illustrated below as two separate figures to be inserted temporally in the sequence of events illustrated. Each data point in the intervention figures represents the absolute value of one whole trial block that consisted of 8 trials. A number of these took place in a session, thus the time span for each date point is much briefer than the data points in the main graph (see the Appendix for a more detailed numerical analysis).

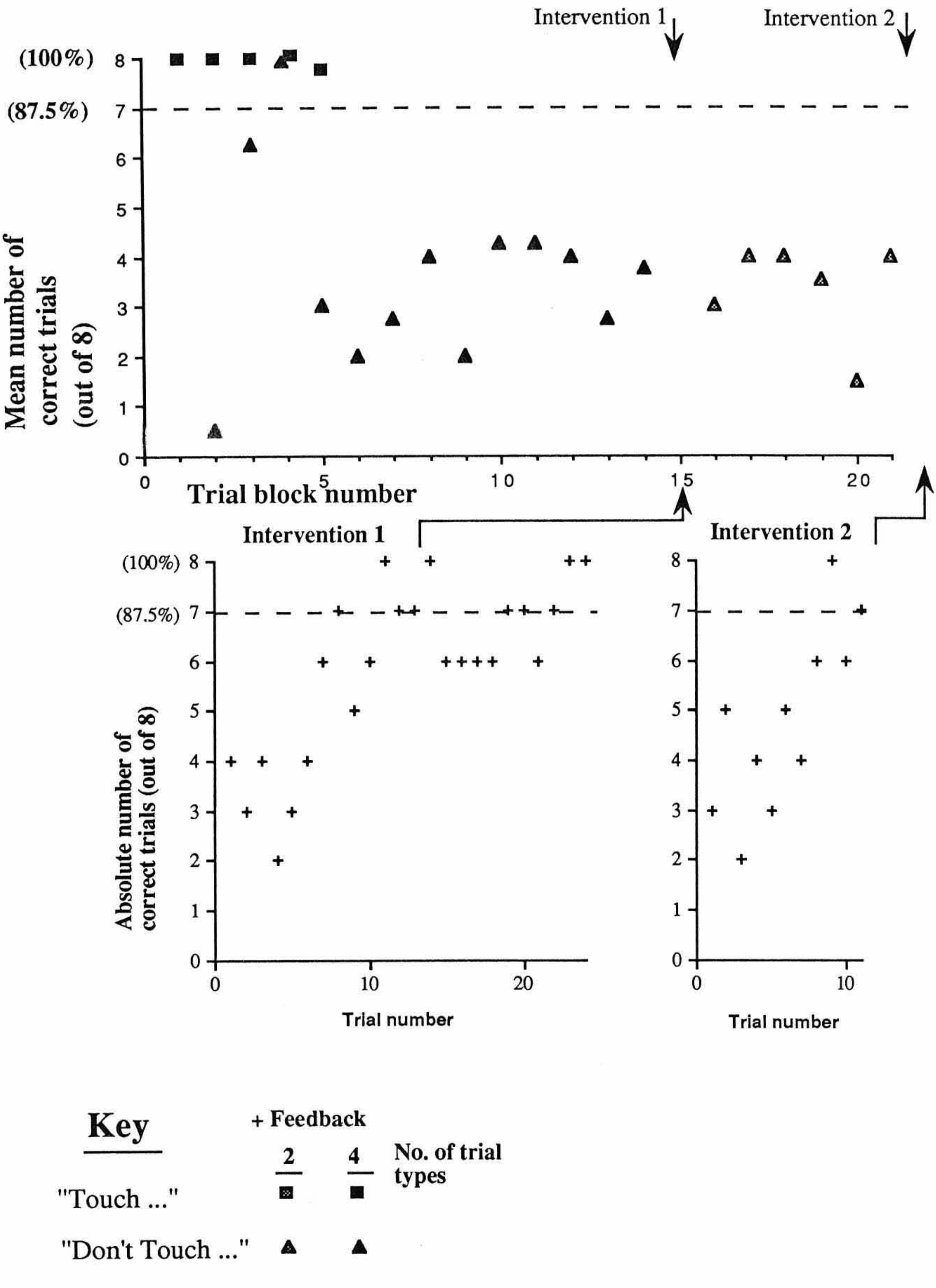
Sheila made no errors on the initial check for the function of the mand "touch the ...", but a mixture of the mands and their negated counterparts gave 8/8 and 0.5/8 respectively. The repetition of this trial block with Welsh instructions following the English ones gave 8/8 for the mand instructions and 6.25/8 for the negated mands. A further repetition (trial block 4) resulted in no errors being made to either instruction, showing that the Welsh instructions were now fully effective upon the subject. A return to the English only version of this trial block produced little improvement with 7.75/8 for the mands and 3/8 for the negated mands. The next simplification of the task involved the same stimuli with just the "don't touch the..." negated mands and continued feedback. This procedure was used during successive trial blocks numbered 6 to 14, but throughout this period her performance remained around the chance level. The next level of simplification is shown in Figure 7.6, intervention 1, and used two stimuli and only one negated mand for each trial block. The first 14 trial blocks in the intervention used "don't touch the fish" as the consistent mand, and her performance showed a gradual

Figure 7.6 : Data for Sheila. The top graph shows the mean number of correct trials (out of 8) plotted against the trial block number, for each trial block. The figures beneath this show the interventions; the absolute number of correct trials (out of 8) are plotted against the trial block number, for each trial block.

Figure 7.6

Sheila

Mean performance on each trial block



improvement, once a side preference in the first few trials had been corrected. Switching to using the "don't touch the peg" instruction showed an initial performance at a higher level followed by a similar improvement. The next increment in task complexity was the mixture of both type of instruction in a single trial block and occurred in trial blocks 16 to 21. However her performance still remained around the chance level. The return to the single instruction trial blocks that followed is shown in Figure 7.6, intervention 2. The first 9 trial blocks show a gradual reacquisition of responding to the "Don't touch the fish" instruction, when the performance again reached criterion. This is followed by two "don't touch the peg" instruction trial blocks that show an initial high level of performance followed by a rapid reaching of criterion. At this the point the experiment with Sheila was terminated by the mother due to personal difficulties. Sheila said nothing relevant to the task in either language.

Discussion

The data in this experiment can be divided into three groups. Firstly Owen and Niall, the performance of these two subjects suggested that ability to do the task was largely present prior to the onset of the experiment. The dip beneath criterion shown upon Owen's first exposure to the mixed combination of mand and negated mand instructions need not be regarded as significant since he rapidly attained the required level of responding with generalization trials being at a satisfactory level of accuracy.

Duane and Dominic showed some similarity in their patterns of behaviour in that both showed some initial ability to do the task with the first set of stimuli. Duane. who was able to do the generalization trials that only involved negated mands, required additional training to get him to distinguish between the mand instructions and their negated counterparts. Dominic, however failed to adequately generalize the ability to a new set of stimuli, though his accuracy was quite near the borderline for criterion. The later gradual rise in the level of his performance, even with feedback, suggests that, despite the ability to respond to negation being present in some strength to begin with, it was still in need of additional reinforcement to provide the necessary improvement. Unlike Duane, once the negation skill was brought up to strength, no additional discrimination learning was necessary to separate out control by the two types of instruction. Both these cases might be seen as partial demonstrations of the success of the intervention, above that of simply quantifying the ability to perform the task. However, this is but one possible interpretation and is compromised by the fact that the relevant skill was already present in some subjects. In the following experiment with subjects that were unable to negate at the baseline stage, clearer evidence for the operant will be reported. That these two subjects were less competent in speaker and listener skills than Owen and Niall is lent support by their Reynell Developmental Language Scale data. Here Duane and Dominic scored lower than Owen and Niall on both the expressive language measures and the verbal comprehension scale, which gave support to the impression obtained by the experimenter in general verbal interaction with the children.

With Sheila it was difficult to get any improvement using the task at the level of complexity presented to the other subjects. Her ability to do the task in Welsh but not in English seems to demonstrate the functional isolation of this ability in the two language repertoires. It was surprising to see no evidence of any generalization across the two during the course of the months involved in the experiment. It was only the extreme simplification of the task to two stimuli and one instruction per trial block that produced behaviour at the criterion, and this can be explained by the simple strategy of varying the choice of stimulus until one is consistently reinforced. This may have arisen through simple operant conditioning, since no evidence of any significant verbal behaviour was found, in either language. It was unfortunate that the experiment was terminated before further manipulations could be tried, but this did provide suggestions for use with later subjects for whom the more complex manipulations proved similarly ineffective. Sheila's scores on the Reynell test were worse than all the others' in the group, which is consistent with the poorer performance shown in the English version of the test. Since a standardized version of the test is not yet available in Welsh, no direct comparison between her English and Welsh repertoires was possible.

In summary, the data from this experiment provided some partial evidence supporting the hypothesis that this class of verbal behaviour might be subject to operant contingencies, as well as further information useful in later experiments. No clear age related trends were present in the data, but the crude measure provided by the Reynell scores did correlate to some degree with the children's final performance on the task. The parental estimate of the child's exposure to English and Welsh also correlated with the child's performance on the task, but one must take into account the small sample size in considering any such relationship.

Chapter 8: Experiment 2: A further study of the action of negated mands upon preschool aged children

Introduction

Experiment 1 yielded results which suggested that most of the children already had some degree of ability to respond to novel stimuli named in the "don't touch the ..." negated mand. So it was decided to run a variant of the study on a younger group of children whom it was hoped, would provide baselines showing little or no ability to do the task at the onset of the experiment. Information obtained in the first experiment meant that it was possible to plan for a greater degree of experimental control. For one criticism of the ABCD... design with direct replications was that it did little to rule out the effect of social and physiological maturation as variables which might be responsible for any observed effect. Thus the original design of this experiment was planned as a multiple baseline design. This staggering of the baselines across subjects would help rule out extra-experimental temporal factors if an observed effect consistently followed the administration of a particular intervention. The multiple baseline design offers a way of increasing the degree of control for extranious factors that is not possible in this case with an ABA withdrawal design, given the irreversible nature of a language intervention of this type.

Design

This was initially planned as a multiple baseline design across subjects. The model of learning followed that outlined earlier in the introductory chapters. The aim of this experiment was to investigate the effect of systematically introducing further simplifications of the task, along the lines of that tried with Sheila in experiment 1. In other words, to 'titrate' the level of simplicity and degree of experience necessary for the acquisition of the higher order response class, characterized by a listener following an autoclitic frame in the form of the negated mand used in the experiment.

The ABCD... stages of the experiment followed a similar pattern to Experiment 1, but involved progressively simpler experimental arrangements as each previous one was shown to be ineffective. Stage 'A' was the check for the function of the mands to be used in the later stages, i.e. a request for the subject to touch particular pictures presented by the experimenter which was reinforced to establish responding by the subject in the experimental setting, and control by the experimenter's instructions. Stage 'B; consisted of a mixture of the "touch the ... " mands and their negated counterparts. Reinforcement was provided since it continued to orient the subjects towards the stimuli and the experimenter's instructions. This effectively formed the baseline phase of the study since it had been shown in experiment 1 that a subject with no ability to perform the task initially, was unlikely to acquire it by simply continuing this stage indefinitely. It was planned that this stage would be varied to provide the staggering of the stages in the multiple baseline design.

As with experiment 1, stages 'C' and 'D' would consist of generalization tests with the negated mands "don't touch the ..." using novel stimuli, with no feedback. Stage 'E' would be the generalization test for the mixed instruction version of the task using "touch the ..." and its negated counterpart, with novel stimuli. The learning criterion was set to

7/8 correct responses, for the reasons outlined in experiment 1. Using 4 picture stimuli this gave 32 trials per block for the single instruction version 64 for trials per block for the two instruction version. Figure 7.1 (in Chapter 7) provides a schematic representation of these stages, though for simplicity the different baseline periods required for the multiple baseline design are not shown.

After the first two subjects had been completed, the design was altered; the instructions were shortened and simplified. This was because the first two subjects failed to learn the task despite the apparent simplification of the experimental arrangement, combined with a large number of trials. It had began to appear as if the length of the initial instruction was too long for subjects of this age, with the result that the word carrying the negated autoclitic function was ineffective upon the subjects due to it being the oldest part of the utterance that was heard. The new mand instruction was designed to remedy this and consisted of just the name of the picture stimuli, which through shaping and instruction had the equivalent mand function to "touch the ..." previously. The negated version was "not" followed by the name of the object. In other words the two instructions where "*name*" and "not *name*". Both the within subject design and the stages of the intervention for the new subjects, who were given these instructions, were the same as those for the earlier two subjects.

Finally, as a final check of the efficacy of the intervention, the two earlier subjects who had failed to learn the initial instructions where tried on the new simplified instruction, providing a within subject comparison of the two sets of instruction, to supplement the between subject comparisons provided by the two groups.

Method

Subjects

Five Subjects aged 1 year, 8 months to 2 years, 4 months at the start of the experiment all of which came from mainly English speaking backgrounds, see tables 8.1 and 8.2 for details. They came from a variety of socioeconomic backgrounds and had no known intellectual, hearing, or visual difficulties. The subjects where recruited through personal contacts with the experimenter, and word of mouth, from the village of Rhiwlas and the city of Bangor, N. Wales. None of the children had taken part in any previous psychology experiments.

Apparatus

The experiments were conducted in the homes of the subjects' parents or child minders across a table approximately 0.5m square, with the subject seated opposite the experimenter, and the child's caretaker in the locality of the house. The stimuli consisted of a series of coloured pictures of familiar objects 7cm X 7cm, placed upwards facing the subject. The order of stimuli was randomized and printed on A4 paper by an IBM AT compatible computer, these sheets were used to record the subjects' responses. A video camera recorded the majority of sessions, providing information about the subjects' verbal responses and their interaction with the experimenter. The position of the choice (comparison) stimuli was randomized during the sessions by a Hewlett Packard HP28S programmable calculator. Material reinforcers consisted of toys, and books valued between £0.50 - £3.50, plus colourful stickers.

Procedure

Pretest

An initial play session was given to acclimatize the subject to the experimenter and the situation, with a prize. The initial play period, given in experiment 1 was replaced by a five minute period of chatting with the child and caretaker. 15-20 minutes were then spent on the experimental session, followed by presentation of the prize to the child.

The initial pretest was the same as that in experiment 1, consisting of presenting the 30 pictures to be used in the experiment to the child, in order to assess which were familiar and thus might be suitable for use in the main experiment. (See Experiment 1 for further details).

Reynell Developmental Language Scale Assessment.

In experiment 1, the Reynell Developmental Language Scale (Reynell, 1977) was administered in the early stages of the experiment to obtain an approximate evaluation of their current linguistic abilities. This had been to avoid possible contamination by the main experiment. However a drawback was that it reflected badly on subjects who where inhibited about speaking to a new person, namely the experimenter, which produced gross distortions in the estimate of their expressive language totals - a couple of them barely said a word. So it was decided to administer the Reynell test at the end of the experiment.

Main Experiment

The main experiment followed the general outline given in the design section. Verbal reinforcers, e.g. "that's good", "yes", "good girl", and mild punisher's e.g. "No", "Not that one", "No, you mustn't", were given during the conditions of the experiment where each trial was followed by feedback from the experimenter.

Initial Check for Mand Function

The first stage of the main experiment, following that of experiment 1, checked the function of the mand phrases, .i.e "touch the..." used with the names of the four picture stimuli used. Two pictures where presented on any trial, one being the correct stimulus corresponding to the mand phrase, the other an incorrect stimulus chosen from the remaining three. The length of a trial block was 32 trials to obtain one data point per trial type. The introductory instruction followed that of experiment 1 and was given on the first occasion. This was "I want you to touch the picture I say".

Negated Mand Baseline Trials

The second stage, negated mand baseline trials consisted of mixed blocks of trials with "Don't touch as well as "touch the ..." instructions for the previous set of four stimuli. A prompt following a "Don't ..." instruction was given in the early stages since the children were usually unsure about the action required. This was usually "which one are you going to touch?" or "Pick one", sometimes with the addition of the experimenter moving a hand towards them palm upwards ready to receive a picture. It was faded out as the children became more competent at the task. Verbal Feedback was given. The experimenter gave a instruction on the first of these trial blocks to minimize any problems that might be caused by the children being told "don't touch the..." or "not *name*" and yet being expected to touch one of the other pictures. It was "Some times I'll say touch one of the pictures, other times I'll say don't touch a picture, you have to touch one of the others". The subjects who were to be given the "*name*" "not "*name*" instructions received a variation of the introductory instruction that used these two instead.

Training and Testing Stages

The plan for the experiment was to continue with a similar progression of stages to experiment 1, while a subject continued to show evidence of acquisition. However subjects who failed to show any such gains in behaviour where introduced to a series of systematic simplifications of the procedure that are outlined below. Subjects who reached criterion during the baseline phase were given a block of just the negated mand instructions with the last set of stimuli, giving a trial block length of 32 trials. Those who narrowly missed it received first feedback blocks and then no feedback blocks.

Generalization Tests

No feedback was given to lead subjects into the next stage which was the first generalization test of the negated mands using 4 novel picture stimuli consisting of the negated mands using novel picture stimuli, and no feedback. The introductory instruction for the 'no feedback' blocks was "This time I'm not going to say how you do during the game; I'll tell you at the end". As in experiment 1, it was unlikely that the children fully understood the instruction, it helped to reduce any bafflement, and the tendency to assume that silence from the experimenter following a response meant that it was incorrect.

A second block of generalization trials followed correct responding on the previous set, i.e. another 4 novel picture stimuli with just the negated mand instruction. and no feedback. If responding on this block also reached criterion, then a final set of 4 novel stimuli was used with a mixture of both the mand and negated mand instructions. This check of the degree of stimulus control was sufficient to keep performance at the required level for all the trial types involved, when presented in close succession. This had a block length of 64 trials. Subjects passing this were then deemed to have successfully completed the task.

The pattern for a subject passing previous stages, but failing a generalization block,followed experiment 1, in that training blocks with feedback were introduced with the same stimuli and instructions. Once at criterion, the subject would then be presented with an identical block with NO feedback, before proceeding with another new set of stimuli under no feedback conditions. The justification for this is provided in experiment 1 (Chapter 7).

Interventions and Simplifications of the Task

The subjects who remained near chance level during the baseline periods were given a successive series of procedural simplifications. The baseline trials had consisted of 4 stimuli with a mixture of mand and negated mand counterparts. So the first simplification was to present only negated mand instructions for the four stimuli, under conditions of feedback. The mand components had already been shown to be present at strength so the first stage was to be the shaping up of the negated mands instructions alone, with 4 pictures, and to establish them as higher order listener response classes by, a set with no feedback, followed by successive sets of novel stimuli with generalization tests. Any lack of stimulus control shown in later mixed mand and negated mand versions of the tasks would to be remedied by simplifications outlined below. When a subject passed these simplifications, there followed a gradual reintroduction of the successively more complex arrangements of the task, followed by a return to the general procedure for subjects passing each stage.

If after extended exposure to the four picture version of the negated mand only trials, the subject still failed to reach criterion, then the number of current instructions would be would be reduce to 2, with the same 2 pictures present on each trial. If exposure to this still resulted in no acquisition, then finally a single instruction version was given, with two constant stimuli. When a subject reached criterion for one instruction, then it was swapped to that for the other picture. These were alternated, as the subject reached criterion on each, until criterion was reached on the first trial block of each. Then a return to the two instruction version would be given. When criterion was reached on that, then the subject was given the 4 picture negated mand task, bringing them back into the main set of procedures.

Some subjects failed even the single negated mand, 2 picture version of the task. At this point the reinforcement frequency for the material reinforcers was successively increased until the subjects showed acquisition. Then it was gradually reduced, keeping the subject at criterion, until finally the subject was put onto the two instruction version, and the further stages of increased task complexity.

During the study a child that proved reluctant received prompting after the instruction, which consisted of the experimenter saying "which one are you going to touch?", faded into "touch one", until eventually a tap on the table was all that was given. Occasionally the reintroduction of a verbal prompt was needed.

It was necessary to depart from the general scheme, outlined here, to accommodate variations in the individual patterns of acquisition. This sometimes involved a return to a previous stage of simplification, following a deterioration in performance. These procedural variations shall be outlined for each subject in turn.

<u>Eli</u>

She was initially given the "touch ..." and "don't touch ..." versions of the instructions. She failed to reach criterion during the baseline trials, and so followed the simplification of the procedure outlined above. Following a long exposure to the single instruction, 2 picture arrangement she produced the required behaviour, and was then introduced to the gradual increments in task complexity, outlined above, over a number of sessions that followed this. Having then reached criterion with the negation instruction and all four of the original picture stimuli, two choices of procedure then presented themselves. The first was to then give a mixture of mand and negated mand instructions with the same four stimuli before moving onto novel stimuli with just the negation instruction. This followed the earlier phases of this experiment and experiment 1 in giving a mixture of both types of instruction with the original 4 pictures, and then giving negated mands only with the pictures, followed by generalization tests with the negated mand only. The second option was to remain with just the negated mands for now and to establish generalization to novel stimuli, before then introducing discrimination between mand and negated mand instructions in later trial blocks. The first option was chosen for its similarity with the earlier procedures, but the latter option in fact would probably have been better given the complete collapse of her behaviour that resulted. A later subject, Mathew, lent support to this suggestion when he acquired generalized responding to negated mands much more easily than the discrimination between mands and negated mands.

Following the disappearance of Eli's correct responding that occurred upon giving her a mixture of both instruction types, she was given gradually more simplified versions of the task until only one instruction and 2 pictures were used, but the gain in her behaviour was very slow.

On the 29/6/90 she was 2 years and 9 months, which was close to the age at which some of the subjects in experiment 1 had learned the task. So it was felt that social/physical maturational factors might soon be responsible for any noticed improvement in her behaviour, rather than exposure to the task itself. Thus it was decided to try her with a simplified version of the "*name*" and "not *name*" instructions, with 2 pictures, which she passed. Then the 4 picture version was given, and finally a mixed mand/negated mand instruction version with 4 novel stimuli to test for generalization of responding to both types of instruction in short succession.

<u>Alun</u>

Alun was also given the "touch ..." and "don't touch ..." instructions initially. Having failed to reach criterion during the baseline trial blocks, he was given the simplifications outlined in the general procedure section for this experiment, and also those for Sheila. This continued to the level where only one instruction and 2 pictures were used with reinforcement increased to a toy delivered almost every trial. When moved back onto two stimuli with two instructions he showed little improvement over chance level.

As with Eli his increasing age (then 2 years, 5 months) suggested trying him with the shorter instructions, i.e. the "*name*" and "not *name*" versions. Eli's success on these suggested trying him with the 4 picture version of the task. Then the general procedure for leading onto the generalization tests was followed. At this point he was often distractble so the more gradual increments in task complexity were used, rather moving rapidly onto the full 4 stimuli, 2 instruction version, which was done with Eli.

Gareth

The shorter "*name*" and "not *name*" instructions were used with him and the procedure followed that given in the general procedure section for this experiment.

Jenny

She followed the simplifications outlined in the general procedure section. After exposure to the 2 pictures, 1 instruction, version of the task, she reached criterion on the next degree of task complexity that of 2 pictures and 2 instructions. With later trial blocks with 4 pictures and their negated mand instructions, she failed to reach criterion before her mother withdrew her from the experiment.

Mathew

He followed the general procedure for the simplification of the task and the subsequent increments in task complexity up to the point where he passed the generalization test blocks where only the negated mands were used. However, introducing novel stimuli with both the "*name*" and "not *name*" instructions, resulted in a failure to discriminate between them. The task emphasis was then shifted to establishing the discrimination between these two instructions and successive simplifications of the task then focussed on reducing the number of trial types, but keeping the proportion of mands and negated mands equal in each trial block. The level of simplification reached that of 2 stimuli, but with only one of them actually referred to in the two types on instruction, e.g. a car picture with a snake picture and a mixture of the two instructions "car" and "not car". This met with only a slight shift away from chance responding, so manipulations varying the way in which the instructions were presented were introduced. These consisted of a phase with differing intonation of the two types of instructions, followed by a phase where the intonation was withdrawn, but the "*not*" part of the negation instruction was elongated. Finally this elongation was withdrawn and the intonated instructions reintroduced. Successive increments in the number of trials types were introduced until the subject reached criterion with 4 pictures and their respective mand and negated mand counterparts. Finally the generalization test with 4 novel stimuli and both types of instruction was given.

Results

The arithmetic mean values for each trial type have been calculated for all the trial blocks, which are plotted graphically in Figures 8.1 to 8.5 and are shown in numerical form in the Appendix. The latter gives the most detailed description of the successive experimental manipulations as well as the raw data. Where one of the original values fell beneath 7/8 this is indicated with an accompanying (-) symbol.

Tables of data are provided for the following information:
8.1) Initial picture vocabulary pretest results, subject ages, study duration, and total number of trials, during the study,
9.2) Parental estimate of English versus Welsh language backgound.
9.3) Reynell Developmental Language Scale Data.

The replacement of the initial play period, given in experiment 1, by a five minute period of chatting with the child and caretaker seemed to be equally effective in preparing the children for the task. If any thing it was slightly better, since they did not become absorbed in playing with a toy before having to begin the task - sometimes a problem in experiment 1, leading to tandrums.

Eli

Eli's mean level of performance throughout the study is shown in Figure 8.1. The simplified interventions that had only 8 data points per trial block are shown by the inset graphs plotted beneath the main figure. As a result each data point in these interventions represents the absolute value of one whole trial block, rather than the mean value of the main figure, and the time taken to obtain each data point was much shorter than the data points in the main graph.

Eli made no errors in the initial check for the function of the "touch the ..." mand, but the mixture of the mand and negated mand instructions resulted in a consisted failure on the negated mands. These constituted the baseline trials, and her performance on them suggested that the "Don't" part of the negated instructions was ineffective, resulting in her treating all of the instructions as straightforward mands. Her baseline was originally planned to be the longest 'leg' of the multiple

EXPERIMENT 2

Table 8.1

Initial Picture Vocabulary Pretest results, subject ages, study duration, and total number of trials, during the study

SUBJECT	INITIAL PICTURE VOCABULARY TEST: Number of Picture Words Correct.	AGES DURING STUDY: Start (years, months)	Finish (years, months)	STUDY DURATION (months)	TOTAL NUMBER OF TRIALS
Eli	29	2, 00	2, 09	9	1926
Alun	30	1, 08	2, 06	9	1768
Gareth	27	2, 00	2, 01	1	320
Mathew	23	2, 01	2, 07	5	1626
Jenny	29	2, 04	2, 05	1	520

Table 8.2

Parental estimate of English versus Welsh Language background.

SUBJECT	ENGLISH & WELSH LANGUAGE BACKROUND
Eli	English only.
Alun	English only.
Gareth	Mainly English, Very little Welsh.
Mathew	Mainly English, some welsh.
Jenny	English only.

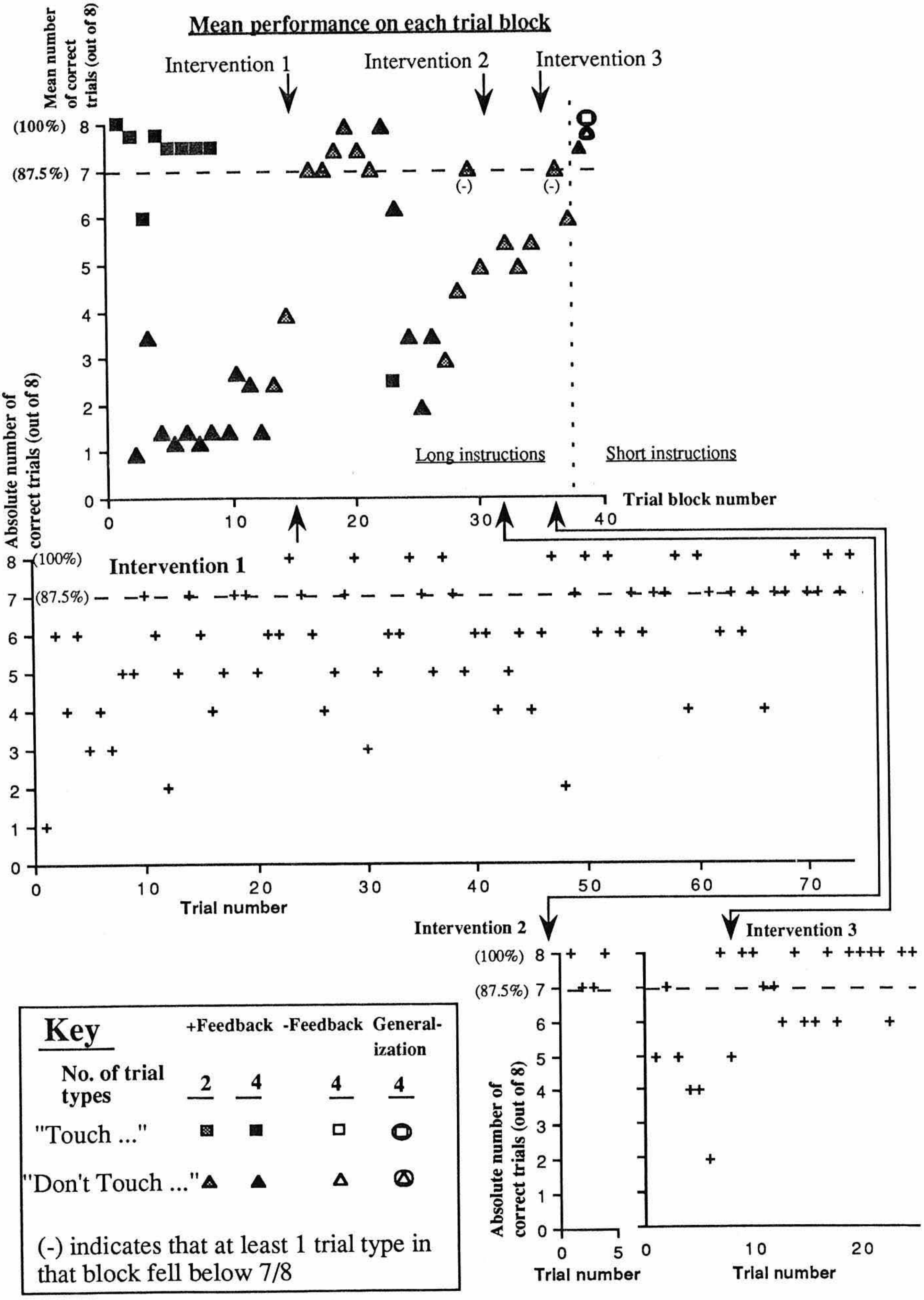
Table 8.3

Reynell Developmental Language Scale Data.

SUBJECT	ACTUAL AGE (years, months)	RAW SCORE	EQUIVALENT AGE (years, months)	STANDARD SCORE
Eli				
Expressive Language total	2,09	31	2,06	-0.2
Verbal Compre-hension A	2,09	49	3,10	1.7
Alun				
Expressive Language total	2,06	30	2,05	-0.9
Verbal Compre-hension A	2,06	46	3,07	1.4
Gareth				
Expressive Language total	Parent terminated experiment before assessment.			
Verbal Compre-hension A				
Mathew				
Expressive Language total	2,07	28	2,04	-0.4
Verbal Compre-hension A	2,07	22	2,01	-0.8
Jenny				
Expressive Language total	Parent terminated experiment before assessment.			
Verbal Compre-hension A				

Figure 8.1 : Data for Eli. The top graph shows the mean number of correct trials (out of 8) plotted against the trial block number, for each trial block. The figures beneath this show the interventions; the absolute number of correct trials (out of 8) are plotted against the trial block number, for each trial block.

Figure 8.1 Eli



baseline design, at 7 trial blocks. The medium length 'leg' was planned at 5 trial blocks and the shortest 'leg' at 3 trial blocks, giving a staggering of two trial blocks across each subject and the minimum of three points required to assess the direction on change in the shortest baseline.

The first simplification of the task involved the same stimuli with just the "don't touch the..." negated mands with continued feedback, and was continued across trial blocks 9 to 11, but her performance failed to show any improvement. Then followed a simplification with just two of the stimuli, the bus and the pig, and their negated mand instructions with feedback, during trial blocks 12 to 14. Her level of performance remained around the chance level and the next level of simplification was introduced using two stimuli and only one negated mand for each trial block. 13 of the trial blocks involved the position of the stimuli being held till approximately 4 responses in a row were correct, upon which they where swapped and this repeated. Her behaviour on this is shown in Figure 8.1, intervention 1. The first trial blocks in the intervention used "don't touch the bus" as the consistent mand, and her performance improved till over 7/8 correct. Followed by trial blocks with the "don't touch the pig" mand. The frequency with which trial blocks with each of these two instructions were alternated increased as the subject reached 7/8 trials correct more rapidly, until the trial blocks where alternated with the subject maintaining this high level of responding. In the first 32 of the trial blocks there had been some improvement though her accuracy and variability had levelled out. At this point the frequency with which toys were given was increased to approximately 1 in 4 correct trials, and a toy taken way every time an incorrect response occured. In addition, a minimum of at least one prize per session was given so that a poor performance, overall, still resulted in the subject receiving a prize for taking part in that session. This period of increased material reinforcement frequency is correlated with the improvement in accuracy and the reduction in variability shown in Intervention 1 on Figure 8.1. In trial block 60 in this intervention, she began to hesitate before responding, sometimes changing from one stimulus to another before settling down to her choice. In trial block 68 she followed my feedback for her first incorrect response by saying "not that one ... (pointing to incorrect stimulus) that one ... (pointing to correct stimulus)", by sticking to pointing to the positions of the latter stimulus she performed correctly on the rest of the trials. In trial blocks 69 - 74 she appeared to use the strategy that if the first response was incorrect in a block of stimuli, she would switch to choosing tho other picture. All of these individual trial blocks are depicted within number 15 in the data for experiment 2 given in the Appendix.

The next increment in task complexity involved mixing the two types of instruction within a trial block using 2 pictures and their negated mand instructions, whilst the material reinforcement frequency remained at approximately 1 / 4 correct responses and the conditions for withdrawal of prizes remained the same. This occurred during trial blocks 16-18, during which Eli's performance reached criterion in all three of the trial blocks, suggesting that she was now under the control of the experimenter's instructions, since the simple strategy of switching to the other stimulus when an error was made would now result in a performance around the chance level. This arrangement was repeated with the remaining two stimuli from the original four stimuli for trial blocks 19-21. During these she gave a number of <u>incorrect</u> accounts of what she was doing in the task, e.g. "not that one (pointing to a fork, which she had just touched and been told was correct)", and "only this one (pointing to the tent stimulus)". Her performance was at criterion for all three of these trial blocks. Then all 4 stimuli with their negated mand instructions were given in trial block 22, where she made no errors. She emitted this incorrect rule on two occasions during the session, "Only touch this one Nick (pointing to the bus in the early part, and then to the pig later)". The material reinforcement frequency during this was reduced to around 1 in 8 correct responses since she was making no errors. At this point there was a choice of either introducing the mand instructions for these stimuli, or to continue just using the negated mand stimuli with novel stimuli and establish generalization on these first before introducing a mixture of mands and negated mands. With Eli the former was chosen which proved to be a mistake since her performance then collapsed and was to very difficult to reestablish. This initial failure is shown in trial block 23 where she had 4 stimuli with their mand and negated mand instructions, with a material reinforcement frequency of 1 toy for every 4 correct responses. The latter option was chosen when the same situation arose with Mathew and proved to be a much better way of proceeding.

Following the failure on the task with 4 stimuli and both instructions, Eli was returned to just the negated mands with the 4 stimuli, and a material reinforcement rate of approximately 1 in 2 correct responses. Three trial blocks of this (Numbers 24-26) failed to show any improvement over a chance level of responding. There then followed a return to the successive simplifications used previously during trial blocks 27 to 35 right down to the most rudimentary combination of

2 stimuli with only one used in the instruction in each trial block. With the material reinforcement frequency being raised as high as 1 toy for every correct trial (the exact values are given in the section for Experiment 2 in the Appendix). Numbers 31 and 35 were actually two interventions depicted as Intevervention 2 and Intervention 3 in the figures below the main graph of Figure 8.1. The first contained four trial blocks which reached criterion, and the second contained 25 trial blocks which showed a gradual rise to criterion. In Intervention 1 the rule "I always touch the/that bus", was emitted on 4 occassions during the session, 3 where incorrect descriptions of what she was doing. Her mother told me afterwards that she was in fact saying this before I came!

As she eventually reached the 7/8 level on these, trial blocks 36 and 37 involved a mixture two stimuli within each trial block, in which the material reinforcement frequency was at approximately 1 in 2 correct reponses. She showed some improvement on these two but failed to reach criterion on them.

At this point her age became of concern (for reasons outlined in the method section for her) and the shorter versions of the instructions were introduced, i.e. "*name*" and "not *name*". Firstly she was given a version of the task with 2 stimuli and their mand and negated mand instructions in trial block 38, with feedback. In this she was returned to only receiving material reinforcement at the end of the session. She passed this with only one error so she was given the generalization test with four novel stimuli and both types of instruction, with NO feedback. This she passed with only one error, illustrating that Eli showed generalized behaviour in responding to novel stimulus combinations, with the present autoclitic frames used in the instructions.

Alun

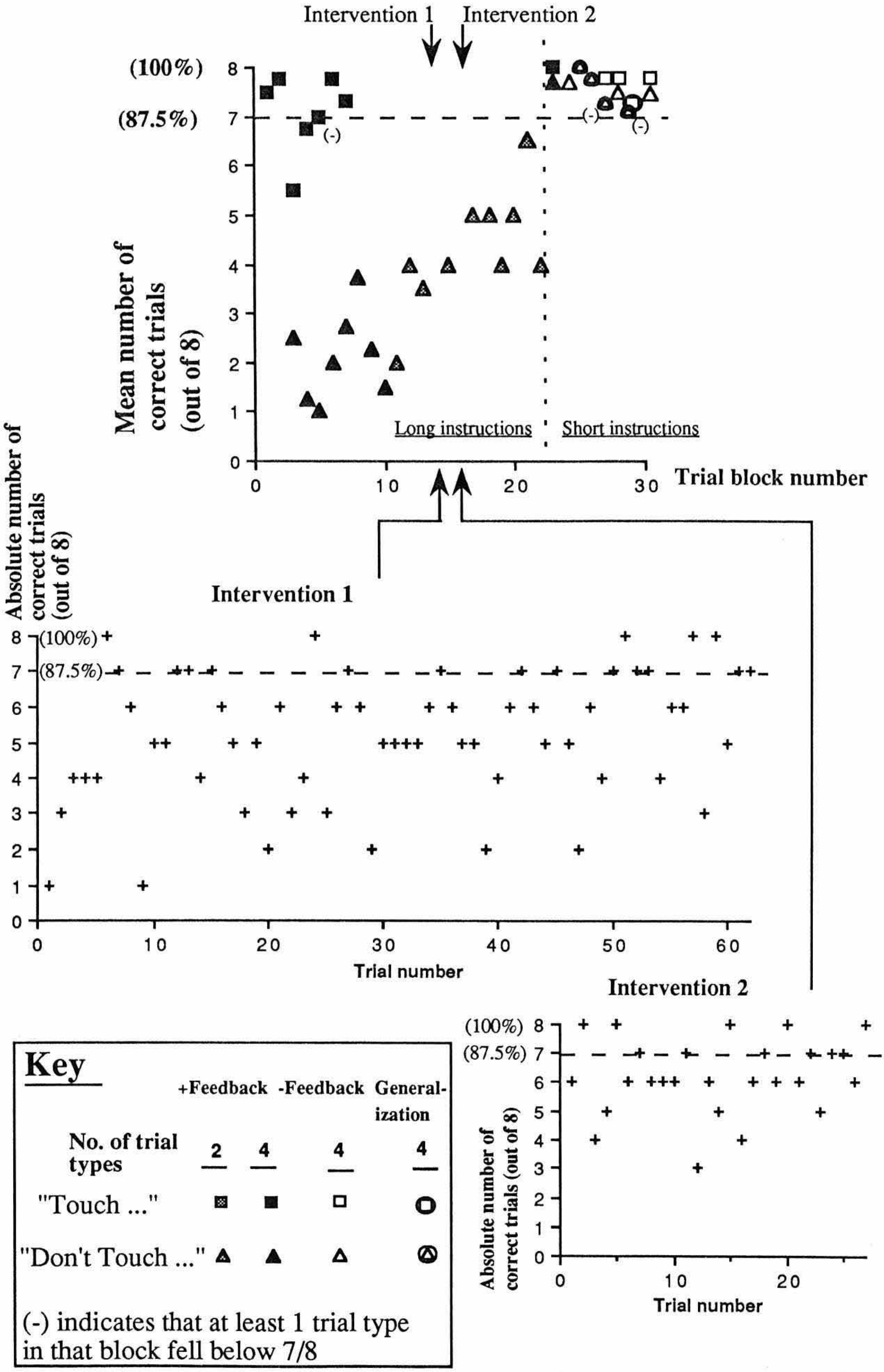
Figure 8.2 shows Alun's mean level of performance during the study. Two simplified interventions which had only 8 data points per trial block are plotted beneath the main graph. Alun failed to reach criterion on one of the trial types in the initial check for the function of the "touch the ..." mand, so this trial block was repeated once more, which he then passed. During the mixture of mand and negated mand instructions which comprised the baseline trial blocks (Numbers 3 - 7) he showed a shift away from the chance level towards responding to the negated mands in the same way as the mand instructions. He was given these as 5 baseline trial blocks for the planned medium length 'leg' of the multiple baseline design.

He was given just the negated mand instructions with the 4 stimuli during the next 3 trial blocks (No.s 8 - 10), which showed no improvement. Then only 2 stimuli with their negated mand instructions were used (trial blocks 11-13) with a similar lack of success. The most basic manipulation was introduced for many trial blocks which consisted of the bus and pig stimulus and only one of their negated mands used in any particular trial block. This is depicted in detail in the Appendix, under section 14. The first 30 of these trial blocks in the intervention consisted of the "Don't touch the bus" instruction. This was followed by 16 trial blocks with the "Don't touch the pig" instruction. Then a further 9 trial blocks with "Don't touch the bus" instruction, followed by 7 trial blocks which alternated more frequently between the two instructions. During the first half of these trial blocks the side of the referent stimulus was held until the subject made approximately 4 correct responses in a

Figure 8.2 : Data for Alun. The top graph shows the mean number of correct trials (out of 8) plotted against the trial block number, for each trial block. The figures beneath this show the interventions; the absolute number of correct trials (out of 8) are plotted against the trial block number, for each trial block.

Figure 8.2 Mean performance on each trial block

Alun



row correct, upon which the sides were swapped. After the 17th of these trial blocks The material reinforcement frequency was increased to approximately 1 toy for every 2 correct responses, whilst all incorrect responses resulted in a toy being removed from the pile. The subject's performance varied widely throughout this between 2/8 and 8/8. In the session covering the 47th - 60th trial blocks in Intervention 1 he emitted the phrase "not that bus now" slightly after his choice which was incorrect.

The last two of these simplified trial blocks reached 7/8 for each of the instruction types so he was was then returned to a mixture of both of the negated mands with the two stimuli for trial block 15, and the material reinforcement frequency was maintained at 1 toy for every 2 correct responses. He only reached a chance level of responding on this so the single mand trial blocks were reintroduced. This is shown as intervention 2, and as section 16 in the raw data for experiment 2 in the Appendix. This consisted of keeping the instruction type constant until a performance of 7/8 correct was reached, then the next trial block would use the other instruction and this would be repeated. Thus the frequency of alternation was more rapid than intervention one, typically every 2 or 3 trial blocks initially and ending up at swapping over every trial block by the end of the intervention. By this time his behaviour frequently reached the 7/8 level. During the section of trial blocks in intervention 2 the material reinforcement frequency varied between 1 in 2, 1 in 4, and 1 in 1 correct responses, the exact values of which are shown in the Experiment 2 section of the Appendix. Then followed 6 trial blocks which gave a mixture of both of the negated mands (trial blocks 17 - 22) with a prize given for every correct response, but his performance remained at around the chance level during these.

As with Eli, his age became of concern so it was decided to try the shorter version of the instructions, i.e. "*name*" and "not *name*". As pointed out in the method section for him, he was often distractble so more gradual increments in task complexity were used, rather moving rapidly onto the full 4 stimuli, 2 instruction version, as was done with Eli. The material reinforcement rate was returned to a prize at the end of the session, he was given all four stimuli with both the mand and negated mand instructions, and reached criterion with only one error (trial block 23). During this trial block, on four "not *name*" instruction trials he said the name of the correct stimulus before touching it, this was different to the stimulus named in the instruction by the experimenter. To fade him into the first generalization test, trial block 24 consisted of the 4 pictures with just the negated mand instructions and NO feedback - he reached criterion on this. In this trial block on six "not *name*" instruction trials he said the name of the correct stimulus before touching it. He passed the two generalization tests for negated mands only (trial blocks 25 and 26) each of which had 4 novel stimuli and NO feedback. In trial block 25 on six "not *name*" instruction trials, and in trial block 26 on four "not *name*" instruction trials, he said the name of the correct stimulus before touching it.

He showed an increase in distractibility as the session length was increased with the final generalization test for both mand and negated mand function and just slipped below criterion on one of the trial types (trial block 27). During this, on six "not *name*" instruction trials he said the name of the correct stimulus before touching it. His expression and wry smile suggested that he got two of the trials wrong deliberately. He passed the criterion on a repetition of this trial block (No. 28), and in this trial block, on one "not *name* instruction trial he said the name of the correct stimulus before touching it. Since no feedback was given throughout, this was felt to be an acceptable result but a tidier result would have been him reaching criterion on the first exposure to the trial block, therefore a second generalization test was given. However, by this stage he was showing an increasing reluctance to partake in the experiment characterized by an increase in the number of tantrums when the experimenter called to conduct the study, and this appeared as slightly more variability with him dropping below 7/8 on two of the trial types (trial block 29). Again, upon repetition he reached criterion (trial block 30). In trial block 29, on fourteen "not *name* instruction trials he said the name of the correct stimulus before touching it. He was also very inattentive, often didn't look at the pictures before making his choice, and he frequently changed his choice. During trial block 30, on two "not *name* instruction trials he said the name of the correct stimulus before making his choice.

Gareth

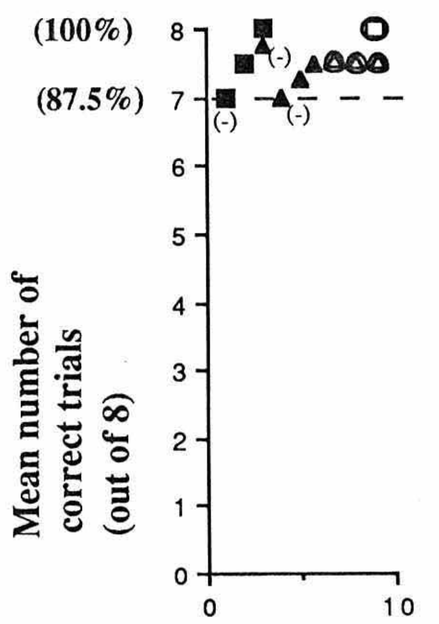
Figure 8.3 shows Gareth's mean level of performance during the study. The instructions used were of the shorter "*name*" "not *name*" type. Gareth failed to reach criterion on the initial check for mand function as one of the trial types only obtained a level of 4/8. He passed criterion in a repetition of this in trial block 2. The first exposure to a mixture of the mand and negated mand instructions using the same four stimuli, in trial block 3, produced behaviour that reached mean levels of 7.75/8 and 7/8,

Figure 8.3 : Data for Gareth. Mean number of correct trials (out of 8) plotted against the trial block number, for each trial block.

Figure 8.3

Gareth

Mean performance on each trial block



Key

	+ Feedback	Generalization	
	4	4	No. of trial types
"Touch ..."	■	O	
"Don't Touch ..."	▲	⊘	

respectively, but dropped beneath the criterion on one on the trial types. Trial block 4 used the negated mands only with these four stimuli, and again dropped beneath criterion on one of the trial types. It was repeated for trial block 5, and produced a mean level of 7.5/8, and passes for all the trial types.

He reached criterion on the first generalization block (No. 6) which used only the "not *name*" instructions with 4 novel stimuli, and also did on the second generalization trial block (No. 7) that repeated this with a further set of stimuli. The final generalization test that involved both the "*name*" "not *name*" instructions, with another novel set of stimuli produced a high performance level which reached criterion.

Jenny

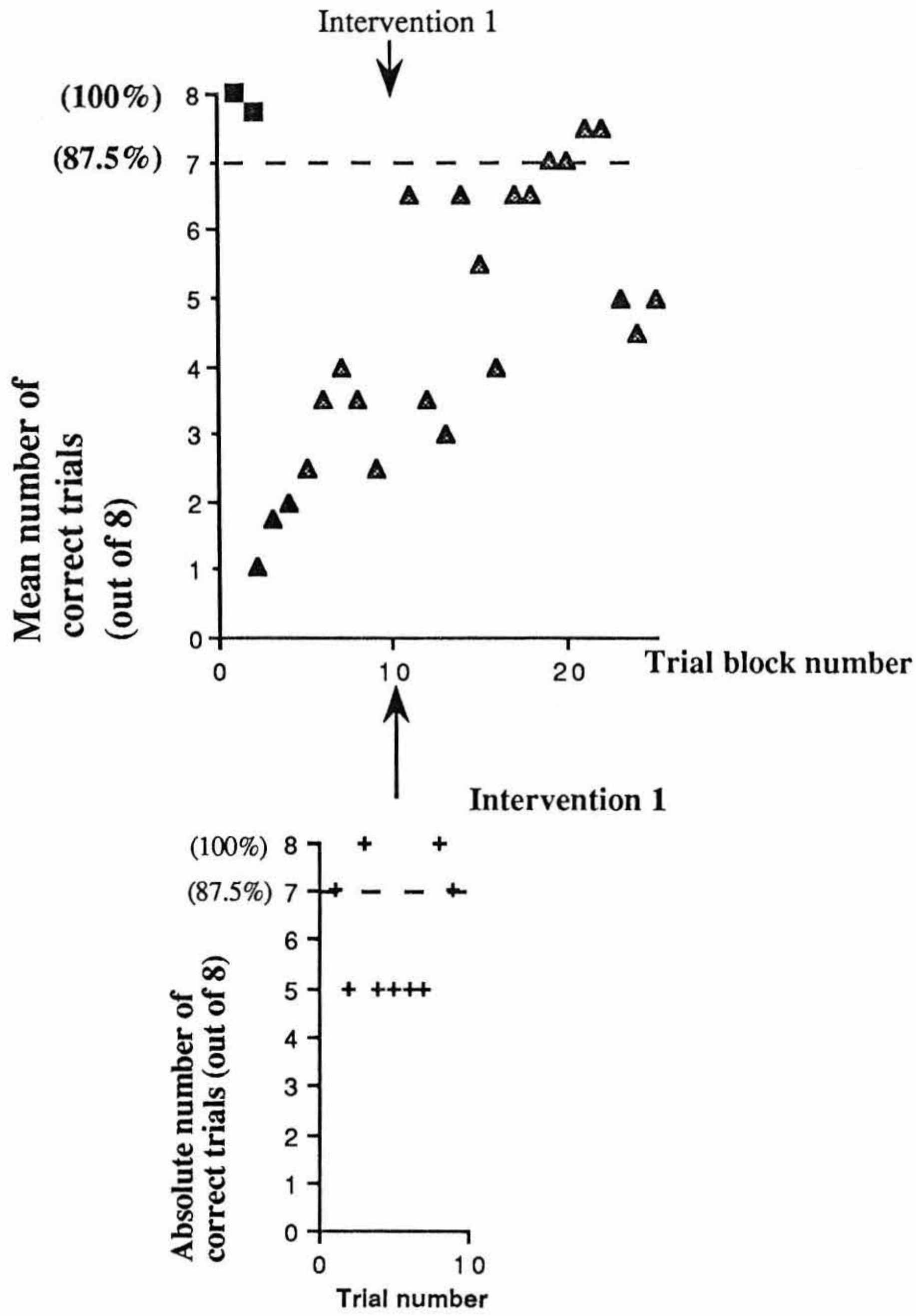
Her mean level of performance during the study in shown in Figure 8.4. One simplified intervention which had only 8 points per trial block is plotted beneath the main graph. The shorter "*name*" and "not *name*" instructions were used. She made no errors in the initial check for the function of the "*name*" mand (trial block 1), but the next trial block involving a mixture of the mands and negated mands resulted in her passing the mand components, but obtaining only low scores on the negated mands (trial block 2). This suggested that negation part of the instructions was ineffective, resulting in her tending to react to them as straightforward mands. In trial block 2 she correctly emitted "not tent, bus today" and she said "bus it was" on five correct "bus" trials, "pig it was" on one correct "pig" trial, and "not this" on one "not pig" trial.

There followed a block of only negated mands (trial block 3), which she failed in a similar fashion. The next level of simplification, involving just two of the stimuli with their negated mand counterparts,

Figure 8.4 : Data for Jenny. The top graph shows the mean number of correct trials (out of 8) plotted against the trial block number, for each trial block. The figure beneath this show the intervention; the absolute number of correct trials (out of 8) are plotted against the trial block number, for each trial block.

Figure 8.4

Jenny Mean performance on each trial block



Key

+Feedback

	2	**4**	**No. of trial types**
"Touch ..."	■	■	
"Don't Touch ..."	▲	▲	

showed an slight increase in the level of performance towards a chance level of 4/8. A final level of simplification was introduced using the two stimuli with only one negated mand for each trial block. Each time she reached criterion with one of the instructions she was swapped onto the other one and kept on it until she reached criterion on that, when the first was reintroduced. Thus she began with "not bus" as the instruction for one trial block and reached criterion. Then 2 trial blocks were given with the "not pig" instruction, followed by 5 with the "not pig" instruction, ending with 1 block with the "not pig" instruction. Her behaviour during these is shown in Figure 8.4 intervention 1. Where she produced responses between 5/8 and 8/8 correct.

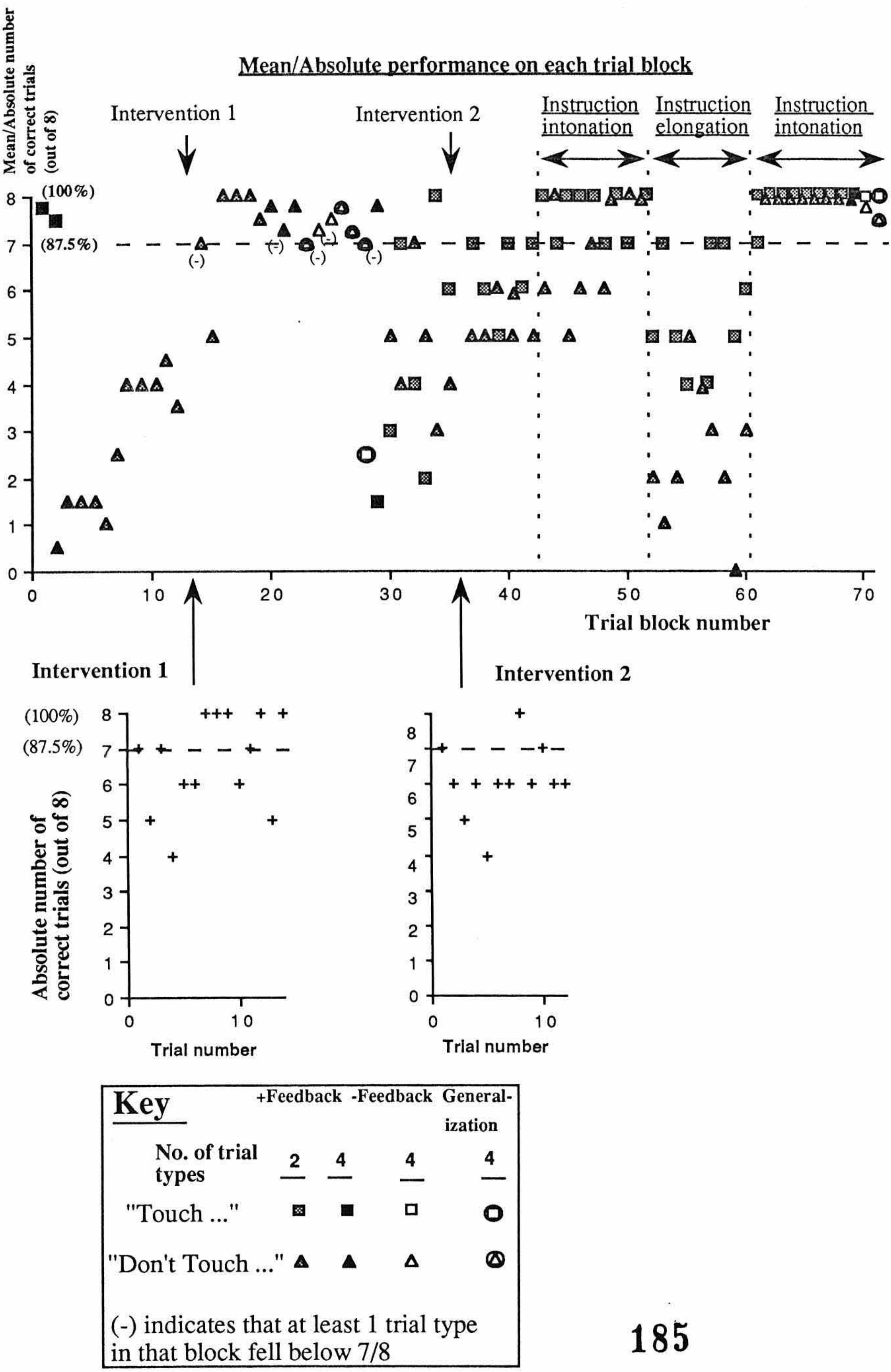
The task complexity was then incremented to the 2 pictures with both of their mand counterparts and was continued during trial blocks 11 to 21, during which she showed a steady improvement and reached criterion in blocks 19 and 21. This was repeated with the remaining two stimuli in trial block 22, where she also met the criterion. Then all four stimuli with their mand counterparts where given (trial block 23) but she fell back below criterion, and reintroduction on the 2 stimulus version failed to produce a rapid return to criterion. At this point the experiment was terminated by the child's mother for family reasons.

<u>Mathew</u>

Mathew's mean level of performance is shown in Figure 8.5. Two simplified interventions involving only 8 data points per trial were given and these are drawn beneath the main figure. The shorter "*name*" and "not *name*" instructions were used. He passed the initial check for the function of the mands, but failed the mixture of the mand and negated

Figure 8.5 : Data for Mathew. The top graph shows the mean number of correct trials (out of 8) plotted against the trial block number, for each trial block. The figures beneath this show the interventions; the absolute number of correct trials (out of 8) are plotted against the trial block number, for each trial block.

Figure 8.5 **Mathew**



mand instructions in the trial block that followed. His near zero performance of the negated mands suggests that they actually acted as ordinary mands with no inversion of function from the negation component.

He failed the first level of simplification involving just the negated mands (trial block 3), so only 2 stimuli with their negated mand counterparts were used for the next 9 trial blocks. He showed an increase in the score obtained on each trial block, but failed to show any improvement over the chance level of responding which he produced in the latter 4 trial blocks. Then the lowest level of simplification was introduced involving the two stimuli with only one negated mand during each trial block. He began with the "not bus" instruction, reached criterion and was put on the "not pig" instruction which was continued until he reached criterion and then this was repeated. Following this pattern he completed 14 trial blocks alternating around every 2 trial blocks, and showed and improvement in his performance reaching criterion on most of those in the latter half of the intervention.

He was then given an increment in task complexity when both of the mand instructions were presented in each trial block (numbers 14 to 17) and improved during these to the criterion level of responding. This was repeated for the remaining two stimuli in trial blocks 18 and 19, where he reached criterion. In trial blocks 20 to 21 he was tested on all four of the baseline stimuli and reached criterion. Then arose a choice point which also occured in Eli's procedure; there it had been found that moving directly onto a mixture of mand and negated mand instructions with the current set of stimuli produced a collapse in her responding. So it was decided to try the other alternative of obtaining generalized responding to negated mands *before* pursuing differential control by the mands and their negations. So there followed the first generalization test, in which NO feedback was provided. He fell beneath criterion on this, and two further exposures to it (trial blocks 23- 25). Training of these was then given with this set up plus feedback, and he missed criterion once more, but did reach it in a second repetition (trial blocks 24 and 25). Another generalization test with 4 more novel stimuli without feedback was given, which he passed (trial block 27).

Having passed the generalization test for negated mand instructions only he was then tested to see if he could discriminate between mand and negated mand instruction. So he was given 4 novel stimuli and both types of instruction, plus feedback (trial block 28). The obtained pattern of responding was the opposite of that obtained earlier, for now both types of instructions tended treated as negated mands, with low scores being obtained on the mands (except "car") and mainly full scores on the negations (except "not car"). A repetition of this in trial block 29 showed a further separation between the instruction types where all the negations reached criterion and all the mands produced low scores. The task was then simplified to 2 stimuli, but with both mand and negated mand instructions (trial block 30). This produced a movement towards chance responding in both instruction types. A further simplification was then introduced for the next 5 trial blocks (No.s 31 to 33) with only one of the stimuli being referred to by the instructions, i.e. the car and snake stimuli with "car" and "not car" stimuli, this produced fluctuation between high scores on the mand and near chance on the negation, and then high scores on the negation with near chance level being reached on the mand.

A final level of simplification was then introduced were the two instructions were used, but each was continued until at least 3 correct responses in a row were obtained, then the other instruction was given. This produced movement towards the criterion level of responding though with some variability present resulting in scores that fell down to 6/8. This was continued over a total of 12 trial blocks, and the data are shown in No. 36 in the Appendix. Each trial block only consisted of a total of 8 trials so the results are shown as Intervention 2 below the main graph in Figure 8.5.

The subject was then returned to the 2 stimuli with the "car" "not car" instructions and 8 trials for each trial type over trial blocks 37 to 41. His scores remained above chance but didn't reach criterion. In the last session I noted that some of the instructions I gave had begun to become intonated with a rising tone in the "car" mand, and a descending tone on the "not" and a rise and fall in the "car" for the "not car" negation. These trials seemed to result in a correct choice by the subject. To test this hypothesis he was given a total of 10 trial blocks with the instructions intonated all the time (No.s 41 to 51). During the last three of these trial blocks the material reinceforcement rate was increased to one prize at the end of every trial block to try to reduce the distractibility of the subject; no withdrawal of prizes occured. He showed a rapid improvement in responding with the mand instruction reaching criterion, then the variability in his response to the negated mands became less until he remained at criterion for the last three trial blocks. This material reinforcement rate continued up to trial block 68, when he was returned to one prize per session.

To confirm that it was the intonation that was responsible for this improvement and not merely a highlighting of the presence of the "not" negation, Dr. Horne suggested a withdrawal phase in which the intonation was removed but the negation emphasized by elongating the word "not" so that in lasted for roughly twice its normal duration. This was carried out during the next 9 trial blocks (No.s 52 to 60). Here an immediate drop in his accuracy of responding occurred, sometimes showing a separation between the mands and negated mand with the former tending towards the criterion and the latter towards zero, whilst at other times both were around the chance level. He had failed to show any improvement by the last trial blocks and did not reach criterion. Reintroduction of the former intonated instruction conditions and NO elongation of the negation "not" produced an immediate performance at the criterion level which was maintained over 3 trial blocks (No.s 61 to 63). The referent of the instructions was then reversed to the snake with "snake" and "not snake" as the instructions in trial block 64, and he made no errors. Trial block 65 was a return to the "car" and "not car" instructions and trial block 66 back to "snake" and "not snake" instructions - in both he also made no errors. This alternation between the two type of trial block was to prepare the subject for a mixture of referents, in trial block 67, in which the snake and car stimuli had mand and negated mand instructions associated with them. Scores of 8/8 were obtained for all the trial types. This arrangement was repeated with the two remaining stimuli, the flower and bone, and no errors were made (trial block 68). All four stimuli with their mand and negated mand instructions plus feedback were given in trial block 69, with again no errors. Then followed a repeat of this with NO feedback to prepare the subject for the generalization test, and a high level of responding at the criterion level was obtained (trial block 70). Finally a generalization test with four novel stimuli and their mand and negated mand instructions and NO feedback was given, which he passed at criterion (trial block 71).

Discussion

From an examination of the results a number of comparisons between the subjects become possible. Eli and Alun initially were given prolonged exposure to the longer versions of the instructions, namely "touch the ..." and "don't touch the ...", before being put onto the shorter "*name*" and "not *name*" versions. Whilst Gareth, Jenny and Mathew formed a second group which only received the shorter instructions. Despite the prolonged exposure (1926 and 1768 trials), extremely simplified interventions, and the increased frequency of material reinforcement, Eli and Alun still failed to produce the required behaviour. Gareth and Mathew both passed all of the required tests and demonstrated a generalized ability to respond to the instructions with novel stimuli. What is interesting however is that, despite their similar ages, they showed very different patterns to each other in their behaviour to the different stages.

Gareth's behaviour was characteristic of those subjects in experiment 1 who required little in the way of exposure to the experimental procedure before passing the later stages. There is no rising curve of acquisition to be found in his data, which together with the accuracy of his responding suggests that the higher order response classes evoked by the mand and negated mand autoclitics were present initially at strength along with the requisite stimulus control. The initial exposure to feedback, therefore, seemed to increase the strength of the response classes and sharpen the stimulus control further, enabling the subject to pass the generalization tests that had no feedback. Mathew, in contrast, showed no evidence of any initial presence of the required higher order response classes and stimulus control, other than that of the response to the mands which was a requirement of him taking part in the experiment, anyway. In fact, both the response class to negation of the mands and the stimulus control had to be established independently, firstly the generalized responding to the negated mands alone, then the discrimination between the mand and negated mand instructions. This provided the pattern of acquisition which the model of these higher order response classes predicted, along with support for the hypothesis that various components might have to be built up in succession before being combined in the resulting response class to this category of instructions. Jenny provided partial support for this as the early stages of acquisition were present in her pattern of responding to 2 stimuli with their mand and negated mand instructions, with feedback. Her response curve shows the rise to criterion following the intervention with just one of the instructions per trial block, that was found in Mathew's data. The early termination of the experiment by her mother unfortunately prevented a further exploration of this.

Eli also showed acquisition of some of the prerequisites for the task, she reached the level of responding to the original 4 stimuli with their negated mand instructions only. As mentioned earlier, the choice was then whether to continue with just negation instructions and establish generalized responding to these, before discrimination between the mand and negated mands, or whether to first establish the discrimination between the mands and negated mands with the original stimuli before then moving onto generalization training and testing. The choice of the latter option in her case produced a collapse in her responding which did not fully recover by the time she was 2 years, and 9 months old, and it took the introduction of the shorter versions of the instructions before she passed. In contrast Mathew was first trained on generalization to negated mands only, which he acquired quite straightforwardly. The later establishment of discrimination between the mand and negated mand instructions proved more difficult to obtain. The systematic manipulation of the intonation and length of the instructions showed that the intonation of the instructions was more important than their differing length and content.

The recordings of the subjects' relevant verbal behaviour indicated that Eli occasionally made utterances that were incorrect when compared to how she was behaving on the task and the feedback she was receiving, e.g. "I always touch the bus" even though she had just chosen the pig stimulus. Alun sometimes emitted the name of a stimulus before touching it. Initially this was often incorrect, but its accuracy improved towards the end of the experiment. However the majority of trials had no such preceding utterance before pointing with his finger occurred. Jenny sometimes emitted phrases such as "bus it was" after her choice and my feedback, but these were relatively infrequent. Gareth and Mathew said little of any relevance during the experiment. Thus in general it can said that relevant verbal behaviour was a comparatively rare occurrence, and that no evidence is present of any rule based strategy which might have governed their choices. Rather the observed patterns of responding seem to result more directly from contact with the experimental contingencies.

As with Experiment 1, The Reynell Developmental Language Scale data were of little use in accounting for a subject's pattern of responding on the task.

The failure of the two subjects exposed to the longer instructions and their later passing the shorter version, along with the passes by Garath and Mathew on the shorter instruction, lends support to the hypothesis that as children mature the function of verbal operants placed earlier in a sentence increases. An autoclitic that inverts the function of a sentence is more effective with them when placed near the end of a sentence rather than near the beginning. The importance of intonation in Mathew's discrimination of the instruction suggests the need for further systematic investigation of the use of intonation in speech, both between adults and children, and between the children and their peers. A standardized listener test involving a wide spectrum of common intonation patterns with different categories of instruction, would also be extremely useful in assessing the childrens' initial listener skills before the onset of the experiment, helping to highlight the areas in which further training might establish the remaining components required for responding on the task.

The information gained from the systematic manipulation of the instructions, and the order in which the different behaviours are trained, provides the basis of the multiple baseline design which was not eventually possible in this experiment. The four subjects which were available till the end of the experiment all passed the shorter versions of the instructions. So if the sample is sufficiently large to allow the exclusion of any subjects like Gareth that can do the task with little training, then the reduction in the variation of these important variables should increase the likelihood of a clear outcome with a multiple baseline design across subjects.

Chapter 9: Experiment 3: An investigation of the acquisition of listener behaviour to conditional mands.

Introduction

Earlier in the introductory chapters it was pointed out that in a section called 'Conditioning the behaviour of the listener' Skinner (1957) discussed how relational autoclitics can be used to bring about changes in the listener's future behaviour to the referents of the primary verbal operants they accompany. In this way discriminative, reinforcing, or aversive functions can be established to previously neutral stimuli via their pairing with a verbal operant already having this effect. An important subclass of the relational autoclitic in the area of rule-governed behaviour is the conditonal mand. This study was aimed at investigating the acquisition of listener behaviour to conditional mands in order to try and develop an understanding of these behaviour patterns in the listener, since Skinner gave little recognition to the problem of their origin. From the models described in the introductory chapters, the ontogeny of these was seen as being due to a history of differential reinforcment made contingent upon the emergent patterns of behaviour that are characteristic of a particular class of autoclitic. This shaping component of the models formed a integral part of the procedure.

Design

As discussed earlier in Chapter 7, the model of acquisition and training strategy indicated that the procedure would be of the irreversible type. The main elements of the design are shown in Figure 9.1. The advantages of a multiple baseline design outlined in experiment 2,

Figure 9.1 : A simplified schematic diagram of the main procedure for the conditional mand study.

Figure 9.1

Simplified Schematic Diagram of the main procedure for the conditional mand study

1

Test and train using conditional mands, with feedback and NO verbal prompt.

e.g. sample: KING
comparisons: MOON BUCKET

instruction:
"when its the king, touch the bucket"

↓

2

Test and train using conditional mands, with feedback PLUS verbal prompt.

prompt:
"when its the ..."
(phrase completed by subject)

↓

3

Return to test and train using conditional mands, with feedback and NO verbal prompt.

↓

4

Generalization tests for conditional mands using novel stimuli, with feedback.

↓

5

Generalization tests for conditional mands using novel stimuli, without feedback.

↓

6

Generalization tests for a conditional mands using conditonal mands, without feedback, behind full screen.

suggested that an implementation of this design was desirable to try and control for extra experimental temporal factors that might be responsible for observed patterns of responding. It was felt that sufficient knowledge of the children's general reaction to the experimental paradigm had been obtained from experiment 1 to allow planning a multiple baseline design. However since the present procedure with conditional mands contained several new components, it was also recognized that individual variations in the subjects' behaviour might call for departures from the general plan, in the manner of experiments 1 and 2. This confirmed the exploratory aspect of the study, for the degree of subject variability was unknown, as were the required successive simplifications in procedure that might be necessary to bring about the required acquisition of listener behaviour in the subjects. Thus a useful outcome of the study would be to provide information on these issues to simplify future experiments and to allow further increases in the experimental control for extraneous factors.

The model of the listener's acquisition of responding to conditional mands followed that outlined earlier (Chapter 6), and formed the basis of the intervention. The ABCD... single subject design used in experiment 1 was adapted to provide a multiple baseline across three subjects aged 3 years, 3 months to 3 years, 4 months at the onset of the experiment. A further subject of age 2 years, 7 months became available and was added to provide a comparison with the older children. The stages of the experiment were planned be as follows: Stage 'A' provided the baseline stage of the intervention, which was staggered across the three older subjects to provide 3, 5, and 7 baseline trials blocks for each subject respectively. This consisted of the conditional mands "when it's the ..., touch the ..." for each pair of picture stimuli followed by verbal feedback after each trial, e.g. for the flag - cat pair it was "when it's the flag touch the cat". Stage 'B' consisted of the addition of a verbal prompt from the experimenter, prior to the subject making a response, "when its the ...". A subject was then required to vocalize the conditional instruction before finally making their choice. Stage 'C' consisted of the removal of the prompt. Stages 'D', 'E' and 'F' were to consist of generalization tests with the conditional mands using novel picture stimuli for each stage, with feedback. Followed by stages 'G', 'H' and 'I' which were conducted under conditions of extinction, that is, no feedback. Finally stages 'J' and 'K' were to provide a further degree of control for experimenter cueing, in that the experimenter was out of sight for the duration of a session. A performance at criterion of stages 'G' to 'K' would provide strong evidence for the presence of listeners' higher-order response classes evoked by this type of conditional mand with novel stimuli, in the context of this experiment.

The learning criterion was the same as experiment 1, at 7/8 correct responses for each trial type in a block. The number of trials per block with 4 picture stimulus pairs was therefore 4 X 8, i.e. 32 trials.

Method

Subjects

Four children aged 2 years, 7 months to 3 years, 4 months at the start of the experiment. All came from English speaking backgrounds, with little or no exposure to Welsh. They came from a variety of socioeconomic backgrounds, and had no known intellectual difficulties, and no hearing or visual disabilities were present. The subjects were recruited through personal contacts with the experimenter and through acquaintances of the mothers already involved in the studies. They came from both the village of Rhiwlas and the city of Bangor in N. Wales. The experiments were carried out in both the children's own homes as well as the experimenter's home. Two of the children had no previous experience in psychology experiments and the other two (Owen and Niall) had taken part in experiment 1, but in none prior to this.

Apparatus

The room in the experimenter's house was that described in experiment 1. Those rooms used in the subject's houses varied in dimensions, but it was arranged that external distractions were kept to a minimum, thus no other children were present, the television set was switched off, etc. The subjects sat opposite the experimenter (approximately 70 cm apart), with the mother sat beside or behind them in the early stages of the experiment, later the mothers frequently went into another room. The stimuli consisted of a series of colored pictures of familiar objects 7cm X 7 cm, placed upwards facing the subject. In order to provide a large enough number of pictures of objects known to the subjects, some of those from Experiment 1 were used, but none had been paired together in any way. The order of the stimuli was randomized on an IBM AT compatible computer which produced A4 printed data record sheets that were used during the actual experiment. A video camera recorded the sessions where a change in intervention or a subject's behaviour took place. This was in order to provide information on the subjects' verbal responses and their interaction with the experimenter. The position of the choice (comparison) stimuli was randomized by a Hewlett Packard HP28S programmable calculator. The Material reinforcers consisted of toys and books values between £0.50 - £3.50, plus colorful stickers.

Procedure

Pretest

As with experiment 1, the experimentally naive subjects first came for a play session with their mothers to the experimental room to habituate them to the situation and the experimenter. The sessions began with around 10 minutes play with toys, then the main prize was chosen, 15-20 minutes were spent on the experimental session, followed by giving the prize to the child.

The naive subjects were given the initial pretest of experiment 1, that of 30 pictures which might be used in the experiment. This was to check for any that might be unfamiliar and require care in their use in the main experiments. Since more than 30 stimuli were eventually required, the later stimuli were tested in this fashion before their introduction in a new stimulus set. Occasionally a stimulus slipped through this procedure in which the subjects use and understanding of the name was weak, but this was a rare occurrence.

Reynell Developmental Language Scale Assessment.

All of the subjects where later used in Experiment 4, which made use of the response classes acquired in this experiment. In Experiment 2 the Reynell Developmental Language Scale (Reynell, 1977) was presented after the experiment which reduced the inhibition of the subjects on the Expressive Language component of the test (Chapter 8). Therefore it was decided to administer the Reynell Developmental Language Scale at the end of Experiment 4.

Main Experiment

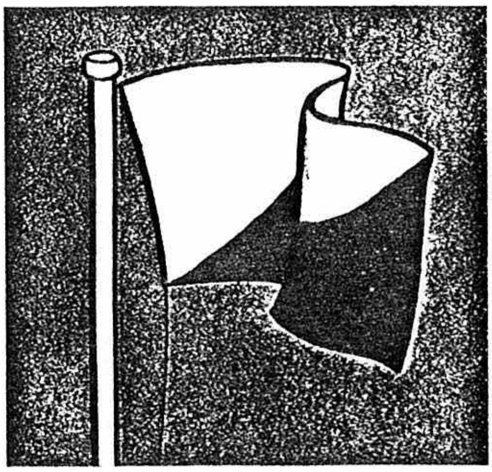
The main experimental stages followed the outline given in the design section. Each session began with the experimenter saying the instruction followed by the child touching the appropriate comparison. Then the experimenter would say "now it's your turn" and the child would repeat the sequence, but saying the instruction themselves. This was repeated for each of the stimulus pairs in a trial block. The reason for the subject repeating the instructions once, was to ensure that they had heard them accurately. A non prompted trial would begin by the experimenter saying "touch one", after which the subject would make their choice. Verbal reinforcers such as "that's good", "yes", "good girl", and mild punishers e.g. "no", "not that one", "no, you mustn't" constituted the feedback from the experimenter. The feedback for an incorrect response would then be followed by the experimenter saying the instruction followed by "now it's your turn", upon which the subject would then give a repetition of the instruction.

Baseline Trial

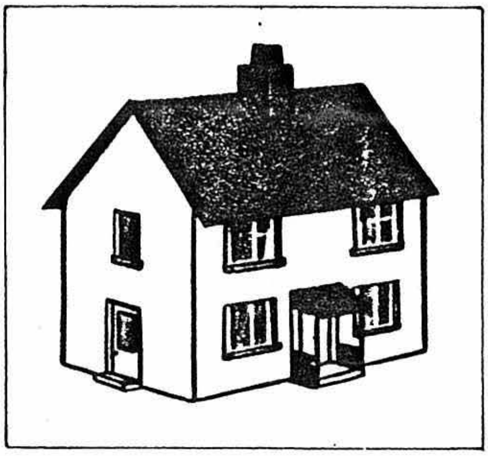
The baseline phases, consisted of four picture stimuli pairs with the "when it's the ... touch the ..." instruction. The picture arrangement consisted of a sample, placed above, and its comparison with one incorrect comparison, both placed below. (see Figure 9.2). The incorrect comparison was drawn from amongst the other comparisons and not the other samples. A child which appeared distracted, or unsure of what was required, received a simple prompt to make a choice between the comparison picture stimuli. This was usually "which one are you going to

Figure 9.2 : The picture arrangment in Experiment 3. This consists of a sample, placed above, and its comparison with one incorrect comparison, both placed below. Example stimuli are shown.

Figure 9.2



Sample



incorrect comparison

Correct comparison

touch?" or "Pick one", occasionally with the experimenter presenting their hand palm upwards ready to receive a picture. In later sessions a gentle tap on the table was sometimes needed. The prompt was faded out as the child consistently made a choice. The number of the trial blocks in the baseline phase was 3, 5, or 7 depending on which step of these baselines a subject was placed.

Training and Testing Stages.

The remaining stages followed that outlined in the design if a subject's performance reached criterion during each. Firstly, the arrangement in the baseline trial blocks continued, with the addition of the verbal prompt from the experiment and the vocalization by the subjects, outlined in design section. Then followed the removal of the verbal prompt. The subjects were required to continue to vocalize the relation prior to their choice until they showed performance consistently at criterion, when the requirement was relaxed until any deterioration in behaviour recurred. During this stage an A4 size piece of card was introduced to shield the experimenter's face and eyes from the subject's vision, though still allowing the experimenter to see the sample and comparison. This was held up by the experimenter's hand and provided a degree of control for cueing, which would later be increased to the experimenter being out of sight of the subject (in the final generalization tests).

If the subject failed to reach the criterion level on a particular stage, then a series of repetitions and simplifications were introduced that followed the general pattern used in experiment's 1 and 2. Thus that set of trial types would then be repeated for a number of trial blocks until the subject either reached criterion and moved onto the generalization stages, or showed no improvement in which case the next level of simplification was introduced. This consisted of two picture stimulus pairs from the four pairs that they failed with, and the corresponding conditional mand instructions. Two trial type gave a block length of 16 trials. Then the same was done with the remaining two of the four stimulus pairs. Finally the task consisted of all four of the original stimulus pairs with their conditional mands.

Generalization Tests

The first three of these consisted of the of the previous arrangement, but using novel stimuli for each, with feedback. Failure on any one resulted in its repetition. Then followed three generalization trial blocks without feedback. Finally two generalization blocks without feedback were given with the with the experimenter out of sight of the subject.

When a subject narrowly missed one of the generalization trial blocks, it was repeated for one further trial block without feedback. The justification for this is that it has been shown in experiments on equivalence (e.g. Sidman, Kirk & Wilson-Morris 1985, and Lazar, Davis-Lang, & Sanchez 1984) that the required level of responding can take a number of trial blocks to emerge. Whilst a number of further trial blocks was undesirable (in terms of added study duration), it would also indicate that the response class was currently weak (had a low probability of emission) which would suggest further reinforcement was required, according to the current model. This would in fact be given if the second trial block failed to reach criterion following the procedure outlined earlier. Thus the current procedure allows for a limited degree of emergence of the response class, before further training by reintroducing the reinforcement contingencies is introduced. Reaching the criterion for generalization on the second trial block still provides support the presence of a higher order response class, since it would have emerged without direct training, as a result of exposure to the instruction as a listener.

Interventions and simplifications of the Task

If performance on one of these generalization blocks failed to reach criterion, then further blocks using the same stimuli with feedback were introduced until the subject reached criterion. Finally the block was repeated with NO feedback, then proceeding onto a new set of stimuli under NO feedback conditions. As pointed out in the procedure of experiment 1 (Chapter 7), by taking a child who failed initially and then repeating this process for different sets of picture, the acquisition of the response class might then have been observed, eventually reaching the point where generalization was shown without feedback.

The necessary variations to this scheme which resulted from the partly exploratory nature of the study are outlined in the procedural sections for each subject, and in the discussion their performances. These include further successive simplifications, phases of increased frequency of reinforcement, repetition of some of the stages involved. The videotape analysis was the same as that given in experiment 1, and details of deciding what was relevant material to transcribe are given in Chapter 7.

Owen

Two of the early baselines sessions required the countering of a right-hand side preference, following a procedure used in experiment 1. This involved placing the correct comparison of the opposite side to the preference, and keeping this constant until he switched sides, upon which the randomization of the position of the comparison stimuli was reintroduced. These interventions were relatively short lived, consisting of four trials with a right hand side preference in trial block 2, and 5 trials with a left hand side preference in trial block 3. The rest of his procedure followed that given in the general procedure section for this experiment.

<u>Niall</u>

A variation on the placement of the comparison picture stimuli was introduced to reduce the subject's tendency to fixate on only the first one glanced at, which was influencing the subject's insertion of the name of the comparison into his conditional mand autoclitic frame. This was done by placing the comparisons near to each other, approximately 1 cm apart, and was introduced in trial block 9.

On four sessions a procedure was introduced to correct a tendency to choose one of the comparisons before finishing his self instruction. This was corrected by stopping him as he prematurely approached one of the comparisons, and asking him to finish what he was saying and then make a choice. This took place during trial blocks 26 to 27, and occasionally in trial block 28. He required the successive simplification of the task to a level of two conditional stimulus pairs and their conditional mand instructions following the pattern outlined in the general procedure of this experiment.

Claire

All of her procedures followed that given in the general procedure section of this experiment.

Steven

With Steven, the main aim was to see if this response class could be established at all in a child of this age. His extreme distractibility suggested starting with the experimenter's verbal prompt in place from the very beginning, since this, and the required repetition of it by him prior to making a choice, tended to orient him more towards the sample and comparisons. A consistent failure on the task in the early sessions would provide the necessary evidence that the response was absent at the start of the experiment.

Following 8 successive trial blocks with the prompt from the experimenter, in which he failed to reach criterion, the task was simplified to two pairs of stimuli and their conditional mand instructions. 13 trial blocks with this arrangement were administered, but the subject failed to reach criterion.

At this point the reinforcement contingency was altered. Toys were given for approximately every 1 in 4 correct responses and every incorrect response resulted in a prize being taken away. The instruction introducing this new contingency was "what we're going to do today is - when you get them right, I'm going to give you prizes that you can keep and take home. But if you bet them wrong, then I can take a prize away. So you have to work very hard to get lots of prizes." This contains a number of conditional mands which the subject was unlikely to understand in full, given that this is what we are trying to establish in the course of the experiment. However they served to mark a change in the reinforcement contingency, and to preempt any bafflement in the subject. After six such trial blocks the reinforcement frequency was increased to a toy for every 1 in 2 correct responses, but still removed for every incorrect response. This continued for 5 trial blocks.

Since the subject was still not reaching criterion, a variation on the most basic level of simplification used in experiment 2 (Chapter 8) was used. This was a single constant conditional stimulus pair and instruction, with a constant incorrect comparison. The position of the correct stimulus varied according to the random constraints outlined earlier (Chapter 7). Where his performance was poor the reinforcement frequency was 1 in 2 correct responses, then as his performance showed consistent improvement it was reduced to 1 in 4 correct responses. The first conditional stimulus pair and instruction used was with the BELT - HOUSE pictures, which was continued until the subject reached criterion. Then the conditional stimulus pair and instruction for the FLAG - CAT pictures was used for successive trial blocks until criterion was reached. The BELT-HOUSE pair and instruction were reintroduced alone till the performance reached criterion, and then the FLAG-CAT pair with their instruction. This switching continued until the subject reached criterion during the first trial block of each change over, i.e. the point at which the pairs could be alternated across successive trial blocks with the behaviour remaining at criterion.

A mixture of both of the conditional stimulus pairs and instructions were used within a trial block once again, till criterion was reached. Then the remaining two stimulus pairs were presented in this way, to criterion.

Finally all four conditional stimulus pairs and instructions were given. Once this point was reached the subject was returned to the main procedural stages outlined above.

Results

Arithmetic means values for each trial block have been calculated and are plotted graphically in Figures 9.3 to 9.6. The numerical values are given in the Appendix which provides the most detailed description of the experimental manipulations and the raw data. Where any of the original values fell beneath 7/8 this is indicated with an accompanying (-) symbol.

Tables of data are provided for the following information:

9.1) Initial picture vocabulary pretest results, subject ages, study duration, and total number of trials, during the study.

9.2) Parental estimate of English versus Welsh Language background.

9.3) Reynell Developmental Language Scale Data.

Claire

The mean level of Claire's performance throughout the study is shown in Figure 9.3. She formed the shortest 'leg' of the multiple baseline component of the design with three trial blocks involving four stimulus pairs, their "when its the ..., touch the ..." instructions, plus feedback (trial blocks 1-3). She obtained scores of 4.25/8, 6/8 and 3.25/8 which suggested that she was unable do the task with any degree of accuracy at the beginning of the experiment. Then followed the addition of the verbal prompt from the experimenter. She was kept on this arrangement until she reached criterion for two trial blocks in a row; this

EXPERIMENT 3

Table 9.1

Initial Picture Vocabulary Pretest results, subject ages, study duration, and total number of trials, during the study

SUBJECT	INITIAL PICTURE VOCABULARY TEST: Number of Picture Words Correct.	AGES DURING STUDY: Start (years, months)	Finish (years, months)	STUDY DURATION (months)	TOTAL NUMBER OF TRIALS
Owen	30*	3, 04	3, 11	7	800
Niel	30*	3, 04	3, 10	6	1024
Claire	30	3, 03	3, 06	3	864
Steven	30	2, 07	3, 02	7	1896

* These subjects took this test in experiment 1, their data are reproduced here for comparison.

Table 9.2

Parental estimate of English versus Welsh Language background.

SUBJECT	ENGLISH & WELSH LANGUAGE BACKROUND
Owen	English only.
Niel	English only.
Claire	English only.
Steven	English only.

Table 9.3

Reynell Developmental Language Scale Data. *

SUBJECT	ACTUAL AGE (years, months)	RAW SCORE	EQUIVALENT AGE (years, months)	STANDARD SCORE
Owen				
Expressive Language total	4,02	42	3,04	-0.9
Verbal Compre-hension A	4,02	62	5,09 - 5,11	1.4
Niel				
Expressive Language total	4,02	32	2,07	-2.9
Verbal Compre-hension A	4,02	62	5,09 - 5,11	1.2
Claire				
Expressive Language total	3,09	38	3	-1.1
Verbal Compre-hension A	3,09	54	4,04	0.7
Steven				
Expressive Language total	3,03	38	3	-0.4
Verbal Compre-hension A	3,03	54	4,04	1.3

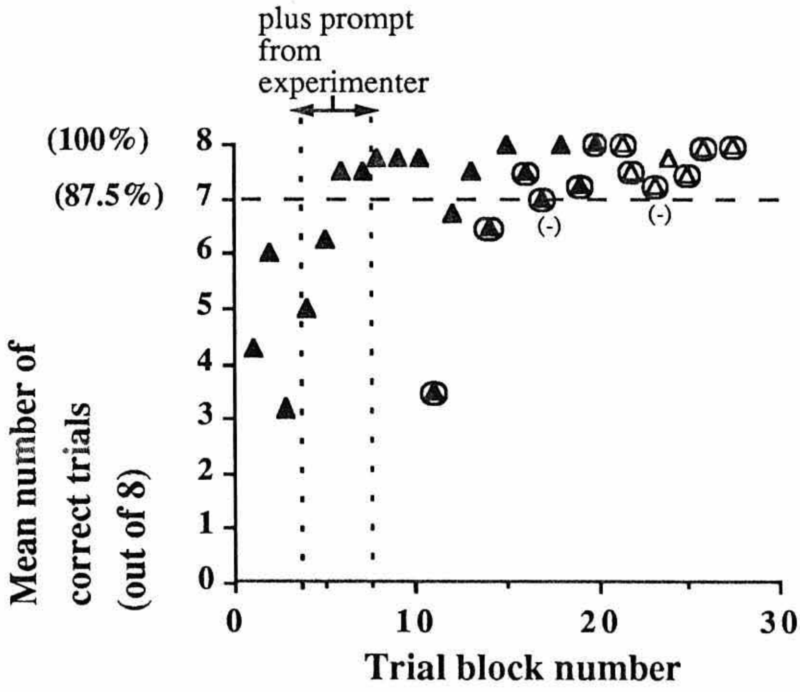
* This table is reproduced from Experiment 4.

Figure 9.3 : Data for Claire. The graph shows the mean number of correct trials (out of 8) plotted against the trial block number, for each trial block.

Figure 9.3

Claire

Mean performance on each trial block



Key

	4	**No. of trial types**
with feedback	▲	
without feedback	△	
Generalization with feedback	(▲)	
Generalization without feedback	(△)	

(-) indicates that at least 1 trial type in that block fell below 7/8

took four trial blocks (No.s 4-7). The prompt was withdrawn and this set of stimuli continued for a further 3 trial blocks, which she performed at high level of 7.75/8. In trial block 5 she often stopped after saying her self instruction, without making a choice . Therefore I introduced a number of trials where I looked up after she said each instruction; once this was successful, this was changed to just a silent pause with my looking away.

Then followed the first generalization block which consisted of 4 novel stimuli, and their "when its the ..., touch the ..." instructions, plus feedback. She only reached around chance level on her first exposure to this (trial block 11), but a number of repetitions of this produced a rapid rise to the criterion level (trial blocks 12 and 13). In trial block 11 she initially used her own name for sheep, which was "bah wah", so I asked her to use the name "sheep". A second generalization test with four new stimulus pairs produced an initial score of 6.5/8, and then a pass at the criterion level with one repetition of the trial block (No.s 14 & 15). She passed a third generalization test with four more novel stimulus pairs on the first exposure to them (trial block 15), and then dropped one trial type below criterion in a fourth generalization test, but made no errors on the subsequent repetition of it (trial blocks 16 & 17). In trial block 16 she said "tick tock" initially instead of the name "clock", which I corrected. She was given two last generalization tests with feedback which she passed on her first exposure to them (trial blocks 19 and 20). In trial block 20 she occasionally substituted the name "envelope" for "letter".

There followed a series of generalization tests without feedback. This tested the control by the instructions alone in establishing the new conditional relations between the novel stimuli, in the absence of any training of the relations between them. The first 3 of these were carried out as before with the experimenter's face shielded by an A4 piece of card. She passed the first two on the first exposure to each (trial blocks 21 & 22), but required a repetition of the third set of stimuli before passing (trial blocks 23 & 24). In trial block 22 she emitted one reversal of the self instruction for key-rabbit, which she followed with a correct response. The reduced level of performance on trial block 23 was correlated with her confusion over the name for the WHALE stimulus. However, trial block 24 did not require any feedback for the improvement in performance that was displayed.

To provide further control for experimenter cueing, the last two generalization tests were carried out with the experimenter completely shielded by the curtain covered hatch way, outlined in the general Procedure section. She passed both of these without any errors, illustrating the degree of stimulus control by the instruction, and the strength of the higher order response classes evoked (trial blocks 26 & 27)

Owen

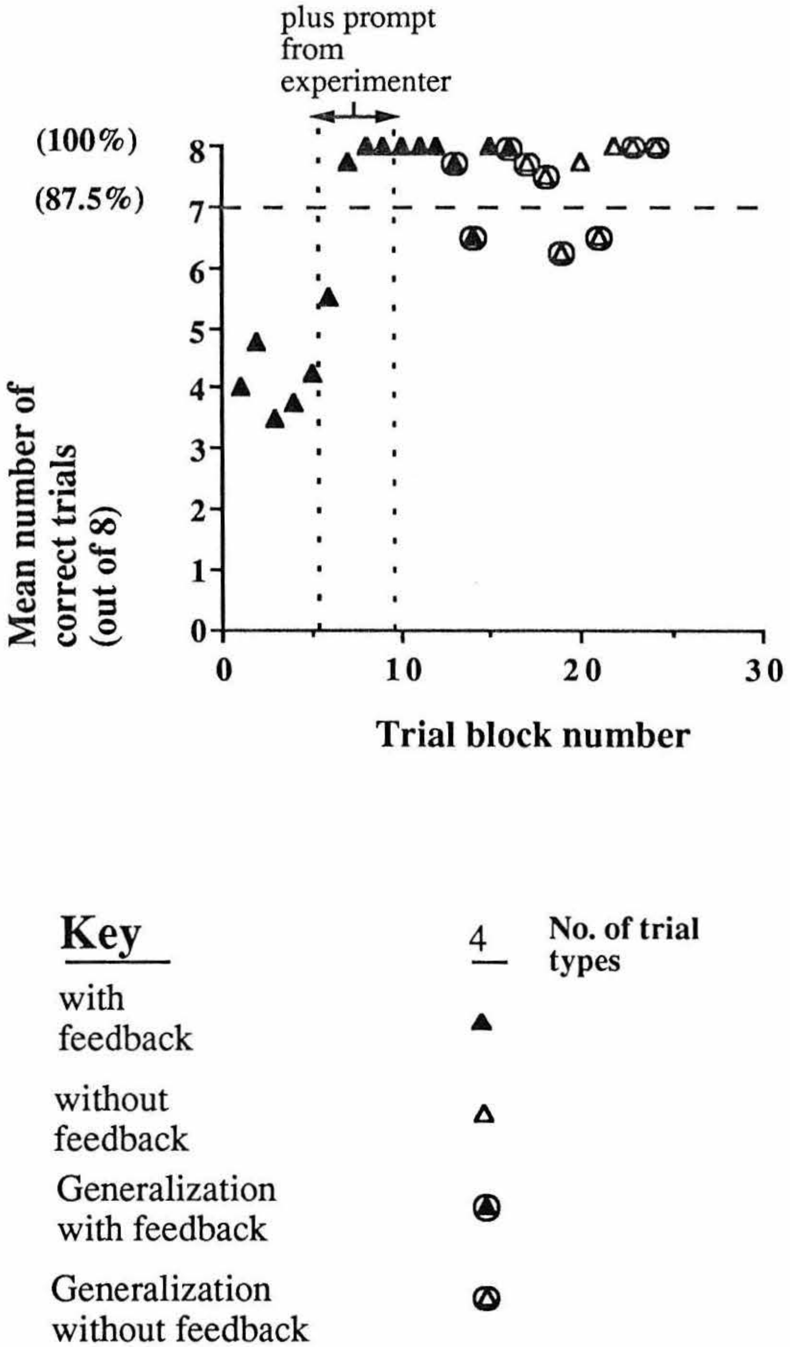
Figure 9.4 shows Owen's mean level of performance during the study. Owen was the medium length 'leg' of the multiple baseline component of the design involving 5 trial blocks with four stimulus pairs and their "when its the ..., touch the ..." instructions, plus feedback (trial blocks 1-5). His scores during this remained at around the chance level and showed no sign of improvement towards the end of these. Then the verbal prompts outlined earlier were added to each trial block, and

Figure 9.4 : Data for Owen. The graph shows the mean number of correct trials (out of 8) plotted against the trial block number, for each trial block.

Figure 9.4

Owen

Mean performance on each trial block



continued until the subject was at criterion for three trial blocks in a row. This required 4 trial blocks (No.s 6-9) in which the last two produced no errors. This high level of performance was maintained when the prompt was withdrawn in the following three trial blocks (N0.s 10-12). In trial block 12 he corrected his own self instruction before making a correct choice on one of the trials.

The first generalization test with feedback was then introduced involving 4 novel stimulus pairs and their "when its the ..., touch the ...," instructions. This he passed in the first trial block (No. 13) - once he got a couple of the trials correct, he appeared to get the other pairings right by exclusion of the comparisons that had already been shown to be paired with a different sample. A second generalization test required one repetition before he reached criterion (trial blocks 14 & 15). In trial block 14 there were problems of distraction by his younger brother who was also in the room and was playing with toys. This may have interfered with Owen's emission of the instructions, so the task was presented with him alone in the future sessions. He was given one more generalization test with feedback which he passed in the first block of trials (No. 16). Then followed the series of generalization tests without feedback. He passed the first two of these generalization tests on his first exposure to them (trial blocks 17 & 18). In the third generalization test without feedback he passed on three trial types, but only reached chance level on the fourth, however after one repetition of this trial block without feedback, he reached criterion (trial blocks 19 & 20). The first of these involved a lot of misbehaviour from the child, so it was stopped and continued on another day.

The additional control for experimenter cueing was introduced in the final generalization tests, both of which were without feedback. (Trial blocks 23 & 24). These were carried out with the experimenter behind the curtain covered hatchway, outlined earlier. He passed both of these without making any errors.

Niall

Niall's mean level of performance throughout the study is shown in Figure 9.5. He was the longest 'leg' of the multiple baseline component of the design with 7 trial blocks of four stimulus pairs and their "when its the ..., touch the ..." instructions, plus feedback (trial blocks 1 - 7). His performance on the task tended to produce scores around the chance level throughout the baseline trial blocks. The introduction of prompting by the experimenter increased the variability in his results, but failed to produce any significant improvement. After this had continued over 6 trial blocks (No.s 8-13), a further simplification of the task was introduced involving only two of the stimulus pairs and their associated instructions with the verbal prompts by the experimenter. These were the Flag-Cat and Belt-House stimulus pairs. This task was presented over 10 trial blocks (No.s 14- 23) and produced a slight improvement over the first half of the trial blocks followed by a sudden improvement above the criterion level which was correlated with the occurrence certain verbal behaviour spontaneously emitted by the subject in trial block 17.

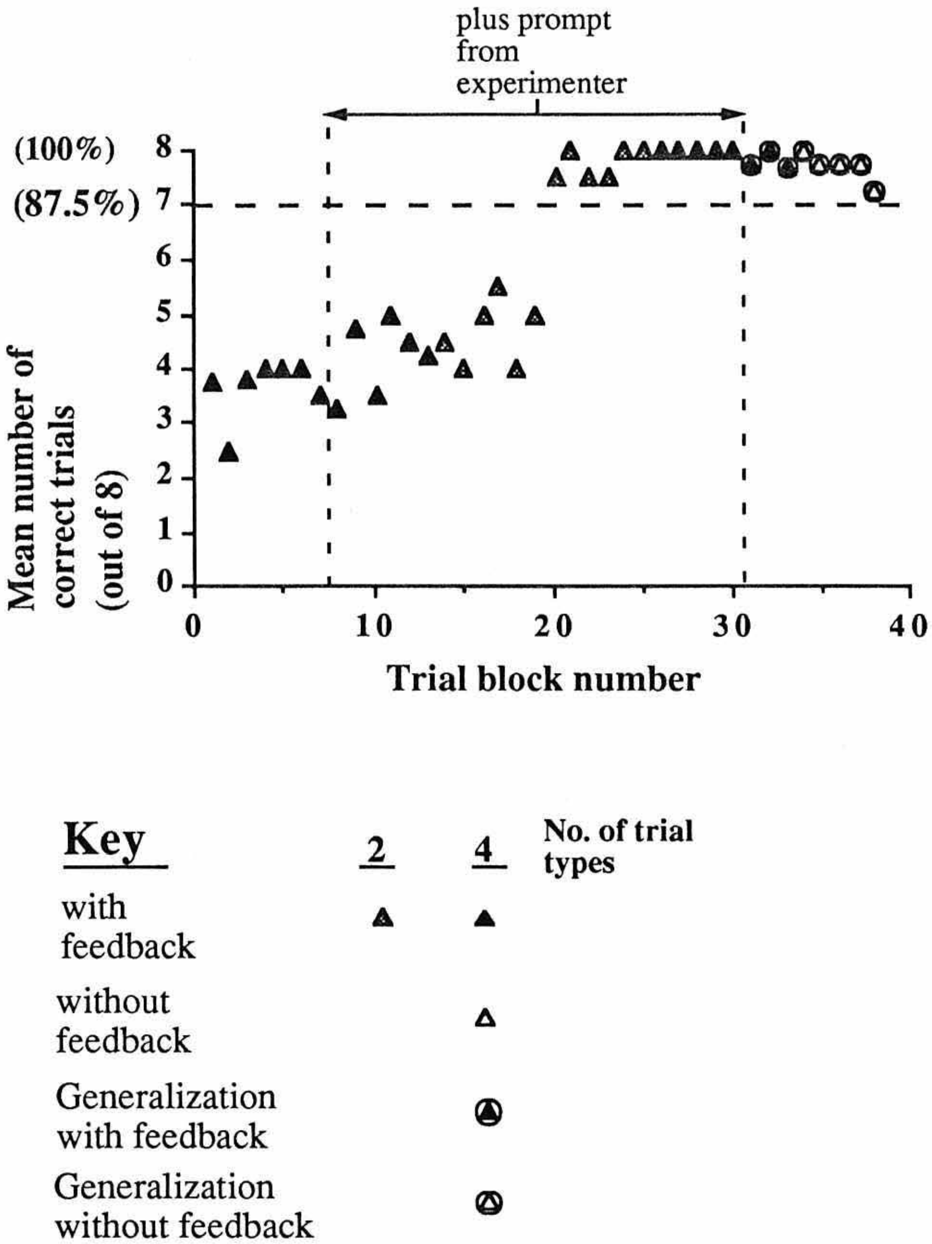
In trial blocks 10 and 16 there were instances where he said the instruction with sample name correctly in place, then began to say the correct comparison's name, but actively stopped himself from finishing it. Instead he appeared to then guess or insert the name of the picture he

Figure 9.5 : Data for Niall. The graph shows the mean number of correct trials (out of 8) plotted against the trial block number, for each trial block.

Figure 9.5

Niall

Mean performance on each trial block



happened to be looking at. The verbal behaviour emitted by him in trial block 17 which I referred to earlier was the question "does the cat go with the flag?" (correct), to which I replied "what do you think?", and he said "yes". Later in the session he said "And the belt goes with the house" (also correct). Following this, his self- instructions became both more fluid and rapid, with the latter comparison section of instruction more under the control of the sample section - rather than the picture he was currently looking at. He finished the last four of these trial blocks with a performance that met the criterion. In trial block 22 he gave an interesting comment when I accidentally placed the sample in a comparison position - "you don't touch that!".

He was then tested with the remaining two stimulus pairs in the same arrangement over two further trial blocks (No.s 24 & 25) and made no errors on these. In trial block 24 he correctly said "Does the King go with the bucket?", I replied "what do you think?" and he said "yes". Later in the session he said "the foot might go with the moon", which was correct. He often clenched his fist as he was saying the mand part of the instruction, paused, clenched his fist again, and then touched the picture.

Following this he was retested on all four of the baseline stimulus pairs in trial blocks 26-29, where he made no errors. The verbal prompts were removed for the next two trial blocks (No.s 29 & 30), but the rest of the arrangement remained the same. Again he made no errors. Three generalization tests were given over the next three trial blocks (No.s 31-33) involving novel stimulus sets in each, with feedback, where his performance reached the criterion level.

Then followed a series of generalization tests with NO feedback to confirm the control by the conditional instructions. The first three of

these used the same arrangement as the previous trial block, with an A4 sheet of card used reduce cueing by shielding the experimenter's face (trial blocks 34-36). He passed all of these tests with either no errors or only one error per trial block. In trial block 34 there were two instances where he repeated the "when its the ..., touch the ..." instruction after he had made his choice, in the first, the banana- horse instruction was the correct way round, but in the second the tree-book instruction was reversed. This involved repetition of the instruction several times. In trial block 35 there were six instances of repetition of the instruction after the choice was made, these consisted of the snail-glasses, peg-window, and chicken-bike instructions, all of which were correct. In trial block 37 there were two instances of repetition of the instruction after making his choice, these were mushroom-teapot, and knife-fire instructions, which were both correct.
The final two generalization tests involved the additional control for experimenter cueing involving the curtain covered hatchway outlined earlier. He passed both of these on the first exposure to each.

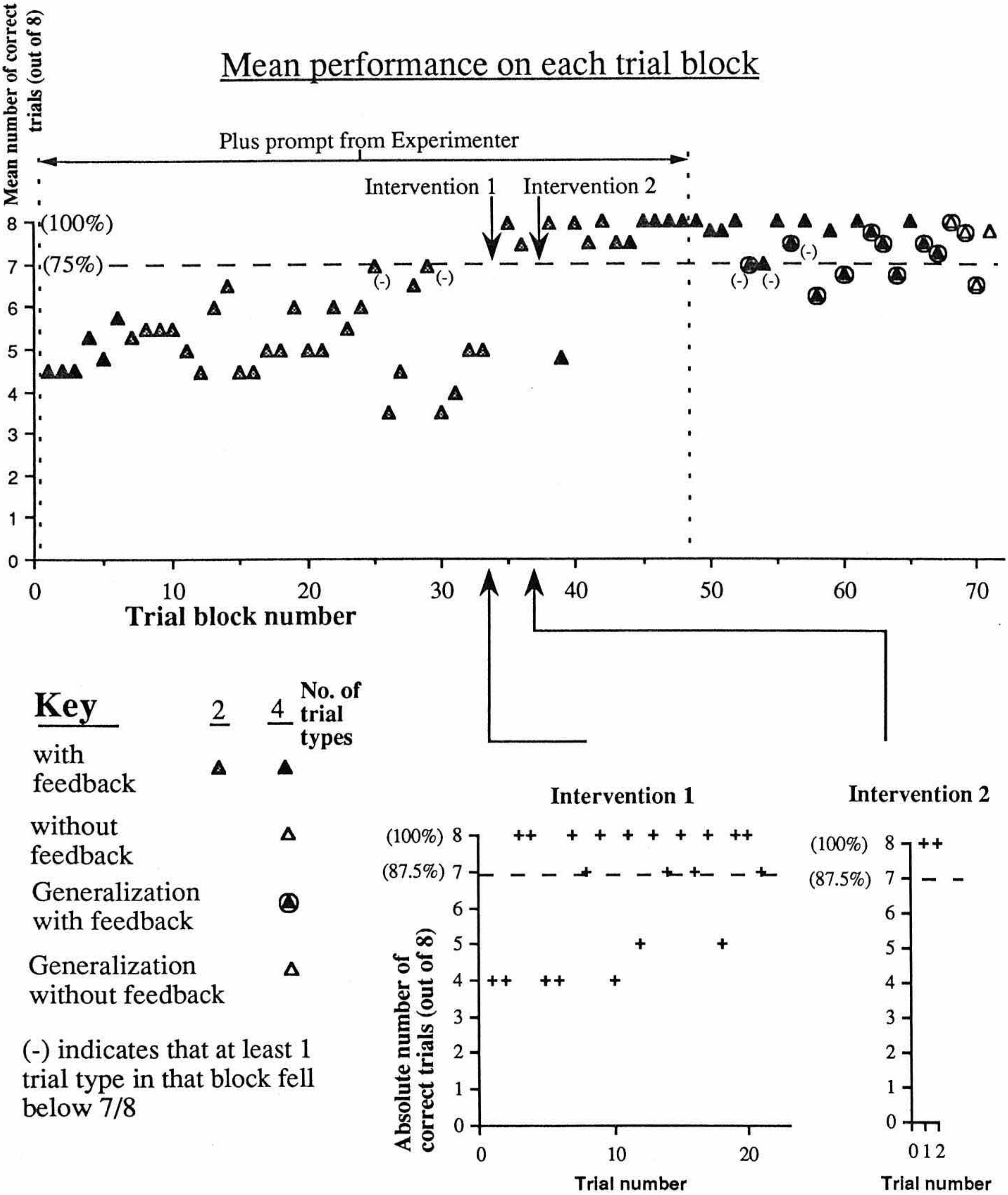
Steven

Figure 9.6 shows Steven's mean level of performance throughout the study. He was not part of the multiple baseline design involving the other three subjects in this experiment. As discussed earlier, Steven was much younger than they (2 years and 7 months at the start) and was involved merely to see if this level of complexity in behaviour could be established on one so young. Thus there was no initial baseline phase without the verbal prompt from the experimenter. This was not a problem since the prolonged period of stability in the early trial blocks

Figure 9.6 : Data for Steven. The top graph shows the mean number of correct trials (out of 8) plotted against the trial block number, for each trial block. The figures beneath this show the interventions; the absolute number of correct trials (out of 8) are plotted against the trial block number, for each trial block.

Figure 9.6

Steven



provided a within subject control for any preexisting ability to do the task, allowing comparison with later stages involving successive simplifications and interventions.

The first series of trial blocks involved four stimulus pairs and their "when its the ..., touch the ..." instructions, the verbal prompt from the experimenter which has been outlined earlier, plus feedback (trial blocks 1-8). He began near the chance level, and then showed a slight improvement to around 5.5/8 at the end of these. In trial block 4 a number of his instructions were followed by getting him to insert the sample name in the first gap in the sentence frame. Also he was not allowed to randomly insert the names of the pictures in the instruction when no pictures were present, in order to help prevent the establishment of any spurious intraverbal linkages which might interfere with his acquisition of the correct versions. In trial block 6 his finger would often land on a comparison before he finished emitting his instruction, which he would then modify to fit. In trial block 7 he emitted the conditional mand six times, unprompted during the initial trials, and emitted one instruction in reverse order. On several occasions he inserted the previously uttered comparison into the place of the sample in the current conditional mand and then inserted the sample that went with it as the present comparison. In this trial block he also showed a tendency for his finger to land on a comparison first, after which he would modify the instruction to fit.

Then the task was simplified to 2 stimulus-pairs over the next series of 25 trial blocks (No.s 9-33). The material reinforcement was increased to 1 in 4 correct responses in trial block 22, and 1 in 2 correct responses in trial block 28, with the removal of a prize for every incorrect response. In trial block 12 premature pointing before finishing his self instruction was stopped by pushing his hand back from the picture, and then making him repeat it until a small pause was present between his instruction and his choice. The result was that a small cue, such as a tap on the table, was required to make him actually touch the picture; this was faded out during the trial block. In trial blocks 15, 16, and 17 he was told to "say it properly" if the timing of his choice and instruction returned to the earlier pattern. He remained below criterion for many of the trial blocks, though reached 7/8 whilst dropping one trial type below criterion on two occasions in the latter stage. This latter section was characterized by greater variability in responding, with drops down to a little below chance between the high scores. This mixture of improvement together with chance levels of responding was the reason that the arrangement was continued over so many trial blocks.

After 4 more trial blocks around the chance level he was given a further simplification of the task involving 2 conditional stimulus pairs, only ONE of which was used with the instruction. During these trial blocks the material reinforcement rate varied between 1 in 2 and 1 in 4 correct responses. Since only 8 trials are involved per trial block, his behaviour is shown in the figure called Intervention 1 that is drawn beneath the main graph of Figure 9.6. All of the individual trial blocks for this intervention are depicted within number 34 in the data for experiment 3 given in the Appendix. The stimulus pair was initially Belt-House in the first 4 trial blocks, then the instruction was switched to the Flag-Cat pair. For these 8 trial blocks the referent stimulus pair was continued until he reached criterion twice in a row, when the other stimulus pair was introduced. Then in the remaining 15 trial blocks, each referent stimulus pair was continued in the instructions until one block at criterion was obtained, when the other referent stimulus pair were then used in the instruction. A gradual improvement in his behaviour was shown as the number of errors made when switching the instructions fell until he was remaining at or above 7/8 despite successive alternation across trial blocks between the two referent stimulus pairs in the instructions.

He was then reintroduced to the arrangement with 2 stimulus pairs and their instructions mixed in each trial block, with a verbal prompt and feedback. Due to a lack of any errors the material reinforcement frequency set to around 1 in 4 correct responses and continued at this level until trial block 44. Two trial blocks were given with the Belt-House and Flag-Cat pairs, which he passed (No.s 35 & 36). Then the remaining 2 stimulus pairs were reintroduced, but with the simplified arrangement of intervention 1, i.e. only ONE of the stimulus pairs was the referent of the instruction in any trial block. He was given 1 trial block with King-Bucket as the referent-stimulus pair, and then 1 trial block with Foot-Moon as the referent-stimulus pair; he passed both of these trial blocks without error. They are drawn as Intervention 2 beneath the main graph in Figure 9.6 and are given numerically in number 37 in the section of the Appendix for Experiment 3.

Following Intervention 2, he was given a trial block with both of the instructions mixed was given (No. 38) which he passed without error. Then followed a retest of all four stimulus pairs, with their instruction counterparts mixed in a single trial block (No. 39), however his performance on this fell back towards the chance level. So He was returned to the two stimulus pair and two instruction version of the task and alternated across the two stimulus pairs in successive trial blocks. This continued for 4 trial blocks all of which were above the criterion level for responding (No.s 40-43). In trial block 41 he corrected two of his own self instructions before making his choice. Then the four instruction and stimulus-pair version of the task was reintroduced for the next 5 trial blocks (No.s 44-48), which he passed straight away - the last four trial blocks resulting in no errors at all. The first of these trial blocks (number 44) involved a special introduction in which he was given 4 presentations of the first stimulus pair in a row with feedback, then 4 presentations of the second pair in a row with feedback. This was designed to evoke the accurate behaviour shown in the alternation across the stimulus pairs of trial blocks 40-43, prior to immediately leading him into the mixture of all four stimulus pairs in the same trial block. In addition the material reinforcement rate was set to around 1 in 2 correct responses initially, and then raised to 1 in 4 correct responses as the session progressed.

After this the arrangement was repeated without the prompt from the experimenter over the next 4 trial blocks (No.s 49-52), and on these he reached the criterion level. In trial blocks 45 and 46 the material reinforcement rate was set to around 1 in 8 and 1 in 16 correct responses, respectively. Then from trial block 67 onwards the material rate of reinforcement was returned to that in the original procedure. He was then given a series of generalization tests with feedback (trial blocks 53 to 67). These showed a gradual reduction in the number of errors made and a reduction in the number of trial blocks required for him to reach criterion, until he passed the latter generalization tests upon the first encounter with each. This trend is shown in trial blocks 53 - 67 in the main graph of Figure 9.6, and in numerical form in the section for Experiment 3 in the Appendix. In trial block 53 on two trials he emitted "when its the chair, touch a mmm..." and then followed this with "mouse". Then In trial block 65 he occasionally called the hammer a "spanner".

There followed a generalization test without feedback that continued the use of the A4 card to shield the experimenter's face, described earlier (Chapter 7). He passed this test without making any errors (Trial block 68). Due to this high level of performance and the limited availability of familiar stimuli for use in the study, he was immediately moved onto the final stage of the experiment. The last two generalization tests involved the further control for experimenter cueing that used the curtain covered hatchway. He passed the first of these tests on his first exposure to it, but required one repetition of the second test, without feedback, for his performance to reach the criterion level.

Discussion

Upon examination of the results one can make a number of comparisons across the subjects. Owen and Claire both showed a similar improvement following the introduction of the verbal prompt from the experimenter, with performance on the original stimulus set then reaching criterion. Following the introduction of the generalization tests, Claire showed a gradual reduction in the number of errors produced upon a first encounter with a novel stimulus set, until she eventually remained above criterion for almost all but one of the last eight generalization tests. Owen, however, began the generalization tests more accurately, but showed little reduction in the number of generalization tests falling below criterion upon his first encounter with them - a failure rate of around 1 in 3. However, the fact that he passed the last two generalization tests without error, completely out of sight of the experimenter suggests that an increase in their strength and stimulus control had occurred towards the end of this series of tests. Owen showed some evidence of learning by exclusion, when examining the pattern of errors in the first exposure to the verbal prompt by the experimenter. This meant that if only some of the instructions had been effective, the remaining relations could still be worked out without making errors, providing the former occurred first in the order of the trials in that block.

Niall and Steven both failed to show an improvement when the trial blocks which involved the additional verbal prompt from the experimenter were given. Niall was continued for 3 more trial blocks, and Steven for 4 more trial blocks, on the 4 stimulus pair version of the task, in order to see if any delayed improvement might occur. However, only marginal increases in the accuracy of their performance occurred. This demonstrated quite conclusively that the subjects were unable to follow an instruction of this form, in the experimental context, in the early stages of the experiment.

These two subjects differed in how they acquired an accurate level of responding. After Niall had been on the two stimulus pair simplification of the task for a number of sessions, he spontaneously emitted two relational autoclitic sentences that connected the stimuli in each pair, in trial block 17. These involved the autoclitics "go with" and "goes with" in "Does the cat go with the flag?" sentence, which received a neutral reply from the experimenter, and in "And the belt goes with the

House". These were correlated with a sudden rise to criterion, after which he never again fell below criterion. It is interesting to note however, that these relational autoclitics were only emitted twice more in trial block 24, in the "Does the King go with the bucket?" sentence, which received a neutral reply from the experimenter, and in "the foot might go with the moon". This makes a total of only 4 emissions of this autoclitic, involving references to aspects of the experiment, yet this qualitative shift to accurate listener behaviour occurred. One possible explanation of this may be that control by the "go with" and "goes with" autoclitics was transferred to the "when...then..." autoclitic frame used in the instructions. Confirmation of the appropriateness of this transfer of stimulus function to the experimental autoclitics would then have been provided by the feedback that followed the subsequent correct responses.

With Steven an initial problem was to build up the correct temporal sequence between his self-instruction, that followed the prompt, and his choice of a comparison. For in the early stages he often would say the section of the instruction containing the sample e.g. "when it's the flag", touch a comparison, and then insert the name of the stimulus he had touched into the remaining section of the sentence containing the name of a comparison e.g "touch the bucket";which resulted in a level of performance near the chance level. The manipulations described in the method and result sections were designed to strengthen the control by the initial sample part over the later comparison part of the sentence, and to eliminate control by spurious factors over the choice of the comparison name - such as the stimulus currently focussed on by the child or one containing a favourite color of theirs.

In addition to this the main manipulations that were correlated with the rise to a criterion level of responding were the simplifications of Interventions 1 and 2. These involved use of two stimulus pairs, only one of which was actually used in the instruction, in a particular trial block. This meant that only one of the comparison stimuli would be correct throughout the trial block, focussing the child on the instruction, and the feedback of the first few trials of each, which indicated which stimulus a child should stick with. It had the effect of reducing any tendency for the child to just keep choosing a comparison at random. By swapping which of the stimulus pairs was used in the instruction, each time the child reached criterion on a trial block, this served to further focus the child on the instruction and the feedback given in the early trials of a block. The result was a gradual improvement in responding over 23 such trial blocks till few errors were made in the latter of these.

Be carefully incrementing the complexity of the task, Steven was gradually returned to the 4 stimulus pair version of the task and onto the various generalization tests. In his case it was the way in which the task components were broken down and then successively reintroduced which appears to be responsible for his improvement to the criterion level of responding, and the subsequent gains which then followed. He did not emit any of the relational autoclitics that were correlated with Niall's improvement in responding. Steven and Niall sometimes spontaneously emitted a series of repetitions of the instructions, which may have had a self strengthening effect upon them, increasing their effectiveness.

There was no indication of any relationship between the subjects' performance on the Reynell Developmental Language Scale test and their performance on the task.

The multiple baseline component of the design across the three older subjects was partially successful in controlling for the effect of any extraneous factors. However since Niall's improvement occurred following the spontaneous emission of the "go with" and "goes with" relational autoclitics sometime after the baseline period had finished and following a number of simplified trials, the role of any extra experimental factors in this becomes difficult to ascertain.

Two of the children had previously taken part in Experiment 1, whilst two had no previous experience in psychology experiments. There appeared to be no consistent consequence of this since of the two subjects who rapidly completed the task, one was from Experiment 1, whilst the other had no such experience. Similarly, those which required considerable extra intervention consisted of one subject from experiment 1, and one who had no previous experience. Thus any influence from this variable can be safely ruled out.

The fact that a verbal prompt from the experimenter and self-instructions by the subjects were required before they could acquire the task suggests that a mere shaping of listener skills with autoclitic frames of this complexity is not sufficient. Rather the listener must behave as their own speaker for a period, taking an active part in the chain of events between the antecedent (the experimenter's instruction), behaviour (the self-instruction followed by the pointing response), and the consequences (both the immediate verbal feedback, and the eventual material prize).

This suggests a closer correspondence between the direct shaping components of Skinner's analysis in Verbal Behaviour (1957), and the social-developmental account of language development proposed by

Vygotsky and later developed by Luria and colleagues. For even a gradual acquisition of the response classes and stimulus control investigated in this experiment, seems to require an interaction between speaker and listener skills. Steven's gradual reduction in the number of errors made, and reduction in the number of trial blocks required for him to reach criterion suggests that contingency shaped components were present during the increasing effectiveness of these rules in establishing the subjects' behaviour. The gradual reduction in the errors made in the generalization tests in Claire and Steven's performance, and the fact that Owen's rate of failure remained constant, in spite of an associated increase in task complexity during these, also lends support for the notion that direct strengthening of effectiveness of the instructions had occurred.

Once subjects were responding to the more complex components of the task whilst remaining at criterion, the requirement that they instruct themselves before making each choice was relaxed. The proportion of self-instructions still remained high. However there did occur correct trials where the subjects said nothing. This suggests that the control by the sample had become stronger and no longer required the support of the verbally expressed relation in the self instruction. It lends support to the suggestion arising from the model that the listener's behaviour comes under the control of the autoclitic frame, which modifies the function of the stimuli named in such a sentence, without the necessity for its repetition prior to emitting a response. However, the fact that listeners frequently do rehearse an instruction before making a response, suggests that both sequences may be common, what is clear is that its emission as an overt self-instruction is not a necessity. Clearly the relative proportion of directly effective instructions versus those where the listener mediates their response with a prior self-instrucion, in everyday learning, is a matter for further investigation.

Chapter 10: Experiment 4: A study of the action of networks of conditional mands upon preschool aged children.

Introduction

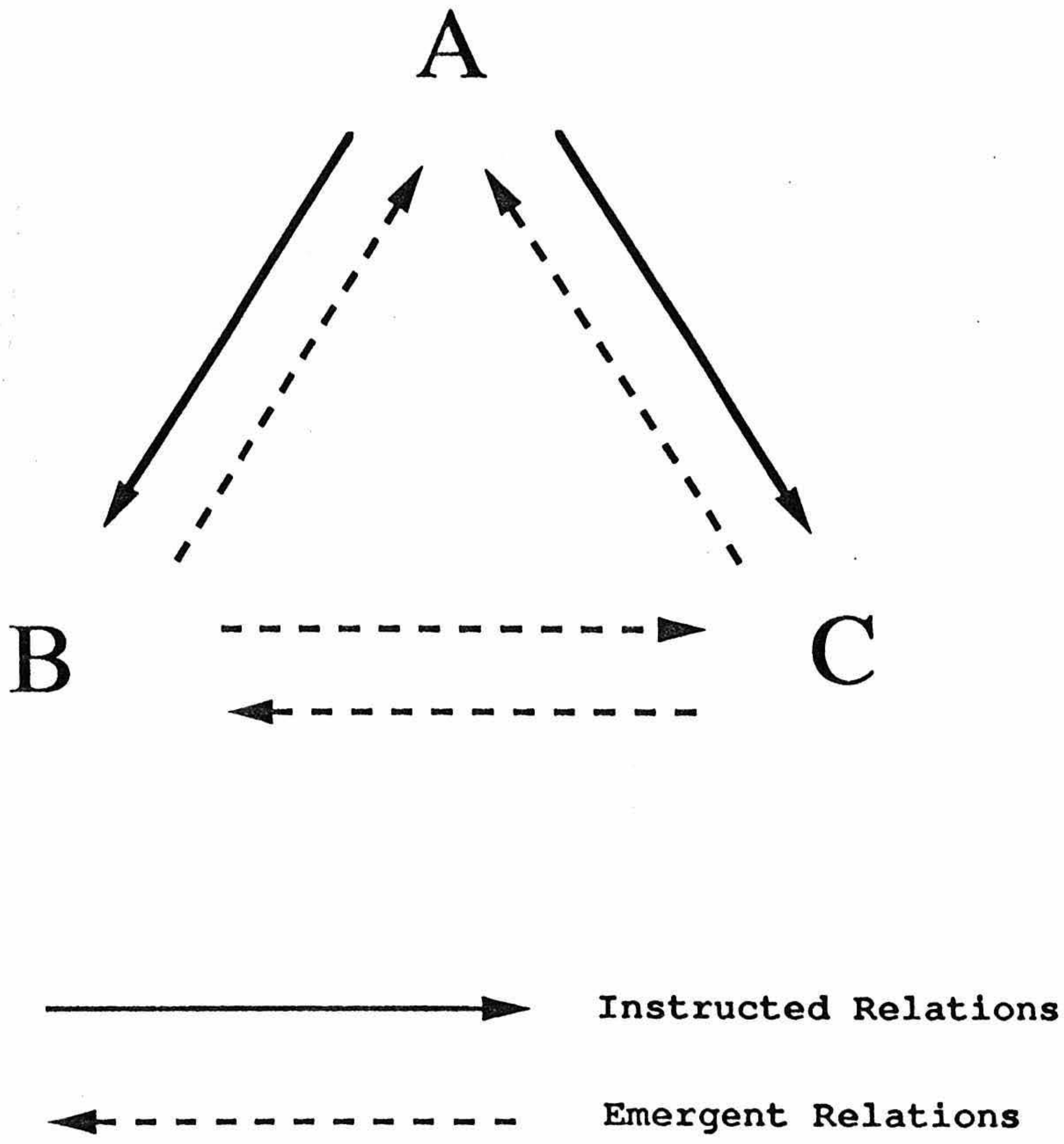
One important property of response classes such as equivalence and relational autoclitics is that they allow the rapid building of a network of untrained conditional relations, given only a few trained ones. These are typically investigated by training the key conditional relations through reinforcement on conditional discrimination tasks. This is reduced in frequency to allow test trials to be inserted under conditions of extinction, thereby showing the emergence of the remaining conditional discriminations without training.

Verbal behaviour is more efficient than this in establishing the prerequisite conditional relations in that a period of training on a current set of stimuli is not needed. All that is required is a prior history of responding to relational autoclitics of that form, after which insertion of the names for the new stimuli will establish the required conditional relations. The study was designed to investigate some of these properties by making use of the listener behaviour that had been established in Experiment 3 to establish a network of conditional relations. A unique feature is that no feedback was provided during any of the experimental trials. The network of instructed and emergent relations can be illustrated like this

[See figure 10.1]

Figure 10.1 : The network of instructed and emergent conditional relations in experiment 4.

Figure 10.1



The "when its the ..., touch the ...," relation is a unidirectional relation in that the names inserted into it cannot be reversed in position whilst retaining the same effect. Thus when examining for the emergence of conditional relations in the reverse direction we are looking at the more general case of bidirectionality rather that the more specific case of symmetry. Since two conditional relations can be used to link together 3 stimuli as in Figure 10.1 the procedure can be used to test for transistivity (establish A->B and B->C, then test for A->C and C->A), and for a combined test of symmetry and transitivity known as an equivalence test (Sidman & Tailby, 1982), though one would not expect these latter two emergent conditional discriminations to be present on purely logical grounds.

Design

This study was exploratory in nature in that the explicit training and subsequent use of the listener's responses to relational autoclitics, for the investigation of equivalence and other relational classes, has not been documented before. Since the subjects were already capable of responding correctly as listeners to conditional mands it was not possible to introduce a baseline phase to the study. The manipulations were introduced to investigate the properties of listeners' responses to networks of conditional mands, i.e. to describe the similarities and differences between the traditional use of training on conditional discriminations to establish networks of relations, and the use of instruction with conditional mands to establish such networks of relations. Once these properties have been outlined in this study, the information provided on these issues should then simplify the planning of future studies where baseline elements can be used to investigate the control by experimental factors to a greater degree of certainty.

The present study was designed to allow investigation of the structuring of relational response classes through their pairing with conditional mands. The conditional mands were the "when it's the ..., touch the ..." instructions used in experiment 3, and were given for each pair of picture stimuli e.g. for the mushroom-teapot pair it was "when its the mushroom, touch the teapot". The study was carried out under conditions of extinction, that is, no feedback given. No verbal prompts were provided since the subjects were by now well acquainted with responding as listeners to the conditional mand instructions.

Two phases were involved. The first of these involved exposure to a conditional mand and then a test for its reversal, e.g. instruct with the cherry-hammer pair, and then test for the hammer-cherry relationship. This was repeated for a number of sets of stimuli to illustrate the robustness of the phenomenon. This first phase of the study tested for bidirectionality alone since this involved the subject having to learn fewer instructed relations at the start of a set of trial blocks, before going on to the main phase of the task, i.e. only the A-B relations needed to be instructed .

The second phase of the study was the combined test for transitivity and bidirectionality, usually termed 'combined test for *symmetry* and transitivity', otherwise known as the equivalence test. This involved teaching two sets of conditional relations, namely the A-B and the A-C relations. In each case the instructed relations were tested alone to ascertain that the subject was responding at the criterion level of responding before they were interspersed with the test trials for the emergent conditional relations. This phase was carried out, where possible, with the experimenter out of sight for the duration of the session - to provide a further degree of control for experimenter cueing.

A performance at criterion for the first phase would proved strong evidence for the presence of emergent bidirectional relations in the subjects, given exposure to conditional mands in only one direction. Similar accuracy in phase two would suggest that the subjects were able to make the transitive inferences necessary for passing the equivalence test, given prior instruction with conditional mands that paired the network of stimuli in certain restricted directions. Results of this nature would illustrate the qualitative improvement in the rapidity with which the prerequisite conditional relations can be established using instructions, rather than training on conditional discriminations. In addition the lack of any required contingent feedback during the task would illustrate a further useful property of verbal behaviour, that of not requiring task specific reinforcement as a prerequisite.

Method

Subjects

Four children aged 3 years, 2 months to 4 years, 1 month old at the start of the experiment. All came from English speaking backgrounds, and had little exposure to Welsh. The subjects came from a range of socioeconomic backgrounds, and they had no known intellectual difficulties, hearing or visual disabilities. They were recruited through personal contacts with the experimenter and via acquaintances of the mothers already involved in the studies. The children came from the village of Rhiwlas and the city of Bangor, N. Wales. The experiments were either carried out in the subjects' own homes or in the experimenter's home. All of the children had participated in Experiment 3, for an attainment of the required behaviour in that study was a prerequisite for participation in this one. In addition two on the children (Owen and Niall) had taken part in Experiment 1, but none prior to this.

Apparatus

The room in the experimenter's house was the one described in Experiment 1. Those in the subjects' houses varied in dimensions, were arranged so that external distractions were minimized. Thus no other children were present, the television set was switched off, etc. The subjects sat opposite the experimenter (about 70cm apart), with the mother sat near by, either beside them or behind them, in the early stages of the experiment. Later on, the mothers were frequently in another room for the duration of a session. The experimental stimuli were a series of colored pictures of familiar objects 7cm X 7cm, placed upwards on a table facing the subject. The stimulus pairs had been used with the subjects in Experiment 3, so care was taken that only those which had previously been presented without feedback were used. The order of the stimuli was randomized on an IBM AT compatible computer which produced A4 printed data record sheets that were used in the course of an experimental session. A video camera recorded the sessions where a change in the intervention, or in a subject's behaviour occured. This provided information on the subject's spontaneous verbal behaviour and their interaction with the experimenter. The position of the choice (comparison) stimuli was randomised with a Hewlett Packard HP28S programmable calculator. The material reinforcers consisted of toys and books valued between £0.50 - £3.50, and colorful stickers.

Procedure

Pretest

Since all subjects had taken part in experiment 3 the initial pretest given in studies 1 to 3 had already been administered in that study and thus was not given in this one.

Reynell Developmental Language Scale Assessment

In experiment 2 it was found that presenting the Reynell Developmental Language Scale (Reynell, 1977) after the experiment reduced the inhibition of the subjects on the Expressive Language component of the test (Chapter 8). So it was decided to follow this procedure at the end of the current experiment.

Main Experiment

The main experiment followed the general outline given in the design section. The sessions began with the experimenter saying an instruction followed by the child touching the appropriate comparison. The experimenter would then say "now it's your turn" and the child would repeat the sequence, but saying the instruction themselves. This sequence was repeated for each of the stimulus pairs in a trial block. The repetition once by the subject of each instruction acted to ensure that they had heard them accurately. In Experiment 3 initially a trial would begin by the experimenter saying "touch one", after which the subject would then make their choice. Later this was faded into just a tap on the table by the experimenter, occasionally the additional verbal command was required. Thus by the time Experiment 4 began,the subject's response in most trials was simply instigated by the tap on the table. Since no feedback was presented after the experimental trials began, the only reinforcement was the presentation of the prizes at the end of a session. In order to orient a distractable child to the task, verbal descriptions of the prizes available and how soon they would be received were given at the beginning of a session, and as often as was needed during the session. Stimulus sets were chosen from those in experiment 3 where no feedback was given after each of the subjects' responses. The initial trial blocks used the A4 card of previous studies to eliminate cueing from the experimenter's eyes and face. Then where possible the later trial blocks involved the strong control for experimenter cueing in the form of the subject and experimenter being separated by a curtain through which the stimulus sets were passed. This typically involved the last of the bidirectionality tests and the 'equivalence' test. The exact details are given in the Appendix. and described, where appropriate, in the results section.

<u>Bidirectionality test phase</u>

This consisted of one trial block which was a repetition of that given in experiment 3 to ensure the presence of the forward relations. Four trial types were involved in this A-B stage, with 8 trials each this gave a total of 32 trials. The second stage consisted of the continued presentation of the A-B trial types interspersed with the B-A reversals. The ratio of A-B to B-A trials was the standard 2:1 ratio used in matching-to-sample tests of equivalence; this gave 96 trials per trial block This was repeated for three different sets of trial blocks to ensure a high level of responding before moving onto the 'equivalence' phase of the study, also proving a test of the robustness of the phenomenon, except for the younger subject, Steven, where a limited availability of previous stimuli not presented with feedback meant that only two sets of stimuli were used - from the results this was still an adequate number of stimulus sets. If a trial block fell below criterion then it was repeated again without feedback since, as was pointed out and observed in experiment 3, it has been found in 'no feedback' conditions that a number of trials may be needed before a subject's level of responding rises to criterion.

'Equivalence' test phase

In this phase a further initial trial block was required to establish the A-C relations (the A-B relations having already been established in one of the preceeding bidirectionality tests). Again it consisted of 32 trials. Then followed a trial block in which the trials with each type of relation were intermixed in a pseudorandom fashion giving a total of 64 trials in this block. This tested to see if responding to both of the instructed relations was at criterion. Finally the B-C trials where interspersed in a further trial block in which the A-B, A-C, and B-C trials were in equal proportion producing a ratio of 2:1 for instructed to emergent conditional relations, as in the Bidirectionality phase and in many studies of equivalence; 96 Trials were used to investigate the trial block. Then followed an identical arrangement, but with the use of C-B test trials to investigate the emergence of the reverse conditional discrimination. These latter two stages provided the test for 'equivalence'. Again if a trial block fell below criterion then it was repeated up to twice more without feedback. A subject who failed to reach criterion on the test trials by this time was deemed to have failed on this component of the test.

Interventions and simplifications of the Task

No interventions other than the successive repetition without feedback of failed trial blocks were used. Some subjects became agitated and distractable towards the end of this phase and refused to cooperate behind the screen. These subjects were returned to the previous control for experimenter cueing with the use of the A4 card to shield the experimenter's eyes and face. Unlike the previous studies, the general procedure was applicable in the same form to all four of the subjects, thus individual adaptations and variations were not required.

Results

Arithmetic mean values for each trial type were calculated for all the trial blocks. These are plotted graphically in Figures 10.2 to 10.5c and are presented in numerical form in the Appendix which gives the most detailed description of the experimental manipulations and the raw data. Where one of the original values fell beneath 7/8 this is indicated with and accompanying (-) symbol.

Tables of data are provided for the following information:

10.1) Initial picture vocabulary pretest results (reproduced from the initial measure in the earlier studies), subject ages, study duration, and total number of trials, during the study.

10.2) Parental estimate of English versus Welsh Language background.

10.3) Reynell Developmental Language Scale Data.

Claire

Claire's mean level of performance for each trial block is shown in Figure 10.2. The first phase was the bidirectionality test phase. The initial trial block, in which A-B instruction for the first set of stimuli took place, resulted in no errors (trial block 1). The interspersal of B-A test

EXPERIMENT 4

Table 10.1

Initial Picture Vocabulary Pretest results, subject ages, study duration, and total number of trials, during the study

SUBJECT	INITIAL PICTURE VOCABULARY TEST: Number of Picture Words Correct.	AGES DURING STUDY: Start (years, months)	Finish (years, months)	STUDY DURATION (months)	TOTAL NUMBER OF TRIALS
Owen	30*1	4, 01	4, 02	1	768
Niel	30*1	3, 11	4, 02	3	768
Claire	30*2	3, 07	3, 09	2	1024
Steven	30*2	3, 02	3, 03	1	768

*1 These subjects took this test in experiment 1.
*2 These subjects took this test in experiment 3.
Their data are reproduced here for comparison.

Table 10.2

Parental estimate of English versus Welsh Language background. *3

SUBJECT	ENGLISH & WELSH LANGUAGE BACKROUND
Owen	English only.
Niel	English only.
Claire	English only.
Steven	English only.

*3 This table is reproduced from Experiment 3.

Table 10.3

Reynell Developmental Language Scale Data.

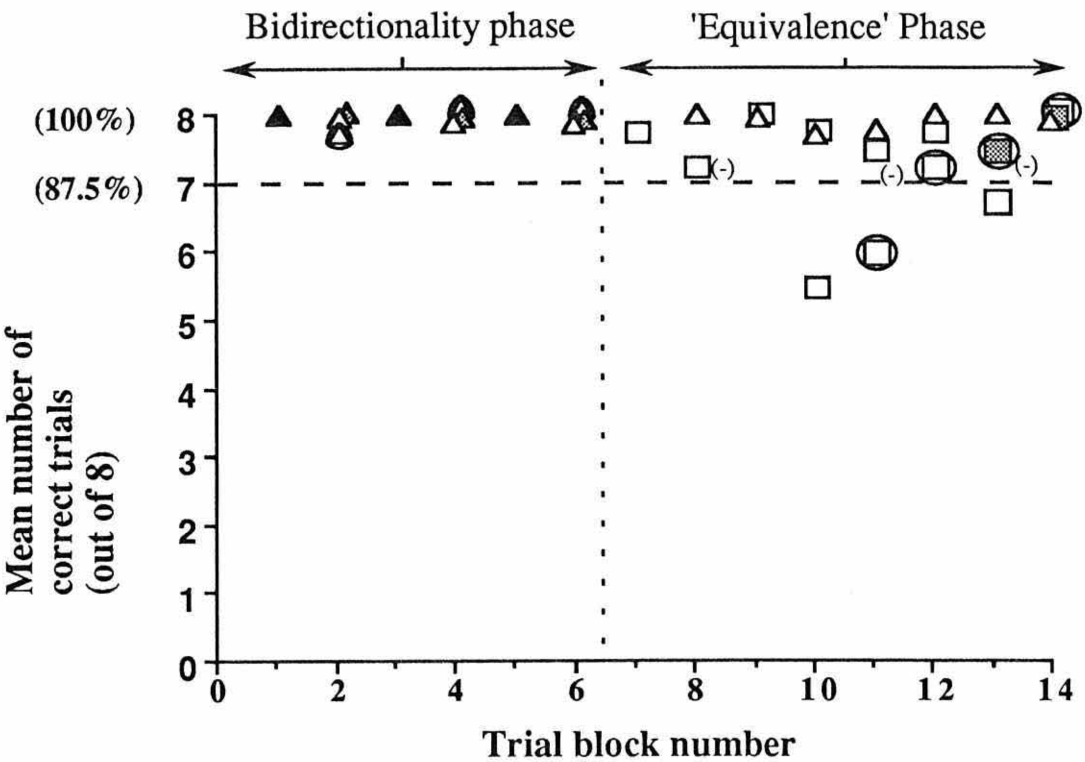
SUBJECT	ACTUAL AGE (years, months)	RAW SCORE	EQUIVALENT AGE (years, months)	STANDARD SCORE
Owen				
Expressive Language total	4,02	42	3,04	-0.9
Verbal Comprehension A	4,02	62	5,09 - 5,11	1.4
Niel				
Expressive Language total	4,02	32	2,07	-2.9
Verbal Comprehension A	4,02	62	5,09 - 5,11	1.2
Claire				
Expressive Language total	3,09	38	3	-1.1
Verbal Comprehension A	3,09	54	4,04	0.7
Steven				
Expressive Language total	3,03	38	3	-0.4
Verbal Comprehension A	3,03	54	4,04	1.3

Figure 10.2 : Data for Claire. The graph shows the mean number of correct trials (out of 8) plotted against the trial block number, for each trial block. On the left are the results of the bidirectionality test, and on the right are the results of the 'equivalence test'.

Figure 10.2

Claire

Mean performance on each trial block



Key

4 — No. of trial types

A change of A→B stimuli, instructed.

A→B stimuli, instructed

Additional A→B stimuli, instructed.

B→A stimuli, tested

A→C stimuli, instructed

B→C stimuli, tested

C→B stimuli, tested

(-) indicates that at least 1 trial type in that block fell below 7/8

trials with A-B trials produced no errors in her performance for the instructed A-B trials and only one error in the B-A test trials (Trial block 2), showing the presence of the bidirectional responding at a high strength. This pattern was reproduced across the instruction and test trial blocks for the other two stimulus sets tested for bidirectionality (trial blocks 3&4, and 5&6), where no errors were made at all. Histograms of the mean performance for the final trial block of each stimulus set are shown in Figure 10.2b. Each histogram bar indicates an equal number of trials used to obtain the mean, therefore two A-B bars are present on each graph (labeled A B 1 and A B 2) with one B-A bar, which is due to the 2:1 ratio in which these were present in the trial block. These graphs clearly illustrate her passing at above the criterion level for both the A-B test trials and the B-A test trials for each of the stimulus sets.

The 'Equivalence' test then followed. The A-B instructed trial types were already at criterion from the previous phase, so there followed the A-C instruction trial block (Trial block 7) which she reached criterion with only one error. Trial block 8 consisted of the mixture of A-B and A-C trials within the same trial block. In this her performance on the A-C trials dropped below criterion, possibly reflecting the increased number of stimuli conditionally related to each of the A stimuli. A repetition of the mixture of A-B and A-C in a different randomized order followed in trial block 9, which she passed without error. There followed the interspersal of B-C test trials with these two instructed trial types (trial block 10). In this she reached criterion on the instructed trials types and two of the test trial types, but stayed around the chance level for the two remaining test trial types. A further repetition in trial block 11 showed some improvement, and an additional repetition in

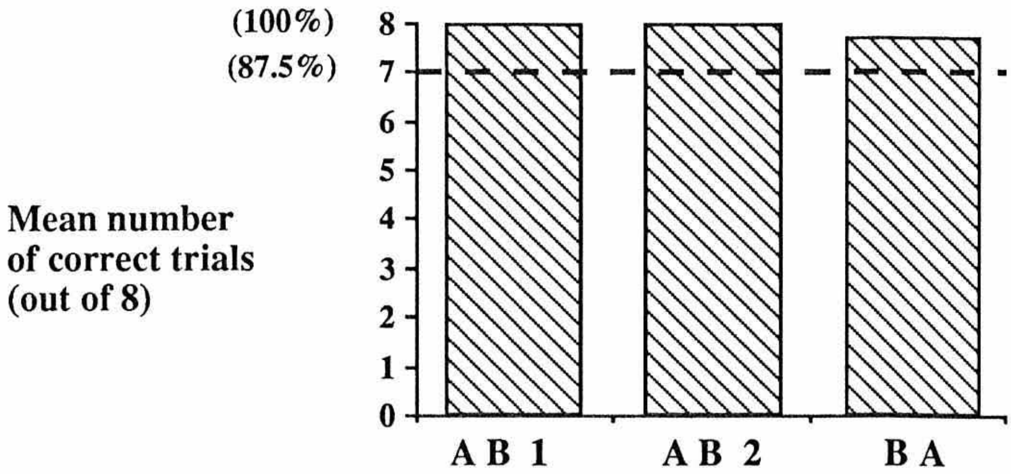
Figure 10.2b : Bidirectionality test data for Claire. The histograms show the mean number of correct trials (out of 8) for the final trial block of each stimulus set.

Figure 10.2 b

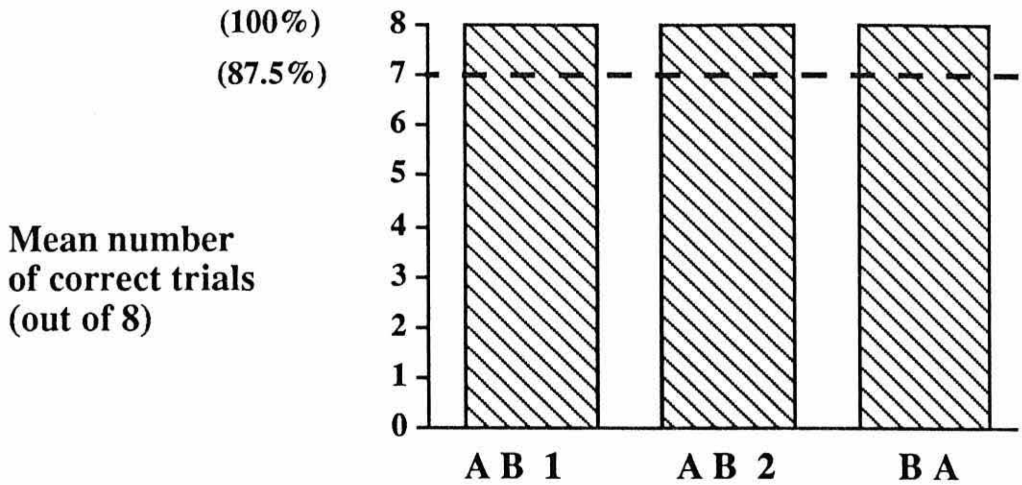
Claire

Bidirectionality tests:
Mean performance on each trial block

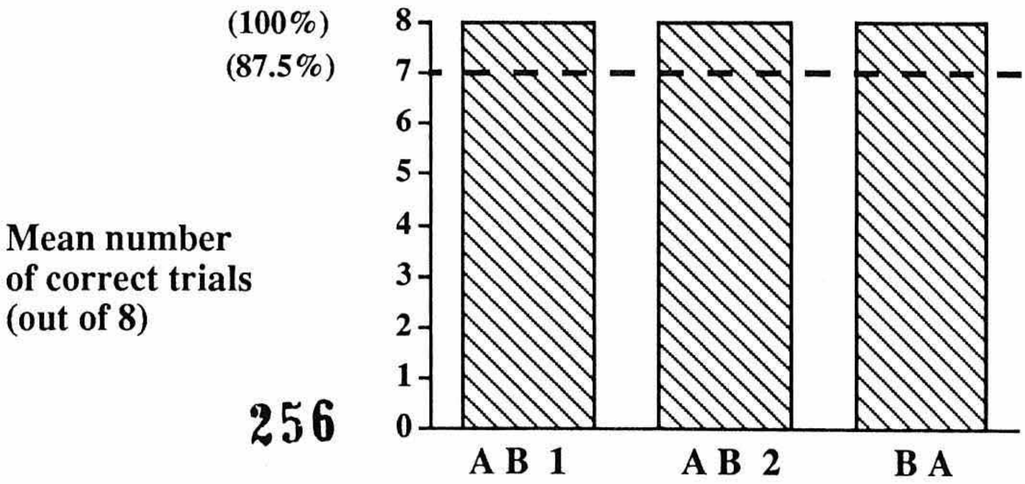
Stimulus set 1



Stimulus set 2



Stimulus set 3



trial block 12 resulted in her reaching criterion in all of the trial types. In the latter there was some confusion with her verbal behaviour on one of the candle-bridge trials, she said "when its the candle touch the ..." and pointed to the bridge and said "I can't remember that". I asked her to guess, with no effect, and then hinted by saying "bri...", she then said the word correctly, emitted the whole sentence and completed the trial correctly. The next trial block involved the same arrangement but with the C-B test trials (trial block 13) to test for the reverse direction of emergent conditional relations. Here she reached criterion on three of the four test trial types the remaining one being at a level of 6/8. However she had dropped below criterion on one of the instructed relations. In addition, she had become uncooperative and very distractable, for some of the previous sessions involved 96 trials and approached 50 minutes in length. This particular trial block was split into two halves as she refused to go on after the first half of the trials. She also would no longer agree to do the task behind the screen, and I had to carry out the rest of the study at her house in order to ger her to complete the final sessions. The latter half of this trial block and the following, therefore, involved the use of the A4 card to shield the experimenter's face and reduce the likelihood cueing. A further repetition of the trial block in trial block 14 resulted in no errors made at all. Her mean performance on the final trial blocks involving the B-C and C-B test trials are plotted as histograms in Figure 10.2c. These graphs show her reaching well above the criterion level. Thus she passed both the B-C and C-B test trials, illustrating the presence of the emergent conditional relations required in the traditional equivalence paradigm.

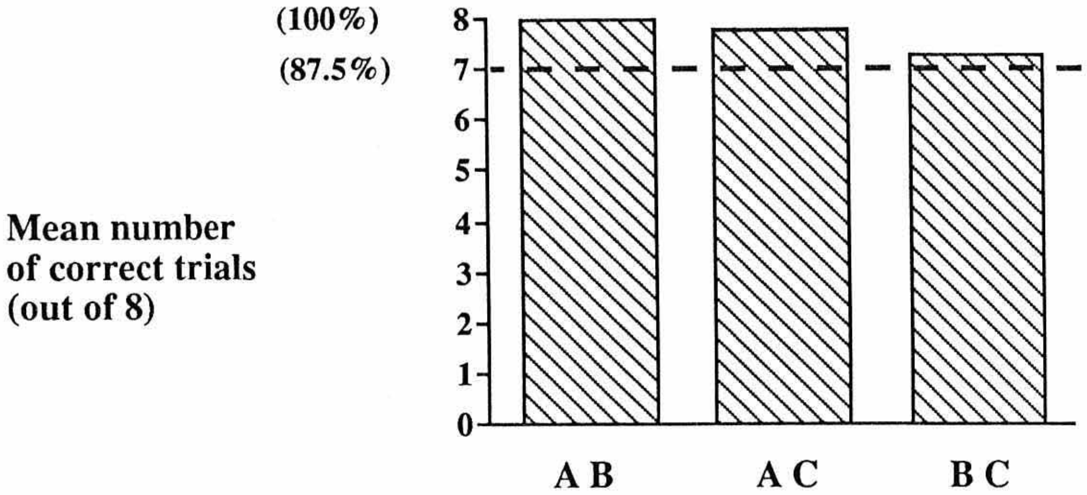
Figure 10.2c : 'Equivalence' test data for Claire. The histograms show the mean number of correct trials (out of 8) for the final trial block of each part of the test. The upper figure is the B C test, and the lower figure is the C B test.

Figure 10.2c

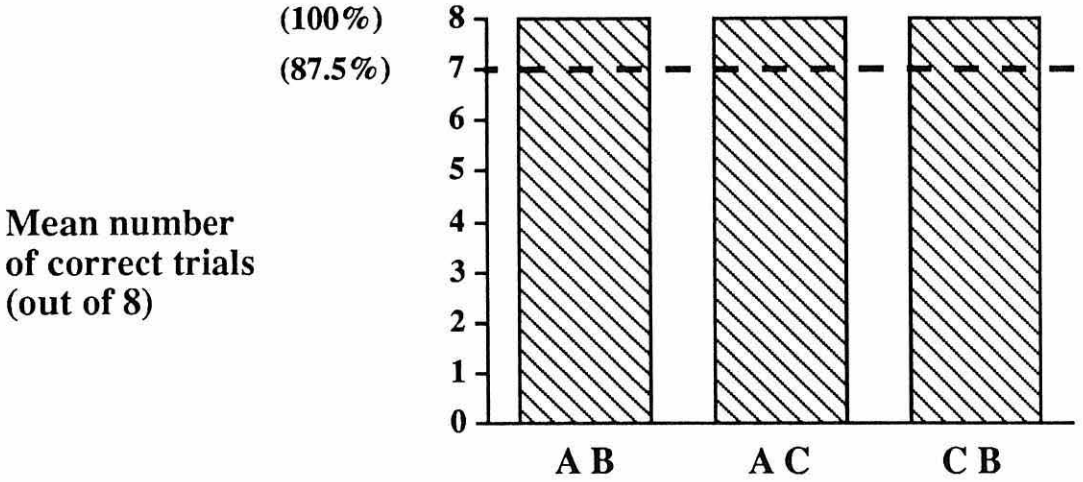
Claire

'Equivalence' test:
Mean performance on the final trial block of each half of the test

Part 1:
B C test
trial block



Part 2:
C B test
trial block



Owen

Figure 10.3 shows Owen's mean level of performance throughout the study. The first phase consisted of the bidirectionality test phase. This began with trial block 1 where A-B instruction of the first set of stimuli occured. As with Claire, this produced no errors. Then followed the mixture of A-B and B-A trial types in a 2:1 ratio (trial block 2) which resulted in no errors. Here, when given his first ever reversal trial he uttered "why are you putting the apple at the bottom?", to which I replied "just have a go". He made no additional errors throughout the next two sets of stimuli in the bidirectionality phase (trial blocks 3&4 and 5&6), thus the emergent response class characterized by the B-A conditional relation was at a very high strength. Histograms of his final mean performance for each stimulus set are plotted in Figure 10.3b which show his passing at above the criterion level.

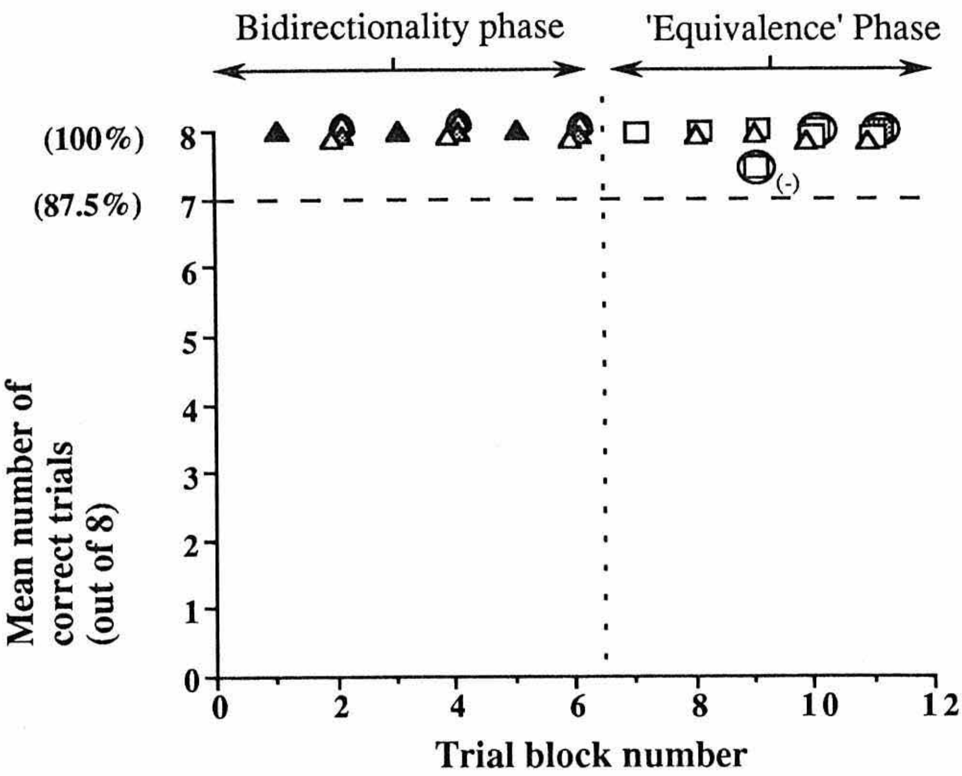
Then followed the 'Equivalence' phase in the study of his behaviour. As the A-B instructed trial types were already at the criterion level from the bidirectionality phase, he was immediately given the A-C instruction trial block (Trial Block 7) which he passed without error. Unlike Claire the mixture of A-B and A-C trial types produced no decline in the level of performance, which was faultless (Trial Block 8). In Trial Block 9 he was given these two instructed trial types interspersed with the B-C test trials. Here his behaviour on the instructed test trials remained at this high level but the newly introduced B-C test trials fell slightly below criterion. A further repetition of this trial block in Trial Block 10 gave an immediate improvement with no errors at all. Trial Block 11 involved the same arrangement but using C-B test trials which tested for the reverse direction of emergent conditional relations. This he

Figure 10.3 : Data for Owen. The graph shows the mean number of correct trials (out of 8) plotted against the trial block number, for each trial block. On the left are the results of the bidirectionality test, and on the right are the results of the 'equivalence test'.

Figure 10.3

Owen

Mean performance on each trial block



Key

4 No. of trial types

A change of A->B stimuli, instructed.

A->B stimuli, instructed

Additional A->B stimuli, instructed.

B->A stimuli, tested

A->C stimuli, instructed

B->C stimuli, tested

C->B stimuli, tested

(-) indicates that at least 1 trial type in that block fell below 7/8

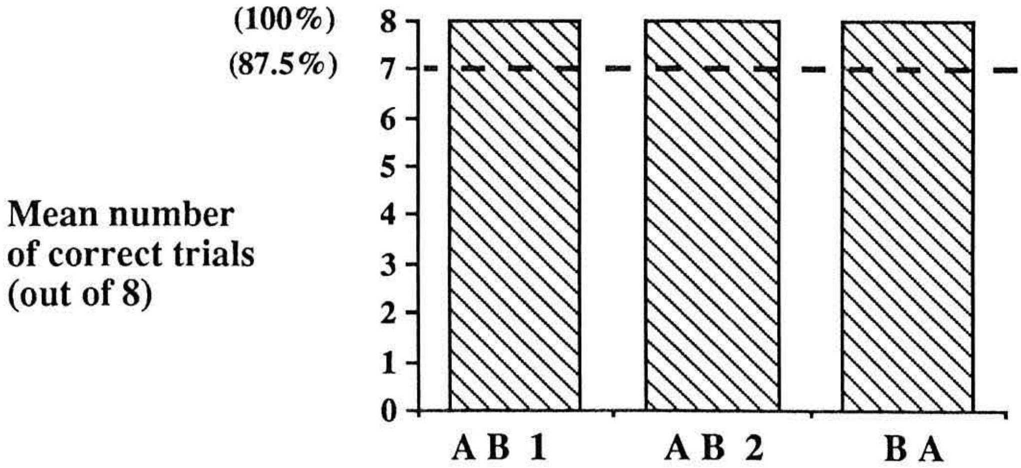
Figure 10.3b : Bidirectionality test data for Owen. The histograms show the mean number of correct trials (out of 8) for the final trial block of each stimulus set.

Figure 10.3b

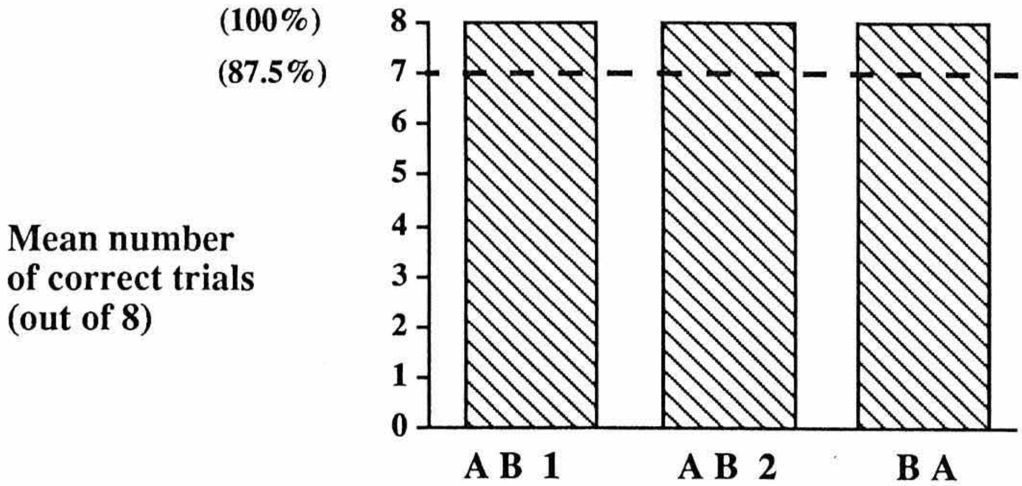
Owen

Bidirectionality tests:
Mean performance on each trial block

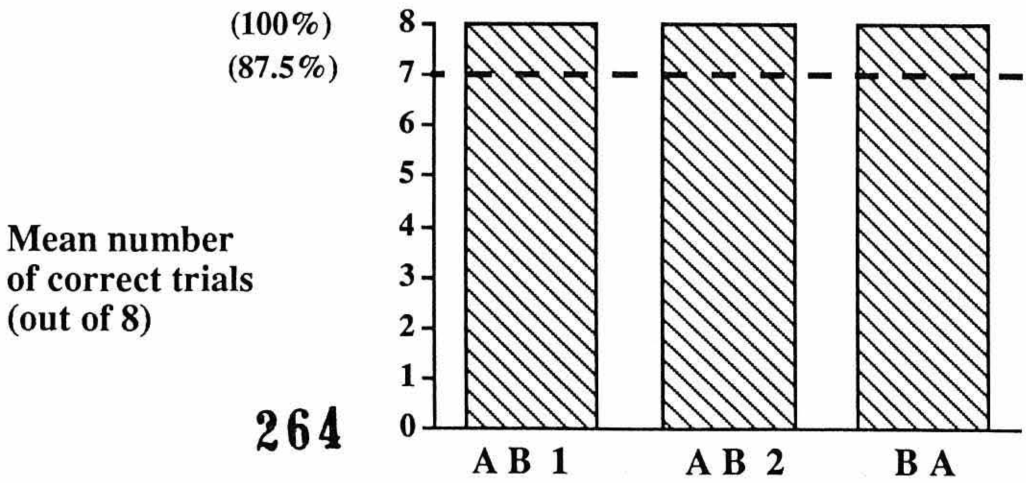
Stimulus set 1



Stimulus set 2



Stimulus set 3



passed immediately without any errors. There was one instance of his repeating the castle-snowman conditional mand in this trial block, following his choosing the correct comparison. Histograms of his final test trial blocks are shown in Figure 10.3c which illustrates his passing without error.

Niall

Niall's mean level of performance during the study is shown in Figure 10.4. His first phase was the bidirectionality test phase which began with the instruction of the A-B trial types (Trial Block 1). His performance was at a very high level, producing no errors. The test for the bidirectionality involving a mixture of A-B and B-A trial types followed, and he passed this without error (Trial Block 2). The second set of stimuli in the bidirectionality test produced a similarly high level of performance with only one error throughout (Trial Blocks 3 and 4). Whilst the third set of stimuli for the bidirectionality test produced no errors (Trial Blocks 5 and 6). The final trial blocks for each stimulus set are presented as Histograms in Figure 10.4b and illustrate this accurate performance. Thus the bidirectional emergent behaviour was present at a high level.

The 'Equivalence' test phase for his behaviour followed. During all of the following trial blocks he refused to do the task behind the screen or come to the experimenter's house, so the rest of the study was completed at his house, with the use of the A4 shield to prevent cueing from the experimenters eyes and face. A-C instruction was given immediately as the A-B trial types were already at criterion from the previous bidirectionality phase (Trial Block 7). This reached a level of

Figure 10.3c : 'Equivalence' test data for Owen. The histograms show the mean number of correct trials (out of 8) for the final trial block of each part of the test. The upper figure is the B C test, and the lower figure is the C B test.

Figure 10.3c

Owen

'Equivalence' test:
Mean performance on the final trial block of each half of the test

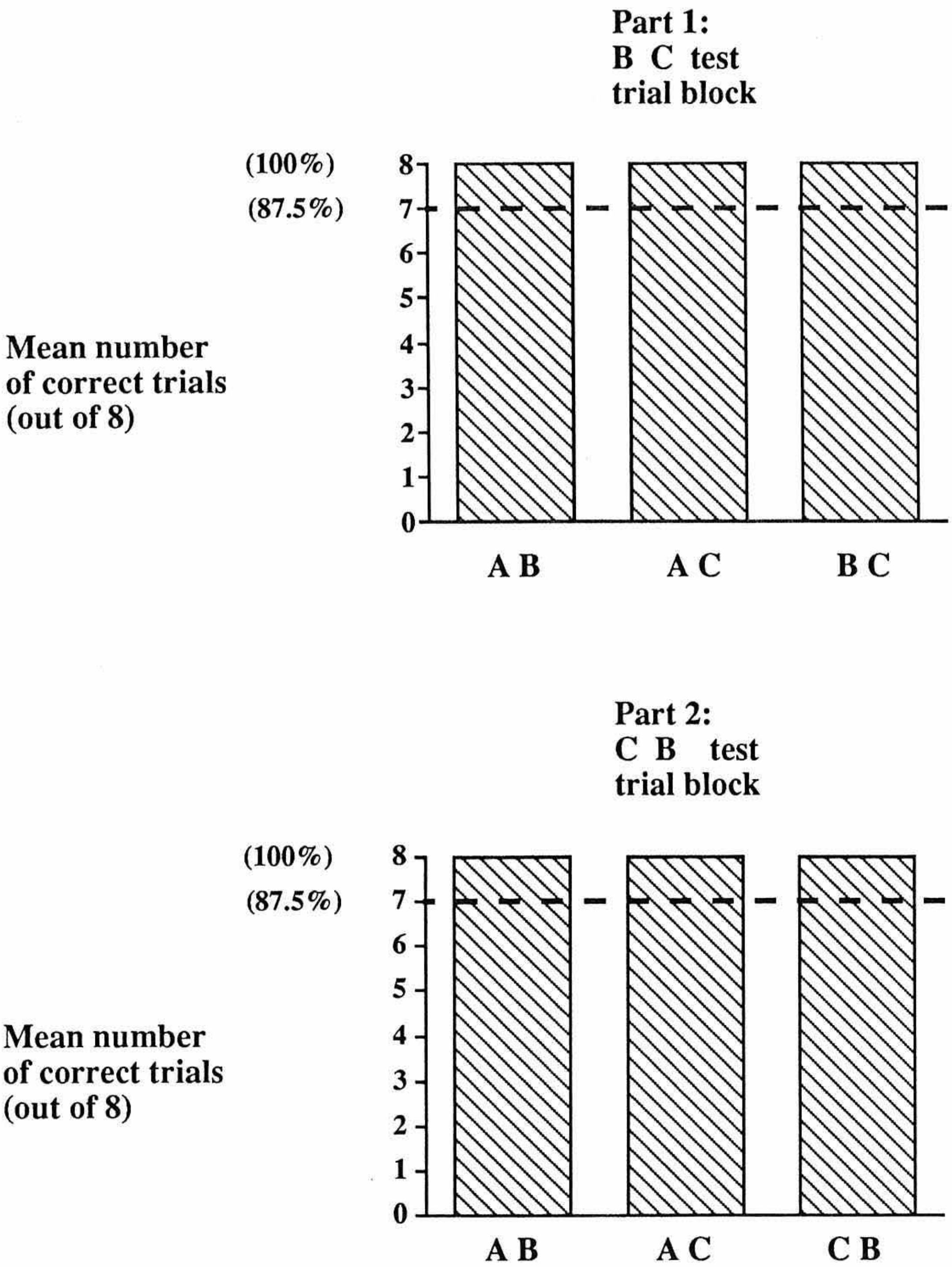
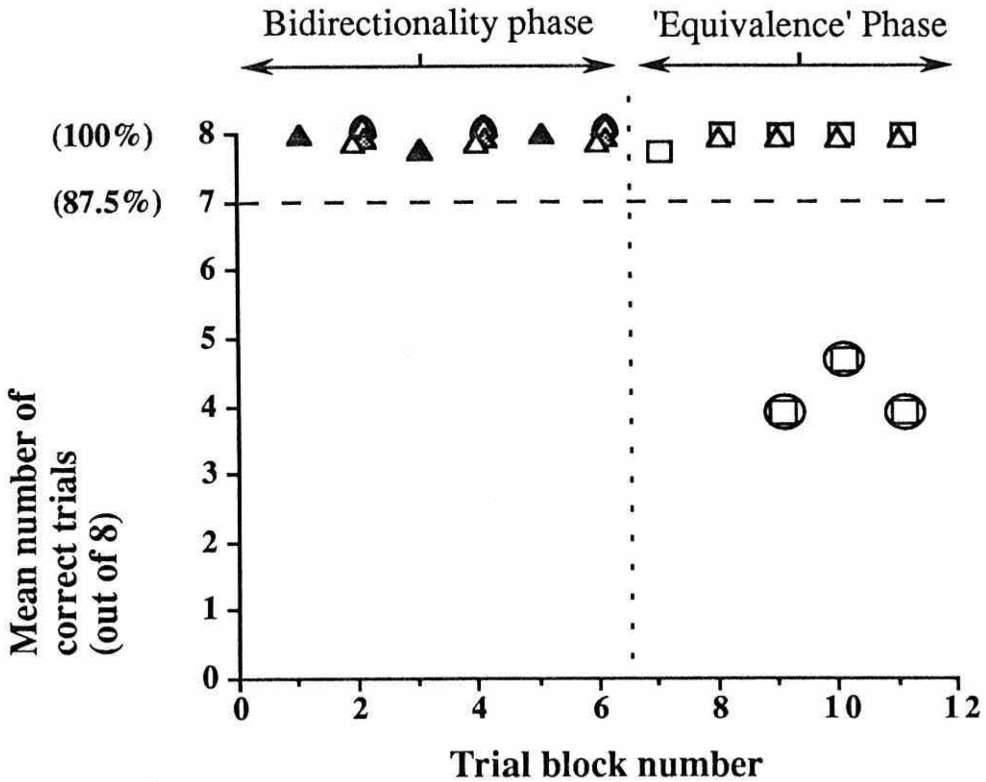


Figure 10.4 : Data for Niall. The graph shows the mean number of correct trials (out of 8) plotted against the trial block number, for each trial block. On the left are the results of the bidirectionality test, and on the right are the results of the 'equivalence test'.

Figure 10.4

Niall

Mean performance on each trial block



Key

	4	**No. of trial types**
A change of A->B stimuli, instructed.	▲	
A->B stimuli, instructed	△	
Additional A->B stimuli, instructed.	▲ (shaded)	
B->A stimuli, tested	ⓐ (triangle in circle)	
A->C stimuli, instructed	□	
B->C stimuli, tested	(square in circle)	

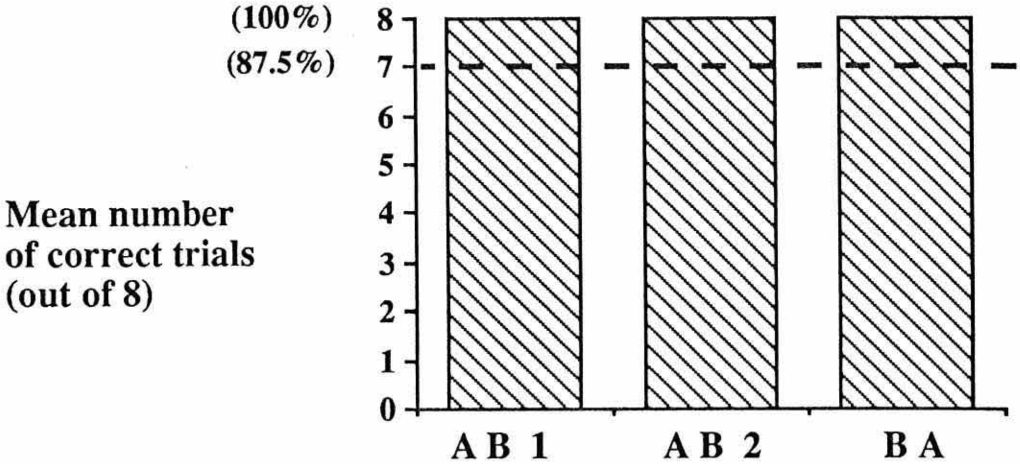
Figure 10.4b : Bidirectionality test data for Niall. The histograms show the mean number of correct trials (out of 8) for the final trial block of each stimulus set.

Figure 10.4b

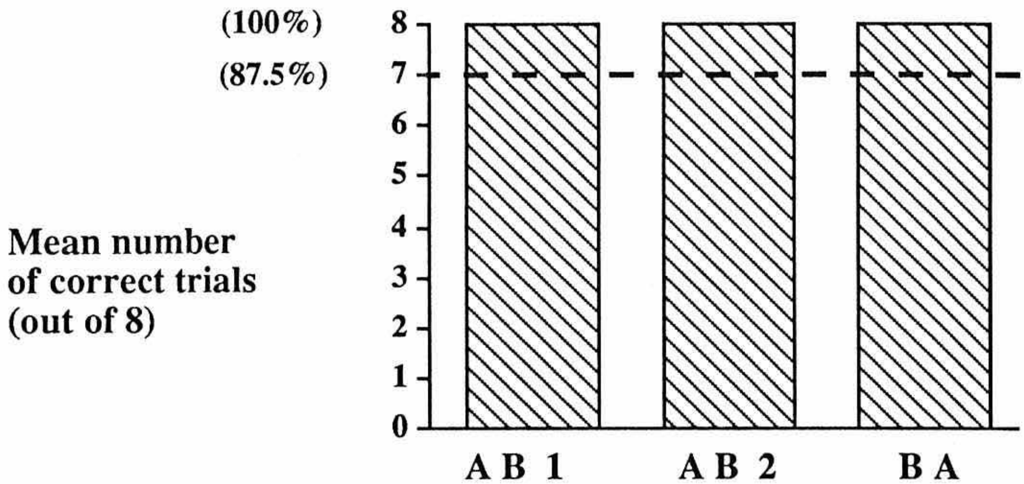
Niall

Bidirectionality tests:
Mean performance on each trial block

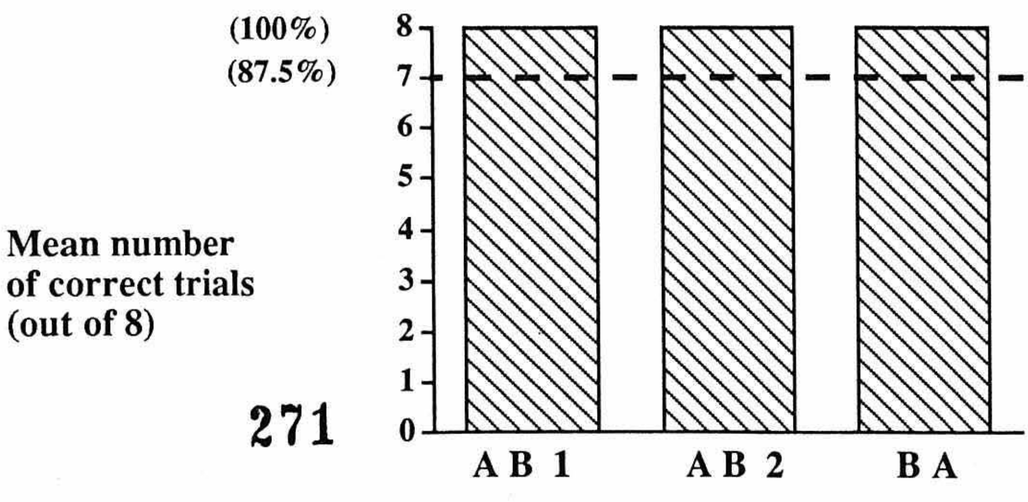
Stimulus set 1



Stimulus set 2



Stimulus set 3



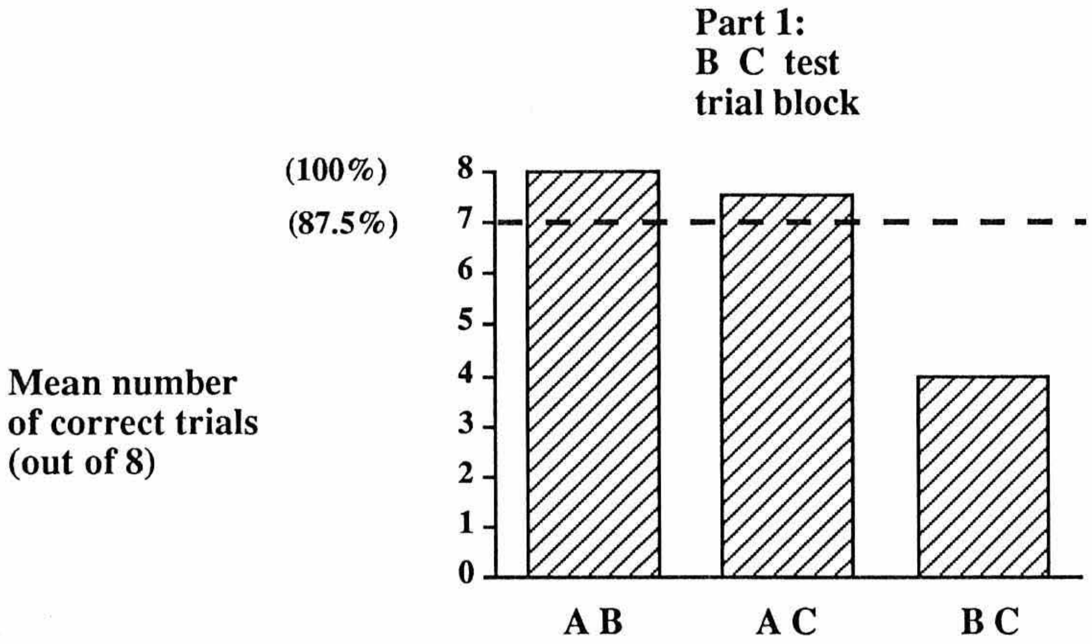
7.75/8, passing the criterion level. His behaviour followed that of Owen upon the interspersal of the A-B and A-C trial types, for he made no error (Trial Block 8). The is in contrast to the same point with Claire, where the increased number of conditional relations appeared to result in a degradation of her behaviour. He was then given the interspersal of B-C test trials with the two instructed trial types, A-B and A-C, in Trial Block 9. He made no errors on the instructed trial types, but only obtained 7/8 on one of the test trial types, the remaining three being below the criterion level. In that trial block he repeated the mushroom-castle conditional mand following his choosing of a correct comparison.This pattern of behaviour occured again when the trial block was repeated in that three of the test trial types failed to reach criterion (Trial Block 10). The trial block was repeated a final time, but still he passed the instructed trial types but failed on the test trial types, this time failing to reach criterion on all four of the test trial types (Trial Block 11). He emitted one instance of a repetition of the mushroom-castle conditional mand after he chose a correct comparison.The pattern is clearly illustrated in the histogram for the final B-C test trial block in Figure 10.4c. It had been decided previously that three failures in a row would constitute a failure to pass the 'equivalence' test phase of the study, and that this would provide a suitable baseline point for studies in the future of the acquisition of the emergence of these networks of relations after which successive simplifications, feedback, and other manipulations might be introduced to shape up the emergent components of the task and bring them under stimulus control, in the manner of the negated mand and conditional mand studies of experiments 1 to 3.

Figure 10.4c : 'Equivalence' test data for Niall. The histograms show the mean number of correct trials (out of 8) for the final trial block of each part of the test. The upper figure is the B C test, and the lower figure is the C B test.

Figure 10.4c

Niall

'Equivalence' test:
Mean performance on the final trial block of each half of the test



Steven

The mean level of performance for Steven throughout the study is given in Figure 10.5. The first phase was the bidirectionality test phase, beginning with instruction of the A-B trial types (Trial Block 1) where he passed without error. Then followed the test for bidirectionality with the mixture of A-B and B-A trial types (Trial Block 2). He reached the criterion level on the instructed A-B trial types, but fell slightly below criterion on one of the B-A test trial types. A repetition of this trial block resulted in his performance rising to 8/8 for all of the trial types (Trial Block 3). The second and final set of stimuli in his bidirectionality test phase then followed in trial blocks 4 and 5, which was carried out with the subject and experimenter separated by the full screen. In trial block 5 he gave one repetition of the rocket-teddy conditional mand, and one of the bridge-candle conditional mand, following correct choices on these trials.This he passed on his first exposure it, reaching criterion on the instructed A-B trial types and passing the B-A test trial types without error. Histograms of the mean performance on the final trial blocks for each stimulus block are plotted in Figure 10.5b. All three bars in each graph lie above the criterion level illustrating his passing this phase of the study.

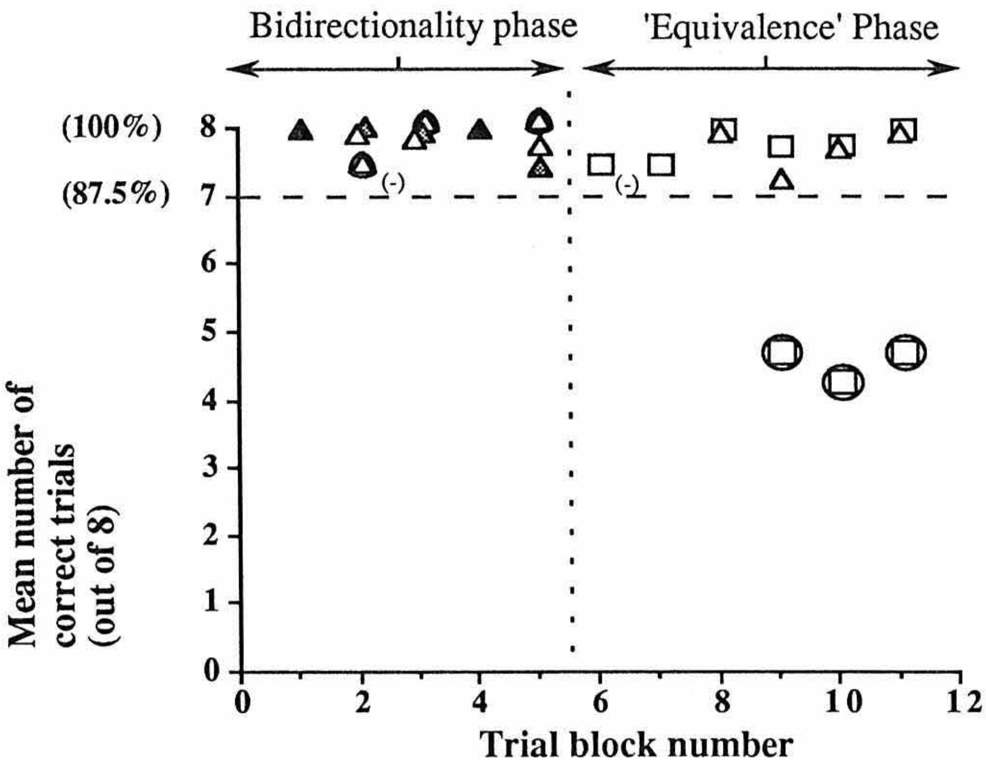
There followed the 'Equivalence' test for his behaviour. The A-B trial types were already at criterion so he was firstly given a trial block of the instructed A-C trial types alone (Trial Block 6). He fell below criterion on one of the trial types so the trial block was repeated once more, which he passed (Trial Block 7). As with Owen and Niall he passed the mixture of A-B and A-C trial types in Trial Block 8 without error. There followed the interspersal of B-C test trials with the instructed A-B

Figure 10.5 : Data for Steven. The graph shows the mean number of correct trials (out of 8) plotted against the trial block number, for each trial block. On the left are the results of the bidirectionality test, and on the right are the results of the 'equivalence test'.

Figure 10.5

Steven

Mean performance on each trial block



Key

4 — **No. of trial types**

A change of A->B stimuli, instructed.

A->B stimuli, instructed

Additional A->B stimuli, instructed.

B->A stimuli, tested

A->C stimuli, instructed

B->C stimuli, tested

(-) indicates that at least 1 trial type in that block fell below 7/8

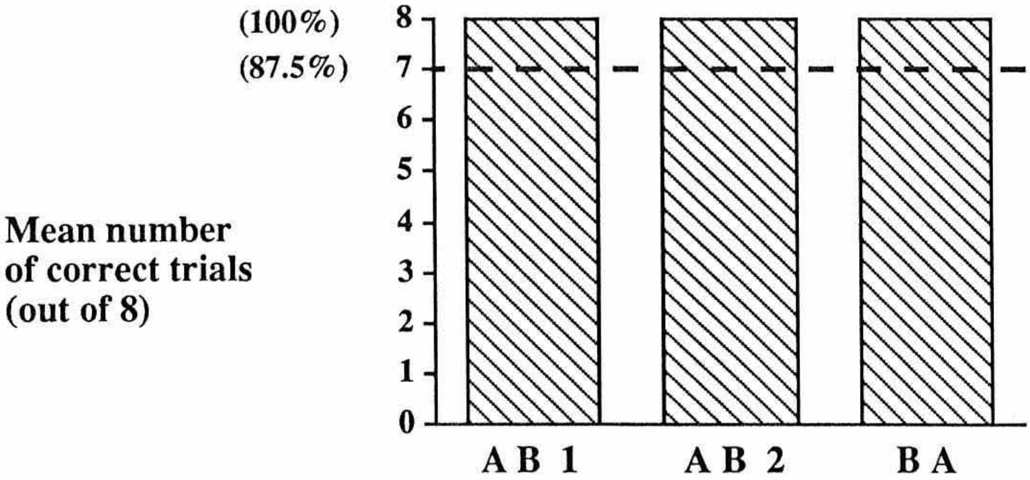
Figure 10.5b : Bidirectionality test data for Steven. The histograms show the mean number of correct trials (out of 8) for the final trial block of each stimulus set.

Figure 10.5b

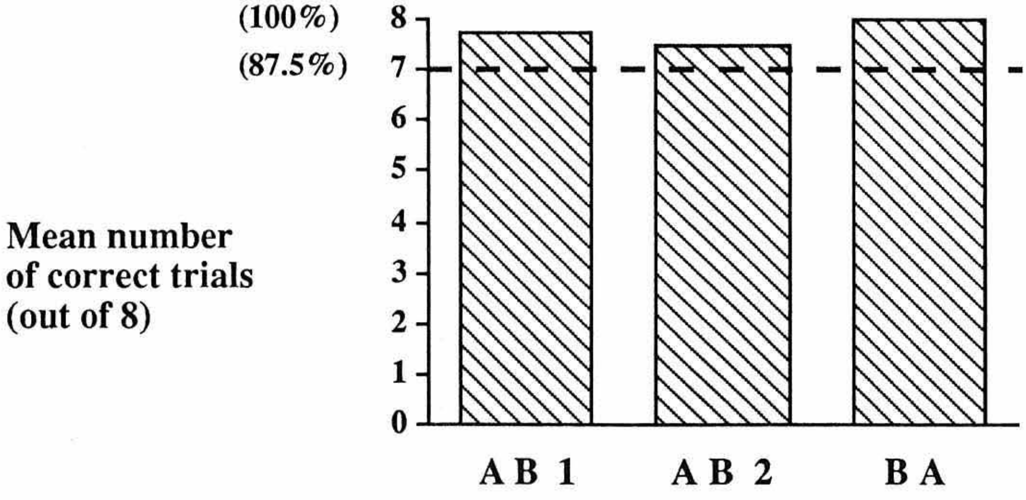
<u>Steven</u>

<u>Bidirectionality tests:</u>
Mean performance on the final trial block of each set of stimuli

Stimulus set 1



Stimulus set 2



and A-C test trials in Trial Block 9). He showed a similar pattern to Niall in that he reached criterion on both of the instructed trial types, but only passed one of the test trial types, the other three falling below criterion. He repeated the ambulance-paintbrush conditional mand once following a correct choice on this trial type. Two repetitions of this trial block resulted in no improvement in his responding on the test trials even though his performance remained at criterion level for the instructed A-B and A-C trial blocks (trial blocks 10 & 11). A histogram of the final B-C test trial block is plotted in Figure 10.5c and also shows this. As with Niall the three failures in a row to reach criterion on the test trials was taken as a lack of the requisite behaviour in the subject's current repertoire in this experimental context. Thus the investigation of his behaviour was terminated at this point, since a systematic analysis of the acquisition of the emergent behaviour needed for responding to networks of conditional relations required the implementation of a further study as outlined earlier.

Discussion

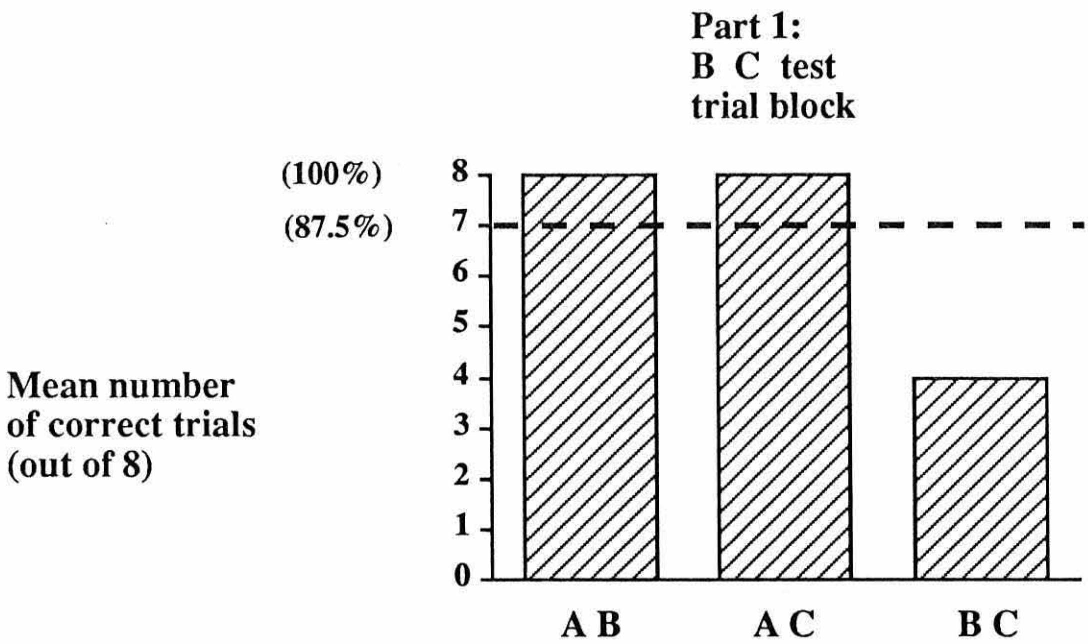
The results suggest a number of comparisons between the subjects. In the case of Claire, Owen and Niall three sets of stimuli were used to test for bidirectionality. All three subjects passed, making few errors. The younger subject, Steven, had two sets of stimuli for the bidirectionality test. He showed an improvement in the performance on the test trials across successive trial blocks, despite no feedback, a phenomenon which has been noted in a number of equivalence studies, and was also present in the 'equivalence' tests.

Figure 10.5c : 'Equivalence' test data for Steven. The histograms show the mean number of correct trials (out of 8) for the final trial block of each part of the test. The upper figure is the B C test, and the lower figure is the C B test.

Figure 10.5c

Steven

'Equivalence' test:
Mean performance on the final trial block of each half of the test



Owen and Claire both passed the 'equivalence' tests, Claire required two additional trial blocks for the performance to rise to criterion, whilst Owen only required one. Niall and Steven both performed at criterion on the instructed relations, but only reached a chance level of responding on the test trials. Three sets of data points were obtained showing no upward trend so these studies were terminated at this point.

The almost error free performance of Claire, Owen and Niall on the Bidirectionality tests, along with that of Owen and Claire on the terminal trial block of the 'Equivalence' test illustrates the high degree of control that the instructed conditional mands can have over the corresponding emergent conditional discriminations, especially when one considers the absence of feedback during the study.

No spontaneous verbal behaviour was emitted by the subjects that might be thought to be of any significance in helping the children do the tasks, other than those types which were deliberately introduced by the experimenter first in Experiment 3. Thus there was no common naming or alternative relational autoclitics emitted at the overt level, which might have been thought responsible for the findings.

Examination of the data from the Reynell Developmental Language Scale test provided no additional information in accounting for the subjects' differing patterns of responding.

The familiarity of the pictures helped to make the tasks easier to learn than the more commonly used abstract shapes, but because they were paired together in a random and arbitrary fashion provides a good control against the possibility that the pairs could already have been related together in the subjects' past experiences.

The difficulties with distractability and refusal to cooperate behind the full shield in the cases of Claire and Steven, did not appear to significantly alter the pattern of their responding, for no marked improvements followed the reversion the to previous control for experimenter cuing involving the A4 shield covering the experimenter's face and eyes.

The emergence of bidirectionality in all four subjects, and 'equivalence' in two of these, suggests that emergent behaviour which is operationally classed as equivalence may originate from the action of alternative relations. This underlines the need for a verbal or contextual component in the definition of equivalence and other relational classes, which has been suggested by Hayes (in press) and Place (in press), amongst others.

As the subjects were already able to respond correctly as listeners to conditional mands, it was not possible to have a baseline phase in the study. Thus the experiment served to provide an initial examination of the properties of networks of conditional mands without tracking their acquisition. Future studies offer the possibility of pursuing the issue of the acquisition of the emergent classes of Bidirectionality and 'Equivalence' within the general methodological framework of the experiments presented here. Using a larger sample of subjects for experiment 3, some of which might be younger, it should then be possible to find a number who fail the 'Equivalence' phase. This failure provides a baseline against which various manipulations and systematic simplifications of the task can be compared, in the manner of the breakdown of the task components in Experiments 2 and 3. It offers the possibility of tracking the emergent components of the Bidirectionality and 'Equivalence' tasks as they are being acquired, which has, so far, not been carried out by experimenters in the field.

Such information is of great importance in adding to our understanding of these phenomena, and how complex hierarchies of relational response classes can be established and brought under control of autoclitics by the listener. For it is in this area that an account of the qualitative changes in the nature of human learning and problem solving during development might be found.

Chapter 11: General Discussion

In the introductory sections a theoretical analysis was presented that attempted to reconcile the account of language given by Skinner in his book Verbal Behavior (1957) with the properties of emergent behaviour. This feature is shown in equivalence and other relational patterns of behaviour and occurs in rule-governed behaviour when novel, or weak, components are present. The models expounded earlier develop upon Skinner's (1957, 1966) assertion that verbal behaviour, whilst giving rise to the unique properties characterized by rule-governed behaviour, may itself be ultimately contingency shaped. Of particular importance to the account of emergent behaviour are relational autoclitics, that indicate that two or more accompanying verbal operants go together in some way and are not simply independent responses. Two important subclasses of the relational autoclitic which were discussed were the conditional mand and the conditional tact. Where, in the conditional mand an ordinary mand is made conditional upon the occurrence of some event, e.g. "when you get the answer, put up your hand.", and in the conditional tact, the event or aspect described by the tact is said to occur when the specified condition comes into being, e.g. "when the bell rings, dinner will be ready".

For want of a mechanism to account for how such autoclitic modification occurs in a suitably disposed listener, I invoked the notion of particular higher order response classes in the listener which correspond to their counterparts in the speaker. As a starting point, and in keeping with the framework of the three term contingency, the ontogeny of these was seen as being due to a history of differential reinforcement in accordance with the emergent patterns of behaviour that characterize a particular class of autoclitic.

An analysis of naming was presented that involved the relation of reciprocity as its basis rather than one of symmetry. This was necessary in order to deal with the qualitatively different roles of a label and its referent in the linguistic behaviour of a speaker and listener, which cannot be subsumed within a relation that relates two things in an identical fashion in both directions - as does the symmetry relation. The involvement of autoclitic accompanyment was discussed, as well as the issue of the observational learning of label-stimulus relations. A label-stimulus relation provides an anchor for a member of an equivalence class involving other labels. It was suggested that, without the definition of the former relation, the labels would lack "meaning" - having no function upon the listener as verbal stimuli, other than as members of the equivalence class. Extending Lowe's suggestion (personal communication, 1988) that objects or stimulus properties may themselves be related by an equivalence relation whilst remaining tied to some common label for them, offered the ability to deal with the case of membership in an arbitrary set, such as "tools" or "toys", as well as "fuzzy" categories. The case of establishing label-stimulus relations through the use of pronouns paired with autoclitics, e.g. "this is a rugby ball"., was also mentioned.

It was initially decided to look at negation of mands since this only involved the pairing of one primary verbal stimulus, the mand, with an autoclitic, the negation. Thus it was conceptually simpler whilst still posing the problem of how to account for the emergence of the autoclitic function in a listener. Experiment 1 provided an initial investigation into the acquisition of listener behaviour to negated mands and involved 5 children aged 2 1/2 years to 3 years. The data from this experiment fell into two main groups. Firstly, the performance of two of the subjects suggested that the ability to do the task was largely present prior to the onset of the experiment, whilst data from two other subjects suggest partial demonstrations of the success of the intervention. For example, Duane was able to do the generalization trials which involved only negated mands, but required additional training to get him to distinguish between the mand instructions and their negated counterparts. The interpretation that this class of verbal behaviour might be subject to operant contingencies was compromised by the finding that in subjects around this age important components of the task may already have been acquired.

Experiment 2 began as a replication of Experiment 1 with a younger age group of children. Five subjects aged 1 year, 8 months to 2 years, 4 months took part. Two types of negated mand instructions were used. The more complex instructions were "touch the ..." and "don't touch the ...", whilst the simpler instructions were just the name of the stimulus for the mand, e.g. "car", and "not" followed by the name to form the negated mand, e.g. "not car". Two of the subjects, Eli and Alun, formed one group that initially were given prolonged exposure to the longer versions of the instructions, before being put onto the shorter versions. Whilst three subjects, Gareth, Jenny and Mathew, formed a second group which only received the shorter instructions. Despite the prolonged exposure (1926 and 1768 trials), extremely simplified interventions, and an increased frequency of material reinforcement, Eli and Alun still failed to produce the required behaviour. However after the introduction of the shorter version of the instructions there was an imediate rise to the criterion level of responding which was well maintained across the generalization trials.

Amongst the shorter instruction group, Gareth and Mathew both passed all of the required tests and demonstrated the generalized ability to respond to the instructions with novel stimuli. Gareth's behaviour was characteristic of those subjects in Experiment 1 who required little in the way of exposure to the experimental procedure before passing the later stages. Mathew, in contrast, showed no evidence of any initial presence of the required higher order response classes. In fact, both the response class to negation of the mands and the stimulus control had to be established independently. First the generalized responding to the negated mands alone was established, and then the discrimination between mand and negated mand instructions. This latter discrimination involved the modification of the instruction to include a difference in the way the instruction was intonated, before he was able to manage this aspect of the task. This occured in the latter withdrawal section of the design, where he was switched between a phase of intonated instructions and ones where elongation of the word "not" in the negation instruction was used to emphasise the autoclitic, Then finally back to the intonated version of the instructions to proceed with the generalization test for the mixture of mand and negated mand instructions.

The failure of the two subjects exposed to the longer instructions and their later passing the shorter version, along with the passes by Gareth and Mathew on the shorter instructions, lends support to the notion that as children mature the effect of verbal operants placed earlier in a sentence increases. However this effect is difficult to isolate in the present case given the additional change in the words that were used. The importance of intonation in Mathew's discrimination of the instruction suggests the need for further systematic investigation of the use of intonation in speech.

The next series of studies involved a development of the model to deal with conditional mands which would allow investigation of some of the properties of relational autoclitics in an experimental setting. The instruction used was the autoclitic frame "when its the ..., touch the ...". The subjects were given the only instructions at the beginning of the session, the aim being to establish behaviour that would enable the effects of these to endure throughout the remaining trials. A multiple baseline design across three subjects ages 3 1/4 years at the onset of the experiment was used. A further subject aged 2 1/2 years, Steven, became available and was added to provide a comparison with the older children. Two of the subjects, Owen and Claire, both showed a similar improvement following the introduction of the verbal prompt from the experimenter, with performance on the original stimulus set then reaching criterion. Claire showed a gradual reduction in the number of errors produced upon first encounter with each novel stimulus set, until she eventually remained above criterion for all but one of the last eight generalization tests. Owen showed little reduction in the number of generalization tests falling below criterion upon his first encounter with them, but the fact that he passed the last two generalization tests without error, completely out of sight of the experimenter suggested that an increase in their strength and stimulus control occurred towards the end of this series of tests.

Niall formed the third stage of the multiple baseline component of the design, but his results group together with those of the younger subject Steven. Both subjects were unable to follow the prompted form of the instruction in the early stages of the experiment. However they differed in how they acquired an accurate level of responding. Niall's improvement was correlated his spontaneous emission of two relational autoclitic sentences that connected the stimuli in each pair, involving the autoclitics "go with" and "goes with". In Steven's case it was the way in which the task components were broken down and then successively reintroduced which appears to have been responsible for his improvement in performance. Neither he, nor Owen or Claire, emitted any of the relational autoclitics that were correlated with Niall's improvement in responding.

The results have a number of implications. The finding that a verbal prompt from the experimenter and self-instructions by the subjects were needed in order for them to do the task implied that simply shaping the listener's skills with autoclitic frames of this complexity is not sufficient. Instead, the results suggest, the listener must act as his/her own speaker for a period, taking an active role in the chain of events from antecedent (the experimenter's instruction), to behaviour (the self-instruction followed by the pointing response), and its consequences (both the immediate verbal feedback, and the eventual material prize). This indicates a close correspondence between the direct shaping of Skinner's analysis, and the social-developmental account of language of Vygotsky and its later development by Luria and his collegues, since the gradual acquisition of the response classes and stimulus control studied in this experiment appeared to require an interaction between speaker and listener skills.

When subjects were responding to the more complex components of the task, yet remaining at criterion, the requirement for self-instruction prior to making each choice was relaxed. The finding that the proportion of self-instructions was maintained at a high level, but with trials occuring where the subjects said nothing, indicated that control by the samples had increased in strength and no longer needed the addition of the verbally expressed relation given in the self-instruction. It supported the model's suggestion that listener behaviour eventually comes under the control of autoclitic frames which are able to alter the function of named stimuli, without the need for repetition of the given sentence by the listener prior to making a response. The fact that the rehearsal of an instruction *does* occur by a listener before emitting a response leaves open the possibility that both sequences may be common, but it seems that its overt emission as a self instruction in not a necessity. These results highlighted the fact that the relative proportion of the two forms of listener behaviour in everyday learning require further investigation.

It was pointed out earlier that an important property of response classes such as equivalence and relational autoclitics is that they allow the rapid building of a network of untrained conditional relations, given only a few trained ones. Investigation usually involves the training of the key conditional relations through reinforcement on conditional discrimination tasks which is reduced in frequency to allow test trials to be inserted under conditions of extinction, thus demonstrating the emergence of the remaining conditional discriminations without training. Verbal behaviour allows the establishment of these prior conditional relations without a period of training on the current stimuli. A history of prior responding to relational autoclitics of that form is needed, after which the simple insertion of the names for the new stimuli establishes the required conditional relation. Experiment 4 investigated such properties through the use of the listener behaviour which had already been established in experiment 3, to generate a network of conditional relations.

The three older subjects were aged 3 1/2 to 4 years , whilst the younger subject was aged 3 years, 2 months. Bidirectionality alone was tested in the first phase of the study since this involved the subject having to learn fewer instructed relations, i.e. only the A-B relations, before going onto the main task. The test for transitivity involved teaching two sets of conditional relations, namely the A-B and the A-C relations, known in the literature as a combined test for symmetry and transitivity. Three sets of tests were done for bidirectionality in the case of Claire, Owen and Niall, which all of the subjects passed, making few errors. The younger subject, Steven, had fewer stimuli available for use so two sets were used, both of which resulted in performances at the criterion level. The first of these missed criterion on one of the trial types initially, but given a second repetition of the trial block, reached criterion. The gradual improvement in the performance on the test trials, despite no feedback, is a phenomenon which has been noted in a number of equivalence studies, and was also present in the transitivity tests.

Owen and Claire both passed the 'equivalence' tests. Niall and Steven both performed at criterion on the instructed relations, but only reached a chance level of responding on the test trials. In this study there was no spontaneous verbal behaviour emitted that might be thought to be of any significance in helping the children do the tasks, other than those types which were deliberately introduced by the experimenter. Thus there was no common naming or alternative relational autoclitics emitted at the overt level, which might have been thought responsible for the findings. The emergence of bidirectionality in all four subjects in the last experiment and transitivity in two of these, suggests that emergent behaviour which is operationally classed as equivalence may originate from the action of alternative relations. This underlines the need for a verbal or contextual component in the definition of equivalence and other relational classes, which has been suggested by Steven Hayes and Ullin Place, amongst others.

The familiarity of the pictures helped to make the tasks easier to learn than the more commonly used abstract shapes, but because they were paired together in a random and arbitrary fashion thus provides a good control against the possibility that the pairs could already have been related together in the subject's past experience.

These findings illustrate the possibility of tracking the acquisition of rule-governed behaviour under experimental conditions. They represent a first attempt to follow the development of the listener's skills involved in rule following, but suggest ways in which the current absence of research in this area might begin to be tackled. The model of the autoclitic based on rule-governed behaviour is still in its infancy, but offers a direction in which the unique properties of language might be reconciled with the three term contingency.

As discussed in the introductory section on French Structuralism, there is a contradiction between the notion of language as an autonomous self-referential process and the socio-historical materialist analyses of langauge found in the work of Skinner and Vygotsky. Some of the ideas of Saussure and Jakobson have been developed in the dialectical materialist perspective of Luria, in his discussion of syntagmatic and paradigmatic forms of an utterance, but the extensions of the structuralist position by Lacan and Deridda received no such treatment. Whilst a development of the areas of contact between behavioural models of language and French Structuralism will require an extended discussion that is beyond the scope of the current work, a preliminary outline of some implications for the autoclitic models in this thesis will be presented.

In addition to the processes of direct shaping and observation, symbol-referent relationships can be altered through the application of relational autoclitics and metonymy, amongst other verbal processes. Calinicos suggested that: 'the stability possessed by the two series of signifiers is only temporary and relative; it exists only so long as their opposition is not displaced by a new one arising from the transformation of signified into signifier, or vice versa' (1982). Hence symbol-symbol relations can be altered by the process of alteration of the symbol-referent relation of one of them, which can occur through direct processes such as shaping, or through verbal means via relational autoclitics and metonymy.

Language need not be viewed as an autonomous process freed from its empirical anchors, but it needs to be recognized that the simple shaping models outlined in Skinners discussion of the ontogeny of primary verbal operants are idealized suggestions. They merely present one aspect of language acquisition/maintenance, that of direct shaping which carries an implication of anchorage of the verbal operants to their referents, maintained through differential reinforcement. This anchorage ceases to exist when autoclitic/metonymic processes of change are introduced. For such symbol-referent relations can be altered through the processes of reasoning in deduction/induction as well as the faulty application of logic, and the self selection of empirical data to support hypotheses compatible with existing preconceptions. This applies to simple label-referent relations, as with basic tacts, but also to rule-based descriptions of empirical relations, especially where data are infrequent or difficult to obtain.

According to the present analysis, the process of intra-linguistic alteration and maintenance of the function relations characterising verbal operants, that which embodies their 'meaning', is not autonomous, but now has a more tenuous relationship with immediate consequences, characterized by the 'insensitivity' to certain experimental contingencies shown by verbally competent humans using rules to guide their pattern of responding (e.g. Shimoff et al, 1986, Hayes et al,1986, and Bentall & Lowe, 1987). The presence of higher order verbal operants that are maintained by more distant consequences, means that the correspondence between a symbol, its particular referent, and the consequences arising from its use, is reduced. Sometimes sensitivity to consequences may be the same or heightened, whilst given a different rule-symbol interaction, it may be eliminated.

An implication of this is that the verbal repertoire and its particular patterns of sensitivity to consequences, shows a 'memory' to events, i.e. a sensitivity to a prior history that affects the connections made between 'reality' and the symbols through which we make contact with it. This is an ongoing process of historical change, with the sensitivity to particular contingencies and the propensity for alteration of symbol-referent relations in a continual state of flux. Thus the implication of a limit to objectivity imposed by our linguistic system, which arose from the French Structuralist analysis, appears to have some basis when considered in the light of the present analysis. For the correspondence between our verbal characterization and reality itself is seen to be dependent on both a contact with the particular events, and a prior verbal history that can distort, emphasise, or eliminate this altogether.

The 'behaviour-behaviour' change, i.e. the interrelationship between linguistic components affecting subsequent dispositions, can be seen as involving an ongoing 'effervescence' of verbal connections involving self-thematic/formal prompts and probes, spontaneous word associations, spurious intraverbal links, as well as the reasoning processes outlined earlier. These processes affect the relationships between symbols and other symbols, and symbols and referents, and are accompanied by a vast number of associated emergent relations, following from equivalence, difference, set membership, and other relations. The number of connections that arise emergently increases more rapidly with each increment in the initially established relations, in the manner of Sidman's (1985) analysis of how the number of potential relations obtained 'for free' becomes successively larger with every increase in the number of members in an equivalence class. Such emergent relations propagate amongst the vast linguistic structure that exists as the verbal repertoire of a human competent in language. Since relational autoclitics do not just establish conditional relations, but transfer and modify the function of stimuli, it can be seen that this large network of emergent relations will alter the properties of assertion, negation, metaphorical extension, tacting, in fact all of those functions carried by verbal stimuli, along with their affective and imagery correlates that effect our private experience of the world.

The linguistic system is thus seen as a deterministic system, but one in which connections within the system play a comparable role to the contact that system makes with reality. This gives it an outwardly autonomous appearance in that the effect of contact with particular events, as well as the way in which individuals actively seek to obtain information and modify their relationship with external reality, is unpredictable and capricious in appearance. In this sense language is seen to bring about a qualitative, or *dialectical*, break in the way in which humans interact with their environment. Through the construction of this verbal edifice by the verbal community, individuals are freed from the constraint of immediate contingencies.

Chapter 12 : References

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Chapter 13 : Appendix

EXPERIMENT 1

Performance on the trial types; given for each block of trials.

SUBJECT: OWEN

DATE OF BIRTH: 4/5/86

AGE DURING STUDY: 3 to 3yr,3mth

CHECK FOR MAND FUNCTION.

1) "Touch..", with 4 stimuli - all present at once, with feedback.
15/5/89

Touch	pig	= 8/8
Touch	bus	= 8/8
Touch	fork	= 8/8
Touch	tent	= 8/8
Touch	mean	= 8/8

2) "Touch..", with 4 stimuli - 2 present at each trial, with feedback.
9/6/89

Touch	pig	= 8/8
Touch	bus	= 8/8
Touch	fork	= 8/8
Touch	tent	= 8/8
Touch	mean	= 8/8

NEGATED MAND TRAINING; NEGATED MAND TRIALS MIXED WITH ORDINARY MAND TRIALS.

3) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback.
9/6/89

Touch	pig	= 8/8
Touch	bus	= 8/8
Touch	fork	= 8/8
Touch	tent	= 8/8
Don't Touch	pig	= 6/8
Don't Touch	bus	= 8/8
Don't Touch	fork	= 6/8
Don't Touch	tent	= 7/8
Touch	mean	= 8/8
Don't Touch	mean	= 6.75/8

4) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback.
13/6/89

Touch	pig	= 8/8

Touch	bus	= 8/8
Touch	fork	= 7/8
Touch	tent	= 8/8
Don't Touch	pig	= 8/8
Don't Touch	bus	= 8/8
Don't Touch	fork	= 8/8
Don't Touch	tent	= 7/8
Touch	<u>mean</u>	= 7.75/8
Don't Touch	<u>mean</u>	= 7.75/8

GENERALIZATION TEST 1; NEGATED MANDS ONLY.

5) "Don't Touch..", with 4 stimuli - 2 present at each trail, NO feedback.

27/6/89

Don't Touch	mouse	= 8/8
Don't Touch	hand	= 8/8
Don't Touch	tap	= 8/8
Don't Touch	bed	= 8/8
Don't Touch	<u>mean</u>	= 8/8

GENERALIZATION TEST 2; NEGATED MANDS ONLY.

6) "Don't Touch..", with 4 stimuli - 2 present at each trail, NO Feedback.

30/6/89

Don't Touch	pie	= 8/8
Don't Touch	frog	= 7/8
Don't Touch	leaf	= 8/8
Don't Touch	boat	= 7/8
Don't Touch	<u>mean</u>	= 7.5/8

GENERALIZATION TEST 3; NEGATED MAND TRIALS MIXED WITH ORDINARY MAND TRIALS.

7) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, NO feedback.

5/7/89

Touch	cup	= 8/8
Touch	chair	= 8/8
Touch	drum	= 8/8
Touch	sheep	= 8/8
Don't Touch	cup	= 7/8
Don't Touch	chair	= 8/8
Don't Touch	drum	= 8/8
Don't Touch	sheep	= 8/8
Touch	<u>mean</u>	= 8/8
Don't Touch	<u>mean</u>	= 7.75/8

SUBJECT: NIEL

DATE OF BIRTH: 18/6/86

AGE DURING STUDY: 2yr,10mth to 3yr,1mth

CHECK FOR MAND FUNCTION.

1) "Touch..", with 4 stimuli - all present at once, with feedback.

31/5/89

Touch	pig	= 8/8
Touch	bus	= 8/8
Touch	fork	= 8/8
Touch	tent	= 8/8
Touch	<u>mean</u>	= 8/8

NEGATED MAND TRAINING; NEGATED MAND TRIALS MIXED WITH ORDINARY MAND TRIALS.

2) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback.

31/5/89

Touch	pig	= 8/8
Touch	bus	= 8/8
Touch	fork	= 8/8
Touch	tent	= 8/8
Don't Touch	pig	= 8/8
Don't Touch	bus	= 8/8
Don't Touch	fork	= 7/8
Don't Touch	tent	= 8/8
Touch	<u>mean</u>	= 8/8
Don't Touch	<u>mean</u>	= 7.75/8

GENERALIZATION TEST 1; NEGATED MANDS ONLY.

3) "Don't Touch..", with 4 stimuli - 2 present at each trail, NO feedback.

31/7/89

Don't Touch	mouse	= 8/8
Don't Touch	hand	= 8/8
Don't Touch	tap	= 8/8
Don't Touch	bed	= 8/8
Don't Touch	<u>mean</u>	= 8/8

GENERALIZATION TEST 2; NEGATED MANDS ONLY.

4) "Don't Touch..", with 4 stimuli - 2 present at each trail, NO Feedback.

31/7/89

Don't Touch	pie	= 8/8
Don't Touch	frog	= 7/8
Don't Touch	leaf	= 8/8
Don't Touch	boat	= 7/8

Don't Touch   mean = 7.5/8

GENERALIZATION TEST 3; NEGATED MAND TRIALS MIXED WITH ORDINARY MAND TRIALS.

5) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, NO feedback.

2/8/89

Touch	cup	= 8/8
Touch	chair	= 8/8
Touch	drum	= 8/8
Touch	sheep	= 8/8
Don't Touch	cup	= 8/8
Don't Touch	chair	= 8/8
Don't Touch	drum	= 8/8
Don't Touch	sheep	= 8/8
Touch	mean	= 8/8
Don't Touch	mean	= 8/8

SUBJECT: DUANE

DATE OF BIRTH: 1/5/86

AGE DURING STUDY: 3yr,1mth to 3yr,9mth

CHECK FOR MAND FUNCTION.

1) "Touch..", with 4 stimuli - 2 present at each trial, with feedback.

16/6/89

Touch	pig	= 7/8
Touch	bus	= 8/8
Touch	fork	= 8/8
Touch	tent	= 8/8
Touch	mean	= 7.75/8

NEGATED MAND TRAINING; NEGATED MAND TRIALS MIXED WITH ORDINARY MAND TRIALS.

2) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback.

19/6/89 + 21/6/89

Touch	pig	= 8/8
Touch	bus	= 8/8
Touch	fork	= 8/8
Touch	tent	= 8/8
Don't Touch	pig	= 8/8
Don't Touch	bus	= 7/8
Don't Touch	fork	= 7/8
Don't Touch	tent	= 7/8
Touch	mean	= 8/8
Don't Touch	mean	= 7.25/8

TEST OF TRAINING STIMULI; NEGATED MAND TRIALS ONLY.

3) "Don't Touch..", with 4 stimuli - 2 present at each trail, NO feedback.

21/6/89

Don't Touch	fork	= 8/8
Don't Touch	bus	= 8/8
Don't Touch	tent	= 7/8
Don't Touch	pig	= 8/8
Don't Touch	mean	= 7.75/8

GENERALIZATION TEST 1; NEGATED MANDS ONLY.

4) "Don't Touch..", with 4 stimuli - 2 present at each trail, NO feedback.

4/7/89

Don't Touch	mouse	= 7/8
Don't Touch	hand	= 8/8
Don't Touch	tap	= 7/8
Don't Touch	bed	= 7/8

Don't Touch mean = 7.25/8

GENERALIZATION TEST 2; NEGATED MANDS ONLY.

5) "Don't Touch..", with 4 stimuli - 2 present at each trail, NO Feedback.

7/7/89

Don't Touch pie = 7/8
Don't Touch frog = 7/8
Don't Touch leaf = 8/8
Don't Touch boat = 7/8
Don't Touch mean = 7.25/8

GENERALIZATION TEST 3; NEGATED MAND TRIALS MIXED WITH ORDINARY MAND TRIALS.

6) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, NO feedback.

10/7/89 + 17/7/89

Touch chair = 2/8
Touch sheep = 7/8
Touch drum = 2/8
Touch cup = 3/8
Don't Touch chair = 5/8
Don't Touch sheep = 4/8
Don't Touch drum = 5/8
Don't Touch cup = 6/8
Touch mean = 3.5/8
Don't Touch mean = 5/8

7) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, NO feedback.

18/7/89 + 21/7/89

Touch chair = 5/8
Touch sheep = 4/8
Touch drum = 8/8
Touch cup = 4/8
Don't Touch chair = 8/8
Don't Touch sheep = 8/8
Don't Touch drum = 8/8
Don't Touch cup = 7/8
Touch mean = 5.25/8
Don't Touch mean = 7.75/8

TRAINING OF GENERALIZATION TEST 3 STIMULI; NEGATED MAND TRIALS MIXED WITH ORDINARY MAND TRIALS.

8) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback.

31/7/89

Touch chair = 7/8
Touch sheep = 7/8
Touch drum = 7/8
Touch cup = 6/8
Don't Touch chair = 8/8

Don't Touch sheep = 7/8
Don't Touch drum = 7/8
Don't Touch cup = 7/8
Touch mean = 6.75/8
Don't Touch mean = 7.25/8

9) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback.
2/8/89
Touch chair = 7/8
Touch sheep = 7/8
Touch drum = 6/8
Touch cup = 7/8
Don't Touch chair = 7/8
Don't Touch sheep = 8/8
Don't Touch drum = 8/8
Don't Touch cup = 7/8
Touch mean = 6.75/8
Don't Touch mean = 7.5/8

10) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback.
11/8/89, 14/8/89
Touch chair = 8/8
Touch sheep = 7/8
Touch drum = 8/8
Touch cup = 8/8
Don't Touch chair = 7/8
Don't Touch sheep = 7/8
Don't Touch drum = 8/8
Don't Touch cup = 6/8
Touch mean = 7.75/8
Don't Touch mean = 7/8 (-)

11) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback.
17/9/89, 29/9/89
Touch chair = 8/8
Touch sheep = 8/8
Touch drum = 8/8
Touch cup = 8/8
Don't Touch chair = 7/8
Don't Touch sheep = 7/8
Don't Touch drum = 8/8
Don't Touch cup = 8/8
Touch mean = 8/8
Don't Touch mean = 7.5/8

RETESTING OF GENERALIZATION TEST 3 STIMULI; NEGATED MAND TRIALS MIXED WITH ORDINARY MAND TRIALS.

12) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, NO feedback.
2/10/89 + 26/10/89
Touch chair = 8/8
Touch sheep = 8/8
Touch drum = 8/8

Touch	cup	= 8/8
Don't Touch	chair	= 7/8
Don't Touch	sheep	= 8/8
Don't Touch	drum	= 8/8
Don't Touch	cup	= 6/8
Touch	<u>mean</u>	= 8/8
Don't Touch	<u>mean</u>	= 7.25/8 (-)

13) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, NO feedback.
31/10/89

Touch	chair	= 8/8
Touch	sheep	= 8/8
Touch	drum	= 7/8
Touch	cup	= 8/8
Don't Touch	chair	= 8/8
Don't Touch	sheep	= 7/8
Don't Touch	drum	= 8/8
Don't Touch	cup	= 8/8
Touch	<u>mean</u>	= 7.75/8
Don't Touch	<u>mean</u>	= 7.75/8

GENERALIZATION TEST 4 STIMULI; NEGATED MAND TRIALS MIXED WITH ORDINARY MAND TRIALS.

14) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, NO feedback.
11/1/90 + 13/2/90

Touch	dog	= 8/8
Touch	duck	= 8/8
Touch	snail	= 8/8
Touch	chicken	= 8/8
Don't Touch	dog	= 7/8
Don't Touch	duck	= 8/8
Don't Touch	snail	= 8/8
Don't Touch	chicken	= 8/8
Touch	<u>mean</u>	= 8/8
Don't Touch	<u>mean</u>	= 7.75/8

GENERALIZATION TEST 5 STIMULI; NEGATED MAND TRIALS MIXED WITH ORDINARY MAND TRIALS.

15) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, NO feedback.
14/2/90

Touch	flower	= 8/8
Touch	snake	= 8/8
Touch	bone	= 8/8
Touch	car	= 8/8
Don't Touch	flower	= 8/8
Don't Touch	snake	= 8/8
Don't Touch	bone	= 8/8
Don't Touch	car	= 7/8
Touch	<u>mean</u>	= 8/8
Don't Touch	<u>mean</u>	= 7.75/8

SUBJECT: DOMINIC

DATE OF BIRTH: 7/9/86

AGE DURING STUDY: 2yr,8mth to 3yr,2mth

CHECK FOR MAND FUNCTION.

1) "Touch..", with 4 stimuli - all present at once, with feedback.

16/6/89

Touch	pig	= 8/8
Touch	bus	= 8/8
Touch	fork	= 8/8
Touch	tent	= 7/8
Touch	<u>mean</u>	= 7.75/8

NEGATED MAND TRAINING; NEGATED MAND TRIALS MIXED WITH ORDINARY MAND TRIALS.

2) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback.

27/6/89

Touch	pig	= 8/8
Touch	bus	= 8/8
Touch	fork	= 8/8
Touch	tent	= 8/8
Don't Touch	pig	= 8/8
Don't Touch	bus	= 7/8
Don't Touch	fork	= 7/8
Don't Touch	tent	= 7/8
Touch	<u>mean</u>	= 8/8
Don't Touch	<u>mean</u>	= 7.25/8

TEST OF TRAINING STIMULI; NEGATED MANDS ONLY.

3) "Don't Touch..", with 4 stimuli - 2 present at each trail, NO feedback.

5/7/89

Don't Touch	tent	= 8/8
Don't Touch	bus	= 8/8
Don't Touch	pig	= 8/8
Don't Touch	fork	= 8/8
Don't Touch	<u>mean</u>	= 8/8

GENERALIZATION TEST 1; NEGATED MANDS ONLY.

4) "Don't Touch..", with 4 stimuli - 2 present at each trail, NO feedback.

7/7/89

Don't Touch	mouse	= 8/8
Don't Touch	hand	= 7/8
Don't Touch	tap	= 6/8

Don't Touch bed = 7/8
Don't Touch <u>mean</u> = 7/8 (-)

5) "Don't Touch..", with 4 stimuli - 2 present at each trail, NO feedback.

14/7/89 + 1/8/89
Don't Touch mouse = 8/8
Don't Touch hand = 6/8
Don't Touch tap = 3/8
Don't Touch bed = 6/8
Don't Touch <u>mean</u> = 5.75/8

TRAINING OF GENERALIZATION TEST 1 STIMULI; NEGATED MANDS ONLY.

6) "Don't Touch..", with 4 stimuli - 2 present at each trail, with feedback

1/8/89 + 12/9/89
Don't Touch mouse = 8/8
Don't Touch hand = 6/8
Don't Touch tap = 7/8
Don't Touch bed = 5/8
Don't Touch <u>mean</u> = 6.5/8

7) "Don't Touch..", with 4 stimuli - 2 present at each trail, with feedback.

19/9/89
Don't Touch mouse = 5/8
Don't Touch hand = 5/8
Don't Touch tap = 6/8
Don't Touch bed = 5/8
Don't Touch <u>mean</u> = 5.25/8

8) "Don't Touch..", with 4 stimuli - 2 present at each trail, with feedback.

3/10/89 + 11/10/89
Don't Touch mouse = 7/8
Don't Touch hand = 8/8
Don't Touch tap = 5/8
Don't Touch bed = 7/8
Don't Touch <u>mean</u> = 6.75/8

9) "Don't Touch..", with 4 stimuli - 2 present at each trail, with feedback.

12/10/89 + 17/10/89
Don't Touch mouse = 8/8
Don't Touch hand = 8/8
Don't Touch tap = 8/8
Don't Touch bed = 8/8
Don't Touch <u>mean</u> = 8/8

10) "Don't Touch..", with 4 stimuli - 2 present at each trail, NO feedback.

18/10/89 + 14/11/89
Don't Touch mouse = 8/8
Don't Touch hand = 8/8
Don't Touch tap = 8/8
Don't Touch bed = 7/8

Don't Touch	mean	= 7.75/8

GENERALIZATION TEST 2; NEGATED MANDS ONLY.

11) "Don't Touch..", with 4 stimuli - 2 present at each trail, NO feedback.

23/11/89

Don't Touch	pie	= 8/8
Don't Touch	boat	= 8/8
Don't Touch	leaf	= 7/8
Don't Touch	frog	= 8/8
Don't Touch	mean	= 7.75/8

GENERALIZATION TEST 3; NEGATED MAND TRIALS MIXED WITH ORDINARY MAND TRIALS.

12) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, NO feedback.

31/10/89

Touch	chair	= 8/8
Touch	sheep	= 8/8
Touch	drum	= 8/8
Touch	cup	= 8/8
Don't Touch	chair	= 8/8
Don't Touch	sheep	= 8/8
Don't Touch	drum	= 8/8
Don't Touch	cup	= 8/8
Touch	mean	= 8/8
Don't Touch	mean	= 8/8

SUBJECT: SHEILA

DATE OF BIRTH: 5/11/86

AGE DURING STUDY: 2yr,7mth to 3yr,1mth

CHECK FOR MAND FUNCTION.

1) "Touch..", with 4 stimuli - 2 present at each trial, with feedback.

15/5/89

Touch	dog	= 8/8
Touch	bus	= 8/8
Touch	peg	= 8/8
Touch	fish	= 8/8
Touch	<u>mean</u>	= 8/8

NEGATED MAND TRAINING; NEGATED MAND TRIALS MIXED WITH ORDINARY MAND TRIALS; ENGLISH VERSION.

2) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback.

2/6/89 + 5/6/89

Touch	dog	= 8/8
Touch	bus	= 8/8
Touch	peg	= 8/8
Touch	fish	= 8/8
Don't Touch	dog	= 1/8
Don't Touch	bus	= 0/8
Don't Touch	peg	= 1/8
Don't Touch	fish	= 0/8
Touch	<u>mean</u>	= 8/8
Don't Touch	<u>mean</u>	= 0.5/8

NEGATED MAND TRAINING; NEGATED MAND TRIALS MIXED WITH ORDINARY MAND TRIALS; ENGLISH & WELSH VERSION.

3) "Touch.." and "Don't Touch.." (English version immediately followed by the Welsh version), ith 4 stimuli - 2 present at each trial, with feedback.

5/6/89 + 9/6/89 + 12/6/89

Touch	dog	= 8/8
Touch	bus	= 8/8
Touch	peg	= 8/8
Touch	fish	= 8/8
Don't Touch	dog	= 6/8
Don't Touch	bus	= 7/8
Don't Touch	peg	= 6/8
Don't Touch	fish	= 6/8
Touch	<u>mean</u>	= 8/8
Don't Touch	<u>mean</u>	= 6.25/8

4) "Touch.." and "Don't Touch.." (English version immediately followed by the Welsh version), with 4 stimuli - 2 present at each trial, with feedback.

14/6/89 + 16/6/89

Touch	dog	= 8/8
Touch	bus	= 8/8
Touch	peg	= 8/8
Touch	fish	= 8/8
Don't Touch	dog	= 8/8
Don't Touch	bus	= 8/8
Don't Touch	peg	= 8/8
Don't Touch	fish	= 8/8
Touch	<u>mean</u>	= 8/8
Don't Touch	<u>mean</u>	= 8/8

NEGATED MAND TRAINING; NEGATED MAND TRIALS MIXED WITH ORDINARY MAND TRIALS; ENGLISH VERSION.

5) "Touch.." and "Don't Touch.." (English version only), with 4 stimuli - 2 present at each trial, with feedback.

19/6/89 + 21/6/89

Touch	dog	= 8/8
Touch	bus	= 7/8
Touch	peg	= 8/8
Touch	fish	= 8/8
Don't Touch	dog	= 1/8
Don't Touch	bus	= 7/8
Don't Touch	peg	= 0/8
Don't Touch	fish	= 4/8
Touch	<u>mean</u>	= 7.75/8
Don't Touch	<u>mean</u>	= 3/8

NEGATED MAND TRAINING; NEGATED MAND TRIALS ONLY; IN ENGLISH.

6) "Don't Touch.." (English version only), with 4 stimuli - 2 present at each trial, with feedback.

23/6/89

Don't Touch	dog	= 1/8
Don't Touch	bus	= 2/8
Don't Touch	peg	= 3/8
Don't Touch	fish	= 2/8
Don't Touch	<u>mean</u>	= 2/8

7) "Don't Touch.." (English version only), with 4 stimuli - 2 present at each trial, with feedback.

26/6/89

Don't Touch	dog	= 5/8
Don't Touch	bus	= 2/8
Don't Touch	peg	= 3/8
Don't Touch	fish	= 1/8
Don't Touch	<u>mean</u>	= 2.75/8

8) "Don't Touch.." (English version only), with 4 stimuli - 2 present at each trial, with feedback.

28/6/89

Don't Touch	dog	= 4/8
Don't Touch	bus	= 4/8
Don't Touch	peg	= 6/8
Don't Touch	fish	= 2/8

Don't Touch mean = 4/8

9) "Don't Touch.." (English version only),
with 4 stimuli - 2 present at each trial, with feedback.
23/6/89 + 5/7/89
Don't Touch dog = 1/8
Don't Touch bus = 2/8
Don't Touch peg = 3/8
Don't Touch fish = 2/8
Don't Touch mean = 2/8

10) "Don't Touch.." (English version only),
with 4 stimuli - 2 present at each trial, with feedback.
7/7/89
Don't Touch dog = 5/8
Don't Touch bus = 4/8
Don't Touch peg = 4/8
Don't Touch fish = 4/8
Don't Touch mean = 4.25/8

11) "Don't Touch.." (English version only),
with 4 stimuli - 2 present at each trial, with feedback.
10/7/89
Don't Touch dog = 6/8
Don't Touch bus = 4/8
Don't Touch peg = 4/8
Don't Touch fish = 3/8
Don't Touch mean = 4.25/8

12) "Don't Touch.." (English version only),
with 4 stimuli - 2 present at each trial, with feedback.
5/7/89
Don't Touch dog = 3/8
Don't Touch bus = 3/8
Don't Touch peg = 6/8
Don't Touch fish = 4/8
Don't Touch mean = 4/8

13) "Don't Touch.." (English version only),
with 4 stimuli - 2 present at each trial, with feedback.
12/7/89
Don't Touch dog = 1/8
Don't Touch bus = 1/8
Don't Touch peg = 5/8
Don't Touch fish = 4/8
Don't Touch mean = 2.75/8

14) "Don't Touch.." (English version only),
with 4 stimuli - 2 present at each trial, with feedback.
17/7/89
Don't Touch dog = 2/8
Don't Touch bus = 4/8
Don't Touch peg = 5/8
Don't Touch fish = 4/8
Don't Touch mean = 3.75/8

SIMPLE NEGATED MAND TRAINING; TWO STIMULI; ONE NEGATED MAND ONLY;

IN ENGLISH.

15) "Don't Touch.." (English version only), with 2 stimuli, only ONE of which was used with the instruction; with feedback.
(Here, each row represents one whole block of trials.)

8/8/90

Don't Touch	fish	(with peg)	= 4/8	
Don't Touch	fish	(with peg)	= 3/8	L. side pref. correction
Don't Touch	fish	(with peg)	= 4/8	R. side pref. correction
Don't Touch	fish	(with peg)	= 2/8	R. side pref. correction

18/8/90

Don't Touch	fish	(with peg)	= 3/8
Don't Touch	fish	(with peg)	= 4/8
Don't Touch	fish	(with peg)	= 6/8

20/9/89

Don't Touch	fish	(with peg)	= 7/8
Don't Touch	fish	(with peg)	= 5/8

25/6/89

Don't Touch	fish	(with peg)	= 6/8
Don't Touch	fish	(with peg)	= 8/8
Don't Touch	fish	(with peg)	= 7/8

26/9/89

Don't Touch	fish	(with peg)	= 7/8
Don't Touch	fish	(with peg)	= 8/8

29/9/90

Don't Touch	peg	(with fish)	= 6/8
Don't Touch	peg	(with fish)	= 6/8
Don't Touch	peg	(with fish)	= 6/8

2/10/89

Don't Touch	peg	(with fish)	= 6/8
Don't Touch	peg	(with fish)	= 7/8
Don't Touch	peg	(with fish)	= 7/8

4/10/89

Don't Touch	peg	(with fish)	= 6/8
Don't Touch	peg	(with fish)	= 7/8
Don't Touch	peg	(with fish)	= 8/8
Don't Touch	peg	(with fish)	= 8/8

COMBINED SIMPLE NEGATED MAND TRAINING; TWO STIMULI; TWO NEGATED MANDS ONLY; IN ENGLISH.

16) "Don't Touch.." (English version only), with 2 stimuli, BOTH of which where used with the instruction; with feedback.

4/10/89

Don't Touch	fish	= 4/8
Don't Touch	peg	= 2/8
Don't Touch	<u>mean</u>	= 3/8

17) "Don't Touch.." (English version only),
with 2 stimuli, BOTH of which where used with the instruction;
with feedback.
11/10/89
Don't Touch fish = 4/8
Don't Touch peg = 4/8
Don't Touch mean = 4/4

18) "Don't Touch.." (English version only),
with 2 stimuli, BOTH of which where used with the instruction;
with feedback.
13/10/89
Don't Touch fish = 3/8
Don't Touch peg = 5/8
Don't Touch mean = 4/8

19) "Don't Touch.." (English version only),
with 2 stimuli, BOTH of which where used with the instruction;
with feedback.
16/10/89
Don't Touch fish = 4/8
Don't Touch peg = 3/8
Don't Touch mean = 3.5/8

20) "Don't Touch.." (English version only),
with 2 stimuli, BOTH of which where used with the instruction;
with feedback.
20/10/89a
Don't Touch fish = 2/8
Don't Touch peg = 1/8
Don't Touch mean = 1.5/8

21) "Don't Touch.." (English version only),
with 2 stimuli, BOTH of which where used with the instruction;
with feedback.
20/10/89b
Don't Touch fish = 4/8
Don't Touch peg = 4/8
Don't Touch mean = 4/8

SIMPLE NEGATED MAND TRAINING; TWO STIMULI; ONE NEGATED MAND ONLY; IN ENGLISH.

22) "Don't Touch.." (English version only),
with 2 stimuli, only ONE of which was used with the instruction;
with feedback.
(Here, each row represents one whole block of trials.)
3/11/89
Don't Touch fish (with peg) = 3/8
Don't Touch fish (with peg) = 5/8
Don't Touch fish (with peg) = 2/8 R. side pref. correction
Don't Touch fish (with peg) = 4/8 R. side pref. correction

14/11/89
Don't Touch fish (with peg) = 3/8
Don't Touch fish (with peg) = 5/8
Don't Touch fish (with peg) = 4/8

4/12/89a

Don't Touch	fish	(with peg)	= 6/8
Don't Touch	fish	(with peg)	= 8/8
Don't Touch	peg	(with fish)	= 6/8
Don't Touch	peg	(with fish)	= 7/8

EXPERIMENT TERMINATED BY CHILD'S MOTHER.

EXPERIMENT 2

Performance on the trial types; given for each block of trials.

SUBJECT: ELI

DATE OF BIRTH: 25/9/87

AGE DURING STUDY: 2 years, 0 months to 2 years, 9 months.

CHECK FOR MAND FUNCTION.

1) "Touch..", with 4 stimuli - all present at once, with feedback.
11/10/90

Touch	bus	= 8/8
Touch	pig	= 8/8
Touch	tent	= 8/8
Touch	fork	= 8/8
Touch	mean	= 8/8

NEGATED MAND TRAINING; NEGATED MAND TRIALS MIXED WITH ORDINARY MAND TRIALS.

2) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback.
13/10/89 & 17/10/89 & 18/10/89 & 24/10/89a

Touch	bus	= 8/8
Touch	pig	= 7/8
Touch	tent	= 8/8
Touch	fork	= 8/8
Don't Touch	bus	= 2/8
Don't Touch	pig	= 0/8
Don't Touch	tent	= 1/8
Don't Touch	fork	= 1/8
Touch	mean	= 7.75/8
Don't Touch	mean	= 1/8

3) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback.
24/10/89b & 6/11/89 & 9/11/89 & 13/11/89

Touch	bus	= 7/8
Touch	pig	= 6/8
Touch	tent	= 3/8
Touch	fork	= 8/8
Don't Touch	bus	= 2/8
Don't Touch	pig	= 1/8
Don't Touch	tent	= 1/8
Don't Touch	fork	= 6/8
Touch	mean	= 6/8
Don't Touch	mean	= 3.5/8

4) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback.

27/11/89 & 4/12/89 & 7/12/89

Touch	bus	= 8/8
Touch	pig	= 8/8
Touch	tent	= 7/8
Touch	fork	= 8/8
Don't Touch	bus	= 1/8
Don't Touch	pig	= 2/8
Don't Touch	tent	= 2/8
Don't Touch	fork	= 1/8
Touch	<u>mean</u>	= 7.75/8
Don't Touch	<u>mean</u>	= 1.5/8

5) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback.

12/12/89 & 13/12/89

Touch	bus	= 7/8
Touch	pig	= 8/8
Touch	tent	= 8/8
Touch	fork	= 7/8
Don't Touch	bus	= 1/8
Don't Touch	pig	= 2/8
Don't Touch	tent	= 0/8
Don't Touch	fork	= 2/8
Touch	<u>mean</u>	= 7.5/8
Don't Touch	<u>mean</u>	= 1.25/8

6) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback.

15/12/89 & 20/12/89

Touch	bus	= 8/8
Touch	pig	= 8/8
Touch	tent	= 7/8
Touch	fork	= 7/8
Don't Touch	bus	= 3/8
Don't Touch	pig	= 1/8
Don't Touch	tent	= 1/8
Don't Touch	fork	= 1/8
Touch	<u>mean</u>	= 7.5/8
Don't Touch	<u>mean</u>	= 1.5/8

7) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback.

3/1/90 & 8/1/90

Touch	bus	= 8/8
Touch	pig	= 8/8
Touch	tent	= 7/8
Touch	fork	= 7/8
Don't Touch	bus	= 1/8
Don't Touch	pig	= 2/8
Don't Touch	tent	= 0/8
Don't Touch	fork	= 2/8
Touch	<u>mean</u>	= 7.5/8
Don't Touch	<u>mean</u>	= 1.25/8

8) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback.

15/1/90 & 17/1/90 & 19/1/90

Touch	bus	= 7/8
Touch	pig	= 7/8
Touch	tent	= 8/8
Touch	fork	= 8/8
Don't Touch	bus	= 0/8
Don't Touch	pig	= 2/8
Don't Touch	tent	= 2/8
Don't Touch	fork	= 2/8
Touch	<u>mean</u>	= 7.5/8
Don't Touch	<u>mean</u>	= 1.5/8

NEGATED MAND TRAINING; NEGATED MAND TRIALS ONLY.

9) "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback.

22/1/90 & 23/1/90

Don't Touch	bus	= 2/8
Don't Touch	pig	= 2/8
Don't Touch	tent	= 0/8
Don't Touch	fork	= 2/8
Don't Touch	<u>mean</u>	= 1.5/8

10) "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback.

12/2/90

Don't Touch	bus	= 3/8
Don't Touch	pig	= 2/8
Don't Touch	tent	= 4/8
Don't Touch	fork	= 2/8
Don't Touch	<u>mean</u>	= 2.75/8

11) "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback.

14/2/90

Don't Touch	bus	= 2/8
Don't Touch	pig	= 3/8
Don't Touch	tent	= 1/8
Don't Touch	fork	= 4/8
Don't Touch	<u>mean</u>	= 2.5/8

SIMPLE NEGATED MAND TRAINING; TWO STIMULI; TWO INSTRUCTIONS.

12) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback.

26/2/90

Don't Touch	bus	= 1/8
Don't Touch	pig	= 2/8
Don't Touch	<u>mean</u>	= 1.5/8

13) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback.

27/2/90

Don't Touch	bus	= 1/8
Don't Touch	pig	= 4/8
Don't Touch	<u>mean</u>	= 2.5/8

14) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback.

2/3/90

Don't Touch bus = 4/8
Don't Touch pig = 4/8
Don't Touch <u>mean</u> = 4/8

SIMPLE NEGATED MAND TRAINING; TWO STIMULI; ONE NEGATED MAND ONLY.

15) "Don't Touch..", with 2 stimuli - 2 present at each trial, only ONE of which was used as the instruction, with feedback,
(here, each row represents one whole block of trials.)

6/3/90 Stickers awarded every few trials to increase cooperation.

Don't Touch bus (with pig) = 1/8
Don't Touch bus (with pig) = 6/8
Don't Touch bus (with pig) = 4/8
Don't Touch bus (with pig) = 6/8
Don't Touch bus (with pig) = 3/8

7/3/90 Stickers awarded every few trials to increase cooperation.

Don't Touch bus (with pig) = 4/8
Don't Touch bus (with pig) = 3/8
Don't Touch bus (with pig) = 5/8
Don't Touch bus (with pig) = 5/8
Don't Touch bus (with pig) = 7/8
Don't Touch bus (with pig) = 6/8

19/3/90 Stickers awarded every few trials to increase cooperation.

Don't Touch bus (with pig) = 2/8
Don't Touch bus (with pig) = 5/8
Don't Touch bus (with pig) = 7/8 « Side held till approx 4
Don't Touch bus (with pig) = 6/8 « in a row correct, then swapped and repeated.
Don't Touch bus (with pig) = 4/8
Don't Touch bus (with pig) = 5/8

21/3/90 Stickers awarded every few trials to increase cooperation.

Don't Touch bus (with pig) = 7/8 « Side held till approx 4
Don't Touch bus (with pig) = 7/8 « in a row correct, then swapped and repeated.
Don't Touch bus (with pig) = 5/8
Don't Touch bus (with pig) = 6/8
Don't Touch bus (with pig) = 6/8
Don't Touch bus (with pig) = 8/8
Don't Touch bus (with pig) = 7/8 « Side held till approx 4
Don't Touch pig (with bus) = 6/8 « in a row correct, then swapped and repeated.
Don't Touch pig (with bus) = 4/8

23/3/90

Don't Touch bus (with pig) = 5/8

Don't Touch	bus	(with pig)	= 7/8	
Don't Touch	bus	(with pig)	= 8/8	
Don't Touch	pig	(with bus)	= 3/8	
Don't Touch	pig	(with bus)	= 5/8	« Side held till approx 4
Don't Touch	pig	(with bus)	= 6/8	« in a row correct, then
				swapped and repeated.

28/3/90 Toys given every few trials to increase cooperation.

Don't Touch	pig	(with bus)	= 6/8	« Side held till approx 4
Don't Touch	pig	(with bus)	= 8/8	« in a row correct, then
				swapped and repeated.
Don't Touch	pig	(with bus)	= 7/8	« " "
Don't Touch	bus	(with pig)	= 5/8	« " "
Don't Touch	bus	(with pig)	= 8/8	« " "
Don't Touch	bus	(with pig)	= 7/8	
Don't Touch	bus	(with pig)	= 5/8	
Don't Touch	bus	(with pig)	= 6/8	
Don't Touch	bus	(with pig)	= 6/8	
Don't Touch	bus	(with pig)	= 4/8	
Don't Touch	bus	(with pig)	= 5/8	
Don't Touch	bus	(with pig)	= 6/8	

29/3/90 Toys given for approx. every 1 in 4 correct responses. Every incorrect response resulted in a prize being removed.

Don't Touch	bus	(with pig)	= 4/8
Don't Touch	bus	(with pig)	= 6/8
Don't Touch	bus	(with pig)	= 8/8
Don't Touch	pig	(with bus)	= 2/8
Don't Touch	pig	(with bus)	= 7/8
Don't Touch	pig	(with bus)	= 8/8
Don't Touch	bus	(with pig)	= 6/8
Don't Touch	bus	(with pig)	= 8/8
Don't Touch	pig	(with bus)	= 6/8
Don't Touch	pig	(with bus)	= 7/8
Don't Touch	bus	(with pig)	= 6/8
Don't Touch	bus	(with pig)	= 7/8

30/3/90 Toys given for approx. every 1 in 4 correct responses. Every incorrect response resulted in a prize being removed.

Don't Touch	bus	(with pig)	= 7/8
Don't Touch	bus	(with pig)	= 8/8
Don't Touch	pig	(with bus)	= 4/8
Don't Touch	pig	(with bus)	= 8/8
Don't Touch	bus	(with pig)	= 7/8
Don't Touch	pig	(with bus)	= 6/8
Don't Touch	pig	(with bus)	= 7/8
Don't Touch	bus	(with pig)	= 6/8
Don't Touch	bus	(with pig)	= 7/8
Don't Touch	pig	(with bus)	= 4/8
Don't Touch	pig	(with bus)	= 7/8
Don't Touch	bus	(with pig)	= 7/8

3/4/90 Toys given for approx. every 1 in 4 correct responses. Every incorrect response resulted in a prize being removed.

Don't Touch bus (with pig) = 8/8
Don't Touch pig (with bus) = 7/8
Don't Touch bus (with pig) = 7/8
Don't Touch pig (with bus) = 8/8
Don't Touch bus (with pig) = 7/8
Don't Touch pig (with bus) = 8/8

RETURN TO SIMPLE NEGATED MAND TRAINING; TWO STIMULI; TWO INSTRUCTIONS.

16) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback. Toys given for approx. every 1 in 4 correct responses. Every incorrect response resulted in a prize being removed.
3/4/90a
Don't Touch bus = 7/8
Don't Touch pig = 7/8
Don't Touch <u>mean</u> = 7/8

17) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback. Toys given for approx. every 1 in 4 correct responses. Every incorrect response resulted in a prize being removed.
3/4/90b
Don't Touch bus = 7/8
Don't Touch pig = 7/8
Don't Touch <u>mean</u> = 7/8

18) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback. Toys given for approx. every 1 in 4 correct responses. Every incorrect response resulted in a prize being removed.
3/4/90c
Don't Touch bus = 8/8
Don't Touch pig = 7/8
Don't Touch <u>mean</u> = 7.5/8

TEST WITH REMAINING TWO STIMULI FROM BASELINE TASK.

19) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback. Toys given for approx. every 1 in 4 correct responses. Every incorrect response resulted in a prize being removed.
5/4/90a
Don't Touch tent = 8/8
Don't Touch fork = 8/8
Don't Touch <u>mean</u> = 8/8

20) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback. Toys given for approx. every 1 in 4 correct responses. Every incorrect response resulted in a prize being removed.
5/4/90b
Don't Touch tent = 8/8
Don't Touch fork = 7/8
Don't Touch <u>mean</u> = 7.5/8

21) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback. Toys given for approx. every 1 in 8 correct responses. Every incorrect response resulted in a prize being removed.

5/4/90c

Don't Touch	tent = 7/8
Don't Touch	fork = 7/8
Don't Touch	<u>mean</u> = 7/8

TEST WITH ALL BASELINE STIMULI. NEGATED MANDS ONLY.

22) "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback. Toys given for approx. every 1 in 8 correct responses. Every incorrect response resulted in a prize being removed.

6/4/90

Don't Touch	bus = 8/8
Don't Touch	pig = 8/8
Don't Touch	tent = 8/8
Don't Touch	fork = 8/8
Don't Touch	<u>mean</u> = 8/8

TEST WITH ALL BASELINE STIMULI AND BOTH TYPES OF INSTRUCTION.

23) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback. Toys given for approx. every 1 in 4 correct responses. Every incorrect response resulted in a prize being removed.

// Justify this decrease in reinforcement rate - due to a poor performance in the early stages, ad the main objective being to obtain correct responding regardless off the reinforcement frequency. For the latter could be decreased across future sets of trials. Make this into a more general note about he procedure. That if performance was poor in the very simplified single instruction sets, then the reinforcement frequency was increased accordingly.

10/4/90 & 25/4/90

Touch	bus = 5/8
Touch	pig = 1/8
Touch	tent = 2/8
Touch	fork = 2/8
Don't Touch	bus = 5/8
Don't Touch	pig = 5/8
Don't Touch	tent = 8/8
Don't Touch	fork = 7/8
Touch	<u>mean</u> = 2.5/8
Don't Touch	<u>mean</u> = 6.25/8

RETEST WITH ALL BASELINE STIMULI. NEGATED MANDS ONLY.

24) "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback. Toys given for approx. every 1 in 2 correct responses. Every incorrect response resulted in a prize being removed.

27/4/90a

Don't Touch bus = 6/8
Don't Touch pig = 2/8
Don't Touch tent = 3/8
Don't Touch fork = 3/8
Don't Touch <u>mean</u> = 3.5/8

25) "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback. Toys given for approx. every 1 in 2 correct responses. Every incorrect response resulted in a prize being removed.
27/4/90b
Don't Touch bus = 4/8
Don't Touch pig = 0/8
Don't Touch tent = 2/8
Don't Touch fork = 2/8
Don't Touch <u>mean</u> = 2/8

26) "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback. Toys given for approx. every 1 in 2 correct responses. Every incorrect response resulted in a prize being removed.
1/5/90
Don't Touch bus = 3/8
Don't Touch pig = 3/8
Don't Touch tent = 3/8
Don't Touch fork = 5/8
Don't Touch <u>mean</u> = 3.5/8

RETURN TO SIMPLE NEGATED MAND TRAINING; TWO STIMULI; TWO INSTRUCTIONS.

27) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback. A toy was given for every correct response. Every incorrect response resulted in a prize being removed.
2/5/90a
Don't Touch bus = 2/8
Don't Touch pig = 4/8
Don't Touch <u>mean</u> = 3/8

28) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback. A toy was given for every correct response. Every incorrect response resulted in a prize being removed.
2/5/90b
Don't Touch bus = 4/8
Don't Touch pig = 5/8
Don't Touch <u>mean</u> = 4.5/8

29) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback. A toy was given for every correct response. Every incorrect response resulted in a prize being removed.
2/5/90c
Don't Touch bus = 8/8
Don't Touch pig = 6/8
Don't Touch <u>mean</u> = 7/8 (-)

30) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback. A toy was given for every correct response. Every incorrect response resulted in a prize being removed.

2/5/90d

Don't Touch	bus	= 5/8
Don't Touch	pig	= 5/8
Don't Touch	mean	= 5/8

RETURN TO SIMPLE NEGATED MAND TRAINING; TWO STIMULI; ONE NEGATED MAND ONLY.

31) "Don't Touch..", with 2 stimuli - 2 present at each trial, only ONE of which was used as the instruction, with feedback. Toys given for approx. every 1 in 4 correct responses. Every incorrect response resulted in a prize being removed.
(here, each row represents one whole block of trials.)

3/5/90

Don't Touch	pig	(with bus)	= 8/8
Don't Touch	bus	(with pig)	= 7/8
Don't Touch	pig	(with bus)	= 7/8
Don't Touch	bus	(with pig)	= 8/8

RETURN TO SIMPLE NEGATED MAND TRAINING; TWO STIMULI; TWO INSTRUCTIONS.

32) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback. Toys given for approx. every 1 in 4 correct responses. Every incorrect response resulted in a prize being removed.

10/5/90a

Don't Touch	bus	= 5/8
Don't Touch	pig	= 6/8
Don't Touch	mean	= 5.5/8

33) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback. Toys given for approx. every 1 in 2 correct responses. Every incorrect response resulted in a prize being removed.

10/5/90b

Don't Touch	bus	= 3/8
Don't Touch	pig	= 7/8
Don't Touch	mean	= 5/8

34) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback. A toy was given for every correct response. Every incorrect response resulted in a prize being removed.

10/5/90c

Don't Touch	bus	= 6/8
Don't Touch	pig	= 5/8
Don't Touch	mean	= 5.5/8

RETURN TO SIMPLE NEGATED MAND TRAINING; TWO STIMULI; ONE NEGATED MAND ONLY.

35) "Don't Touch..", with 2 stimuli - 2 present at each trial, only ONE of which was used as the instruction, with feedback.

(here, each row represents one whole block of trials.)

11/5/90 Toys given initally for approx. every 1 in 2 correct responses (See each trial block for details). Every incorrect response resulted in a prize being removed.

Don't Touch	pig	(with bus)	= 5/8	«Toys every 1 in 2 correct.
Don't Touch	pig	(with bus)	= 7/8	«Toys every 1 in 2 correct.
Don't Touch	pig	(with bus)	= 5/8	«Toys every 1 in 2 correct.
Don't Touch	pig	(with bus)	= 4/8	«Toys every 1 in 1 correct.
Don't Touch	bus	(with pig)	= 4/8	«Toys every 1 in 1 correct.
Don't Touch	bus	(with pig)	= 2/8	«Toys every 1 in 1 correct.
Don't Touch	bus	(with pig)	= 8/8	«Toys every 1 in 1 correct.
Don't Touch	pig	(with bus)	= 5/8	«Toys every 1 in 1 correct.

14/5/90 Toys given for approx. every 1 in 2 correct responses. Every incorrect response resulted in a prize being removed.

Don't Touch	bus	(with pig)	= 8/8
Don't Touch	pig	(with bus)	= 8/8
Don't Touch	bus	(with pig)	= 7/8
Don't Touch	pig	(with bus)	= 7/8

16/5/90 Toys given initally for approx. every 1 in 2 correct responses (See each trial block for details). Every incorrect response resulted in a prize being removed.

Don't Touch	bus	(with pig)	= 6/8	«Toys every 1 in 2 correct.
Don't Touch	bus	(with pig)	= 8/8	«Toys every 1 in 4 correct.
Don't Touch	pig	(with bus)	= 6/8	«Toys every 1 in 2 correct.
Don't Touch	pig	(with bus)	= 6/8	«Toys every 1 in 2 correct.
Don't Touch	pig	(with bus)	= 8/8	«Toys every 1 in 4 correct.
Don't Touch	bus	(with pig)	= 6/8	«Toys every 1 in 2 correct.
Don't Touch	bus	(with pig)	= 8/8	«Toys every 1 in 4 correct.
Don't Touch	pig	(with bus)	= 8/8	«Toys every 1 in 4 correct.

18/5/90 Toys given for approx. every 1 in 4 correct responses. Every incorrect response resulted in a prize being removed.

Don't Touch	bus	(with pig)	= 8/8
Don't Touch	pig	(with bus)	= 8/8
Don't Touch	bus	(with pig)	= 6/8
Don't Touch	bus	(with pig)	= 8/8
Don't Touch	pig	(with bus)	= 8/8

RETURN TO SIMPLE NEGATED MAND TRAINING; TWO STIMULI; TWO INSTRUCTIONS.

36) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback. Toys given for approx. every 1 in 2 correct responses. Every incorrect response resulted in a prize being removed.

21/5/90a

Don't Touch	bus	= 8/8
Don't Touch	pig	= 6/8
Don't Touch	<u>mean</u>	= 7/8 (-)

37) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback. Toys given for approx. every 1 in 2 correct

responses. Every incorrect response resulted in a prize being removed.

21/5/90a

Don't Touch	bus	= 6/8
Don't Touch	pig	= 6/8
Don't Touch	mean	= 6/8

SIMPLE MAND/NEGATED MAND TRAINING; TWO STIMULI; "NAME.." & "NOT NAME.." INSTRUCTIONS USED.

38) "name.." and "not name..", with 4 stimuli - 2 present at each trial, with feedback.

29/6/90a

name	bus	= 8/8
name	pig	= 8/8
not name	bus	= 8/8
not name	pig	= 7/8
name	mean	= 8/8
not name	mean	= 7.5/8

GENERALIZATION TEST 1; NEGATED MAND TRIALS MIXED WITH ORDINARY MAND TRIALS. "NAME.." & "NOT NAME.." INSTRUCTIONS USED.

39) "name.." and "not name..", with 4 stimuli - 2 present at each trial, NO feedback.

29/6/90b

name	cup	= 7/8
name	drum	= 8/8
name	sheep	= 8/8
name	chair	= 8/8
not name	cup	= 8/8
not name	drum	= 8/8
not name	sheep	= 8/8
not name	chair	= 8/8
name	mean	= 7.75/8
not name	mean	= 8/8

SUBJECT: ALUN

DATE OF BIRTH: 17/1/88

AGE DURING STUDY: 1 year, 8 months to 2 years, 6months

CHECK FOR MAND FUNCTION.

1) "Touch..", with 4 stimuli - all present at once, with feedback.
6/10/90a

Touch	bus	= 8/8
Touch	pig	= 8/8
Touch	tent	= 6/8
Touch	fork	= 8/8
Touch	<u>mean</u>	= 7.5/8 (-)

2) "Touch..", with 4 stimuli - all present at once, with feedback.
6/10/90b

Touch	bus	= 8/8
Touch	pig	= 8/8
Touch	tent	= 7/8
Touch	fork	= 8/8
Touch	<u>mean</u>	= 7.75/8

NEGATED MAND TRAINING; NEGATED MAND TRIALS MIXED WITH ORDINARY MAND TRIALS.

3) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback.
9/10/89 & 16/10/89 & 18/10/89

Touch	bus	= 4/8
Touch	pig	= 7/8
Touch	tent	= 7/8
Touch	fork	= 4/8
Don't Touch	bus	= 0/8
Don't Touch	pig	= 2/8
Don't Touch	tent	= 4/8
Don't Touch	fork	= 4/8
Touch	<u>mean</u>	= 5.5/8
Don't Touch	<u>mean</u>	= 2.5/8

4) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback.
24/10/89 & 27/10/89 & 6/11/09

Touch	bus	= 7/8
Touch	pig	= 8/8
Touch	tent	= 6/8
Touch	fork	= 6/8
Don't Touch	bus	= 1/8
Don't Touch	pig	= 2/8
Don't Touch	tent	= 0/8
Don't Touch	fork	= 2/8
Touch	<u>mean</u>	= 6.75/8
Don't Touch	<u>mean</u>	= 1.25/8

5) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback.

7/11/89 & 24/11/89 & 30/12/89

Touch	bus	= 6/8
Touch	pig	= 8/8
Touch	tent	= 7/8
Touch	fork	= 7/8
Don't Touch	bus	= 1/8
Don't Touch	pig	= 2/8
Don't Touch	tent	= 1/8
Don't Touch	fork	= 0/8
Touch	<u>mean</u>	= 7/8 (-)
Don't Touch	<u>mean</u>	= 1/8

6) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback.

6/12/89 & 18/12/89 & 8/1/90

Touch	bus	= 8/8
Touch	pig	= 8/8
Touch	tent	= 7/8
Touch	fork	= 8/8
Don't Touch	bus	= 2/8
Don't Touch	pig	= 2/8
Don't Touch	tent	= 2/8
Don't Touch	fork	= 2/8
Touch	<u>mean</u>	= 7.75/8
Don't Touch	<u>mean</u>	= 2/8

7) "Touch.." and "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback.

12/1/90 & 15/1/90 & 17/1/90

Touch	bus	= 7/8
Touch	pig	= 8/8
Touch	tent	= 7/8
Touch	fork	= 7/8
Don't Touch	bus	= 5/8
Don't Touch	pig	= 3/8
Don't Touch	tent	= 1/8
Don't Touch	fork	= 2/8
Touch	<u>mean</u>	= 7.25/8
Don't Touch	<u>mean</u>	= 2.75/8

NEGATED MAND TRAINING; NEGATED MAND TRIALS ONLY.

8) "Dont Touch..", with 4 stimuli - 2 present at each trial, with feedback.

30/1/90 & 31/1/90

Don't Touch	bus	= 2/8
Don't Touch	pig	= 0/8
Don't Touch	tent	= 8/8
Don't Touch	fork	= 5/8
Don't Touch	<u>mean</u>	= 3.75/8

9) "Don't Touch..", with 4 stimuli - 2 present at each trial, with feedback.

6/2/90 & 19/2/90

Don't Touch	bus	= 0/8

Don't Touch pig = 1/8
Don't Touch tent = 5/8
Don't Touch fork = 3/8
Don't Touch mean = 2.25/8

10) "Dont Touch..", with 4 stimuli - 2 present at each trial, with feedback. Stickers awarded every few trials to increase cooperation.

2/2/90

Don't Touch bus = 0/8
Don't Touch pig = 1/8
Don't Touch tent = 2/8
Don't Touch fork = 3/8
Don't Touch mean = 1.5/8

SIMPLE NEGATED MAND TRAINING; TWO STIMULI; TWO INSTRUCTIONS.

11) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback.

28/2/90a

Don't Touch bus = 2/8
Don't Touch pig = 2/8
Don't Touch mean = 2/8

12) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback.

28/2/90b

Don't Touch bus = 5/8
Don't Touch pig = 3/8
Don't Touch mean = 4/8

13) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback.

2/3/90

Don't Touch bus = 3/8
Don't Touch pig = 4/8
Don't Touch mean = 3.5/8

SIMPLE NEGATED MAND TRAINING; TWO STIMULI; ONE NEGATED MAND ONLY.

14) "Don't Touch..", with 2 stimuli - 2 present at each trial, only ONE of which was used as the instruction, with feedback.

(here, each row represents one whole block of trials.)

5/3/90

Don't Touch bus (with pig) = 1/8
Don't Touch bus (with pig) = 3/8
Don't Touch bus (with pig) = 4/8
Don't Touch bus (with pig) = 4/8
Don't Touch bus (with pig) = 4/8
Don't Touch bus (with pig) = 8/8
Don't Touch bus (with pig) = 7/8
Don't Touch bus (with pig) = 6/8

21/3/90

Don't Touch bus (with pig) = 1/8 « Side held till approx 4

Don't Touch	bus	(with pig)	= 5/8	« in a row correct, then
Don't Touch	bus	(with pig)	= 5/8	« swapped and repeated.
Don't Touch	bus	(with pig)	= 7/8	« " "
Don't Touch	bus	(with pig)	= 7/8	« " "
Don't Touch	bus	(with pig)	= 4/8	« " "
Don't Touch	bus	(with pig)	= 7/8	« " "
Don't Touch	bus	(with pig)	= 6/8	« " "
Don't Touch	bus	(with pig)	= 5/8	« " "

28/3/90 Toys given for approx. every 1 in 2 correct responses. Every incorrect response resulted in a prize being removed.

Don't Touch	bus	(with pig)	= 3/8	« Side held till approx 4
Don't Touch	bus	(with pig)	= 5/8	« in a row correct, then
Don't Touch	bus	(with pig)	= 2/8	« swapped and repeated.
Don't Touch	bus	(with pig)	= 6/8	« " "
Don't Touch	bus	(with pig)	= 3/8	« " "
Don't Touch	bus	(with pig)	= 4/8	« " "
Don't Touch	bus	(with pig)	= 8/8	« " "
Don't Touch	bus	(with pig)	= 3/8	« " "
Don't Touch	bus	(with pig)	= 6/8	« " "
Don't Touch	bus	(with pig)	= 7/8	« " "
Don't Touch	bus	(with pig)	= 6/8	« " "
Don't Touch	bus	(with pig)	= 2/8	« " "
Don't Touch	bus	(with pig)	= 5/8	« " "

30/3/90 Toys given for approx. every 1 in 2 correct responses. Every incorrect response resulted in a prize being removed.

Don't Touch	pig	(with bus)	= 5/8	« Side held till approx 4
Don't Touch	pig	(with bus)	= 5/8	« in a row correct, then
Don't Touch	pig	(with bus)	= 5/8	« swapped and repeated.
Don't Touch	pig	(with bus)	= 6/8	« " "
Don't Touch	pig	(with bus)	= 7/8	« " "
Don't Touch	pig	(with bus)	= 6/8	
Don't Touch	pig	(with bus)	= 5/8	
Don't Touch	pig	(with bus)	= 5/8	

2/4/90 Toys given for approx. every 1 in 2 correct responses. Every incorrect response resulted in a prize being removed.

Don't Touch	pig	(with bus)	= 2/8
Don't Touch	pig	(with bus)	= 4/8
Don't Touch	pig	(with bus)	= 6/8
Don't Touch	pig	(with bus)	= 7/8
Don't Touch	pig	(with bus)	= 6/8
Don't Touch	pig	(with bus)	= 5/8
Don't Touch	pig	(with bus)	= 7/8
Don't Touch	pig	(with bus)	= 5/8

2/5/90. Toys given initally for approx. every 1 in 2 correct responses (See each trial block for details). Every incorrect response resulted in a prize being removed.

Don't Touch	bus	(with pig)	= 2/8	
Don't Touch	bus	(with pig)	= 6/8	
Don't Touch	bus	(with pig)	= 4/8	«Toys every 1 in 2 correct.
Don't Touch	bus	(with pig)	= 7/8	«Toys every 1 in 2 correct.

Don't Touch bus (with pig) = 8/8 «Toys every 1 in 2 correct.
Don't Touch bus (with pig) = 7/8 «Toys every 1 in 2 correct.
Don't Touch bus (with pig) = 7/8 «Toys every 1 in 2 correct.
Don't Touch bus (with pig) = 4/8 «Toys every 1 in 2 correct.
Don't Touch bus (with pig) = 6/8 «Toys every 1 in 2 correct.

3/5/90a. Toys given for approx. every 1 in 2 correct responses. Every incorrect response resulted in a prize being removed.

Don't Touch pig (with bus) = 6/8
Don't Touch pig (with bus) = 8/8
Don't Touch bus (with pig) = 3/8
Don't Touch bus (with pig) = 8/8
Don't Touch pig (with bus) = 5/8
Don't Touch pig (with bus) = 7/8
Don't Touch bus (with pig) = 7/8

RETURN TO SIMPLE NEGATED MAND TRAINING; TWO STIMULI; TWO INSTRUCTIONS.

15) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback. Toys given for approx. every 1 in 2 correct responses. Every incorrect response resulted in a prize being removed.

3/5/90b
Don't Touch bus = 5/8
Don't Touch pig = 3/8
Don't Touch <u>mean</u> = 4/8

RETURN TO SIMPLE NEGATED MAND TRAINING; TWO STIMULI; ONE NEGATED MAND ONLY.

16) "Don't Touch..", with 2 stimuli - 2 present at each trial, only ONE of which was used as the instruction, with feedback.
(here, each row represents one whole block of trials.)

9/5/90 Toys given for approx. every 1 in 2 correct responses. Every incorrect response resulted in a prize being removed.

Don't Touch pig (with bus) = 6/8
Don't Touch pig (with bus) = 8/8
Don't Touch bus (with pig) = 4/8
Don't Touch bus (with pig) = 5/8
Don't Touch bus (with pig) = 8/8
Don't Touch pig (with bus) = 6/8
Don't Touch pig (with bus) = 7/8
Don't Touch bus (with pig) = 6/8
Don't Touch bus (with pig) = 6/8

14/5/90 Toys given for approx. every 1 in 2 correct responses. Every incorrect response resulted in a prize being removed.

Don't Touch pig (with bus) = 6/8
Don't Touch bus (with pig) = 7/8
Don't Touch pig (with bus) = 3/8
Don't Touch pig (with bus) = 6/8
Don't Touch pig (with bus) = 5/8

16/5/90 Toys given initally for approx. every 1 in 2 correct responses (See each trial block for details). Every incorrect response resulted in a prize being removed.

Don't Touch	bus	(with pig)	= 8/8	
Don't Touch	pig	(with bus)	= 4/8	«Toys every 1 in 4 correct.
Don't Touch	pig	(with bus)	= 6/8	«Toys every 1 in 4 correct.
Don't Touch	pig	(with bus)	= 7/8	«Toys every 1 in 4 correct.
Don't Touch	bus	(with pig)	= 6/8	«Toys every 1 in 2 correct.
Don't Touch	bus	(with pig)	= 8/8	«Toys every 1 in 4 correct.
Don't Touch	pig	(with bus)	= 6/8	«Toys every 1 in 4 correct.

6/6/90 Toys given initally for approx. every 1 in 1 correct responses (See each trial block for details). Every incorrect response resulted in a prize being removed.

Don't Touch	bus	(with pig)	= 7/8	
Don't Touch	pig	(with bus)	= 5/8	
Don't Touch	pig	(with bus)	= 7/8	«Toys every 1 in 2 correct.
Don't Touch	bus	(with pig)	= 7/8	«Toys every 1 in 1 correct.
Don't Touch	pig	(with bus)	= 6/8	«Toys every 1 in 1 correct.
Don't Touch	pig	(with bus)	= 8/8	«Toys every 1 in 2 correct.

RETURN TO SIMPLE NEGATED MAND TRAINING; TWO STIMULI; TWO INSTRUCTIONS.

17) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback. A toy was given for every correct response. Every incorrect response resulted in a prize being removed.
8/6/90a

Don't Touch	bus	= 5/8
Don't Touch	pig	= 5/8
Don't Touch	<u>mean</u>	= 5/8

18) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback. A toy was given for every correct response. Every incorrect response resulted in a prize being removed.
8/6/90b

Don't Touch	bus	= 4/8
Don't Touch	pig	= 6/8
Don't Touch	<u>mean</u>	= 5/8

19) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback. A toy was given for every correct response. Every incorrect response resulted in a prize being removed.
8/6/90c

Don't Touch	bus	= 3/8
Don't Touch	pig	= 5/8
Don't Touch	<u>mean</u>	= 4/8

20) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback. A toy was given for every correct response. Every incorrect response resulted in a prize being removed.
12/6/90a

Don't Touch	bus	= 5/8
Don't Touch	pig	= 5/8
Don't Touch	<u>mean</u>	= 5/8

21) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback. A toy was given for every correct response. Every incorrect response resulted in a prize being removed.
12/6/90b

Don't Touch	bus	= 7/8
Don't Touch	pig	= 6/8
Don't Touch	mean	= 6.5/8

22) "Don't Touch..", with 2 stimuli - 2 present at each trial, with feedback. A toy was given for every correct response. Every incorrect response resulted in a prize being removed.
12/6/90c

Don't Touch	bus	= 3/8
Don't Touch	pig	= 5/8
Don't Touch	mean	= 4/8

TRAINING OF NEGATED MAND TRIALS MIXED WITH ORDINARY MAND TRIALS. "NAME.." & "NOT NAME.." INSTRUCTIONS USED.

23) "name.." and "not name..", with 4 stimuli - 2 present at each trial, with feedback.
18/6/90

name	bus	= 8/8
name	pig	= 8/8
name	tent	= 8/8
name	fork	= 8/8
not name	bus	= 8/8
not name	pig	= 8/8
not name	tent	= 8/8
not name	fork	= 7/8
name	mean	= 8/8
not name	mean	= 7.75/8

TEST OF TRAINING STIMULI; NEGATED MAND TRIALS ONLY; "NOT NAME.." INSTRUCTION USED.

24) "not name..", with 4 stimuli - 2 present at each trial, NO feedback.
20/6/90

not name	bus	= 8/8
not name	pig	= 7/8
not name	tent	= 8/8
not name	fork	= 8/8
not name	mean	= 7.75/8

GENERALIZATION TEST 1; NEGATED MANDS ONLY; "NOT NAME.." INSTRUCTION USED.

25) "not name..", with 4 stimuli - 2 present at each trial, NO feedback.
25/6/90

not name	mouse	= 8/8
not name	hand	= 8/8
not name	bed	= 8/8

not name	tap	= 8/8
not name	mean	= 8/8

GENERALIZATION TEST 2; NEGATED MANDS ONLY; "NOT NAME.." INSTRUCTION USED.

26) "not name..", with 4 stimuli - 2 present at each trial, NO feedback.
4/7/90

not name	pie	= 8/8
not name	boat	= 8/8
not name	leaf	= 7/8
not name	frog	= 8/8
not name	mean	= 7.75/8

GENERALIZATION TEST 3; NEGATED MAND TRIALS MIXED WITH ORDINARY MAND TRIALS. "NAME.." & "NOT NAME.." INSTRUCTIONS USED.

27) "name.." and "not name..", with 4 stimuli - 2 present at each trial, NO feedback.
5/7/90

name	cup	= 8/8
name	sheep	= 8/8
name	chair	= 7/8
name	drum	= 8/8
not name	cup	= 6/8
not name	sheep	= 8/8
not name	chair	= 7/8
not name	drum	= 8/8
name	mean	= 7.75/8
not name	mean	= 7.25/8 (-)

28) "name.." and "not name..", with 4 stimuli - 2 present at each trial, NO feedback.
9/7/90

name	cup	= 8/8
name	sheep	= 8/8
name	chair	= 7/8
name	drum	= 8/8
not name	cup	= 8/8
not name	sheep	= 7/8
not name	chair	= 7/8
not name	drum	= 8/8
name	mean	= 7.75/8
not name	mean	= 7.5/8

GENERALIZATION TEST 3; NEGATED MAND TRIALS MIXED WITH ORDINARY MAND TRIALS. "NAME.." & "NOT NAME.." INSTRUCTIONS USED.

29) "name.." and "not name..", with 4 stimuli - 2 present at each trial, NO feedback.
11/7/90a

name	car	= 8/8
name	bone	= 8/8

name	flower	= 5/8
name	snake	= 8/8
not name	car	= 8/8
not name	bone	= 6/8
not name	flower	= 8/8
not name	snake	= 7/8
name	<u>mean</u>	= 7.25/8 (-)
not name	<u>mean</u>	= 7.25/8 (-)

30) "name.." and "not name..", with 4 stimuli - 2 present at each trial, NO feedback.

11/7/90b

name	car	= 8/8
name	bone	= 7/8
name	flower	= 8/8
name	snake	= 8/8
not name	car	= 7/8
not name	bone	= 7/8
not name	flower	= 8/8
not name	snake	= 8/8
name	<u>mean</u>	= 7.75/8
not name	<u>mean</u>	= 7.5/8

SUBJECT: GARETH

DATE OF BIRTH: 27/5/88

AGE DURING STUDY: 2 years, 0 months to 2 years, 1 month.

CHECK FOR MAND FUNCTION.

1) "Name..", with 4 stimuli - all present at once, with feedback.
25/6/90

Name	bus	= 8/8
Name	pig	= 8/8
Name	tent	= 4/8
Name	fork	= 8/8
Name	<u>mean</u>	= 7/8 (-)

2) "Name..", with 4 stimuli - all present at once, with feedback.
27/6/90

Name	bus	= 8/8
Name	pig	= 7/8
Name	tent	= 7/8
Name	fork	= 8/8
Name	<u>mean</u>	= 7.5/8

NEGATED MAND TRAINING; NEGATED MAND TRIALS MIXED WITH ORDINARY MAND TRIALS.

3) "Name.." and "Not Name..", with 4 stimuli - 2 present at each trial, with feedback.
2/7/90

Name	bus	= 7/8
Name	pig	= 8/8
Name	tent	= 8/8
Name	fork	= 8/8
Not Name	bus	= 8/8
Not Name	pig	= 8/8
Not Name	tent	= 5/8
Not Name	fork	= 7/8
Name	<u>mean</u>	= 7.75/8
Not Name	<u>mean</u>	= 7/8 (-)

TEST OF TRAINING STIMULI; NEGATED MAND TRIALS ONLY.

4) "Not Name..", with 4 stimuli - 2 present at each trial, with feedback.
4/7/90a

Not Name	bus	= 8/8
Not Name	pig	= 6/8
Not Name	tent	= 8/8
Not Name	fork	= 7/8
Not Name	<u>mean</u>	= 7.25/8 (-)

5) "Not Name..", with 4 stimuli - 2 present at each trial, with feedback.

5/7/90

Not Name	bus	= 8/8
Not Name	pig	= 7/8
Not Name	tent	= 7/8
Not Name	fork	= 8/8
Not Name	<u>mean</u>	= 7.5/8

GENERALIZATION TEST 1; NEGATED MANDS ONLY.

6) "Not Name..", with 4 stimuli - 2 present at each trial, NO feedback.

9/7/90

Not Name	pie	= 7/8
Not Name	frog	= 8/8
Not Name	leaf	= 7/8
Not Name	boat	= 8/8
Not Name	<u>mean</u>	= 7.5/8

GENERALIZATION TEST 2; NEGATED MANDS ONLY.

7) "Not Name..", with 4 stimuli - 2 present at each trial, NO feedback.

11/7/90

Not Name	hand	= 7/8
Not Name	tap	= 7/8
Not Name	bed	= 8/8
Not Name	mouse	= 8/8
Not Name	<u>mean</u>	= 7.5/8

GENERALIZATION TEST 3; NEGATED MAND TRIALS MIXED WITH ORDINARY MAND TRIALS.

8) "Name.." and "Not Name..", with 4 stimuli - 2 present at each trial, NO feedback.

19/7/90

Name	sheep	= 8/8
Name	cup	= 8/8
Name	chair	= 8/8
Name	drum	= 8/8
Not Name	sheep	= 8/8
Not Name	cup	= 8/8
Not Name	chair	= 7/8
Not Name	drum	= 7/8
Name	<u>mean</u>	= 8/8
Not Name	<u>mean</u>	= 7.5/8

SUBJECT: MATHEW

DATE OF BIRTH: 29/4/88

AGE DURING STUDY: 2 years, 1 month to 2 years 7 months.

CHECK FOR MAND FUNCTION.

1) "Name..", with 4 stimuli - all present at once, with feedback.

25/6/90

Name	bus	= 8/8
Name	pig	= 8/8
Name	tent	= 7/8
Name	fork	= 8/8
Name	<u>mean</u>	= 7.75/8

NEGATED MAND TRAINING; NEGATED MAND TRIALS MIXED WITH ORDINARY MAND TRIALS.

2) "Name.." and "Not Name..", with 4 stimuli - 2 present at each trial, with feedback.

26/6/90 & 27/6/90

Name	bus	= 8/8
Name	pig	= 8/8
Name	tent	= 7/8
Name	fork	= 7/8
Not Name	bus	= 0/8
Not Name	pig	= 2/8
Not Name	tent	= 0/8
Not Name	fork	= 0/8
Name	<u>mean</u>	= 7.5/8
Not Name	<u>mean</u>	= 0.5/8

NEGATED MAND TRAINING; NEGATED MAND TRIALS ONLY.

3) "Not Name..", with 4 stimuli - 2 present at each trial, with feedback.

28/6/90

Not Name	bus	= 2/8
Not Name	pig	= 2/8
Not Name	tent	= 0/8
Not Name	fork	= 2/8
Not Name	<u>mean</u>	= 1.5/8

SIMPLE NEGATED MAND TRAINING; TWO STIMULI; TWO INSTRUCTIONS.

4) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.

29/6/90a

Not Name	bus	= 2/8
Not Name	pig	= 1/8
Not Name	<u>mean</u>	= 1.5/8

5) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.
29/6/90b

Not Name	bus	= 1/8
Not Name	pig	= 2/8
Not Name	mean	= 1.5/8

6) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.
29/6/90c

Not Name	bus	= 1/8
Not Name	pig	= 1/8
Not Name	mean	= 1/8

7) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.
2/7/90a

Not Name	bus	= 1/8
Not Name	pig	= 4/8
Not Name	mean	= 2.5/8

8) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.
2/7/90b

Not Name	bus	= 4/8
Not Name	pig	= 4/8
Not Name	mean	= 4/8

9) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.
2/7/90c

Not Name	bus	= 3/8
Not Name	pig	= 5/8
Not Name	mean	= 4/8

10) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.
2/7/90d

Not Name	bus	= 3/8
Not Name	pig	= 5/8
Not Name	mean	= 4/8

11) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.
2/7/90e

Not Name	bus	= 6/8
Not Name	pig	= 3/8
Not Name	mean	= 4.5/8

12) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.
2/7/90f

Not Name	bus	= 3/8
Not Name	pig	= 4/8
Not Name	mean	= 3.5/8

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13) "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used as the instruction, with feedback.
(here, each row represents one whole block of trials.)

3/7/90

Not Name	bus	(with pig)	= 7/8
Not Name	pig	(with bus)	= 5/8
Not Name	pig	(with bus)	= 7/8
Not Name	bus	(with pig)	= 4/8
Not Name	bus	(with pig)	= 6/8
Not Name	bus	(with pig)	= 6/8

4/7/90

Not Name	pig	(with bus)	= 8/8
Not Name	bus	(with pig)	= 8/8
Not Name	pig	(with bus)	= 8/8
Not Name	bus	(with pig)	= 6/8
Not Name	bus	(with pig)	= 7/8

5/7/90a

Not Name	pig	(with bus)	= 8/8
Not Name	bus	(with pig)	= 5/8
Not Name	bus	(with pig)	= 8/8

RETURN TO SIMPLE NEGATED MAND TRAINING; TWO STIMULI; TWO INSTRUCTIONS.

14) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.

5/7/90b

Not Name	bus	= 8/8
Not Name	pig	= 6/8
Not Name	<u>mean</u>	= 7/8 (-)

15) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.

5/7/90c

Not Name	bus	= 7/8
Not Name	pig	= 3/8
Not Name	<u>mean</u>	= 5/8

16) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.

9/7/90a

Not Name	bus	= 8/8
Not Name	pig	= 8/8
Not Name	<u>mean</u>	= 8/8

17) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.

9/7/90b

Not Name	bus	= 8/8
Not Name	pig	= 8/8
Not Name	<u>mean</u>	= 8/8

TEST WITH REMAINING TWO STIMULI FROM BASELINE TASK; TWO INSTRUCTIONS

18) "Not Name..", with 2 stimuli - 2 present at each
    trial, with feedback.
    10/7/90a
    Not Name   tent = 8/8
    Not Name   fork = 8/8
    Not Name   <u>mean</u> = 8/8

19) "Not Name..", with 2 stimuli - 2 present at each
    trial, with feedback.
    10/7/90b
    Not Name   tent = 7/8
    Not Name   fork = 8/8
    Not Name   <u>mean</u> = 7.5/8

TEST WITH ALL BASELINE STIMULI; NEGATED MANDS ONLY.

20) "Not Name..", with 4 stimuli - 2 present at each
    trial, with feedback.
    11/7/90
    Not Name   bus = 8/8
    Not Name   pig = 8/8
    Not Name   tent = 7/8
    Not Name   fork = 8/8
    Not Name   <u>mean</u> = 7.75/8

21) "Not Name..", with 4 stimuli - 2 present at each
    trial, with feedback.
    12/7/90
    Not Name   bus = 8/8
    Not Name   pig = 8/8
    Not Name   tent = 7/8
    Not Name   fork = 6/8
    Not Name   <u>mean</u> = 7.25/8 (-)

22) "Not Name..", with 4 stimuli - 2 present at each
    trial, with feedback.
    18/7/90
    Not Name   bus = 8/8
    Not Name   pig = 8/8
    Not Name   tent = 7/8
    Not Name   fork = 8/8
    Not Name   <u>mean</u> = 7.75/8

GENERALIZATION TEST 1; NEGATED MANDS ONLY

23) "Not Name..", with 4 stimuli - 2 present at each
    trial, with feedback.
    19/7/90a
    Not Name   leaf = 6/8
    Not Name   pie = 6/8
    Not Name   frog = 8/8
    Not Name   boat = 8/8
    Not Name   <u>mean</u> = 7/8 (-)

TRAINING OF GENERALIZATION TEST 1 STIMULI; NEGATED MANDS ONLY.

24) "Not Name..", with 4 stimuli - 2 present at each
trial, with feedback.
19/7/90b

Not Name	leaf = 6/8
Not Name	pie = 7/8
Not Name	frog = 8/8
Not Name	boat = 8/8
Not Name	mean = 7.25/8 (-)

25) "Not Name..", with 4 stimuli - 2 present at each
trial, with feedback.
20/7/90

Not Name	leaf = 8/8
Not Name	pie = 7/8
Not Name	frog = 8/8
Not Name	boat = 7/8
Not Name	mean = 7.5/8

GENERALIZATION TEST 2 ; NEGATED MANDS ONLY.

26) "Not Name..", with 4 stimuli - 2 present at each
trial, with feedback.
23/7/90

Not Name	hand = 8/8
Not Name	bed = 8/8
Not Name	mouse = 8/8
Not Name	tap = 7/8
Not Name	mean = 7.75/8

GENERALIZATION TEST 3; NEGATED MANDS ONLY.

27) "Not Name..", with 4 stimuli - 2 present at each
trial, with feedback.
24/7/90

Not Name	chair = 7/8
Not Name	sheep = 8/8
Not Name	drum = 7/8
Not Name	cup = 7/8
Not Name	mean = 7.25/8

GENERALIZATION TEST 4; NEGATED MANDS TRIALS MIXED WITH ORDINARY MAND TRIALS.

28) "Name.." and "Not Name..", with 4 stimuli - 2 present at each
trial, with feedback.
25/7/90

Name	car = 8/8
Name	bone = 1/8
Name	flower = 1/8
Name	snake = 0/8
Not Name	car = 4/8
Not Name	bone = 8/8
Not Name	flower = 8/8

Not Name	snake	= 8/8
Name	mean	= 2.5/8
Not Name	mean	= 7/8 (-)

29) "Name.." and "Not Name..", with 4 stimuli - 2 present at each trial, with feedback.

26/7/90

Name	car	= 3/8
Name	bone	= 2/8
Name	flower	= 1/8
Name	snake	= 0/8
Not Name	car	= 7/8
Not Name	bone	= 8/8
Not Name	flower	= 8/8
Not Name	snake	= 8/8
Name	mean	= 1.5/8
Not Name	mean	= 7.75/8

SIMPLE TRAINING OF GENERALIZATION TEST 4 STIMULI; TWO STIMULI; NEGATED MANDS TRIALS MIXED WITH ORDINARY MAND TRIALS.

30) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.

31/7/90

Name	car	= 3/8
Name	snake	= 3/8
Not Name	car	= 5/8
Not Name	snake	= 5/8
Name	mean	= 3/8
Not Name	mean	= 5/8

SIMPLE TRAINING OF GENERALIZATION TEST 4 STIMULI; TWO STIMULI; TWO INSTRUCTIONS.

31) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback.

1/8/90a

Name	car	(with snake) = 7/8
Not Name	car	(with snake) = 4/8

32) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback.

1/8/90b

Name	car	(with snake) = 4/8
Not Name	car	(with snake) = 7/8

33) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback.

1/8/90c

Name	car	(with snake) = 2/8
Not Name	car	(with snake) = 5/8

34) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback.

3/8/90a

Name	car	(with snake) = 8/8

Not Name car (with snake) = 3/8

35) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback.
3/8/90b
Name car (with snake) = 6/8
Not Name car (with snake) = 4/8

SIMPLE TRAINING OF GENERALIZATION TEST 4 STIMULI; TWO STIMULI; ONE INSTRUCTION.

36) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback. Each instruction was continued until at least 3 correct responses in a row were obtained, then the other instruction was given in this way.
14/10/90
car (with snake) = 7/8
car (with snake) = 6/8
car (with snake) = 5/8
car (with snake) = 6/8

17/10/90
car (with snake) = 4/8
car (with snake) = 6/8
car (with snake) = 6/8
car (with snake) = 8/8
car (with snake) = 6/8
car (with snake) = 7/8
car (with snake) = 6/8
car (with snake) = 6/8

SIMPLE TRAINING OF GENERALIZATION TEST 4 STIMULI; TWO STIMULI; TWO INSTRUCTIONS.

37) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback.
18/10/90a
Name car (with snake) = 5/8
Not Name car (with snake) = 7/8

38) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback.
18/10/90b
Name car (with snake) = 6/8
Not Name car (with snake) = 5/8

39) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback.
29/10/90a
Name car (with snake) = 5/8
Not Name car (with snake) = 6/8

40) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback.
29/10/90b

Name car (with snake) = 7/8
Not Name car (with snake) = 5/8

41) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback.
29/10/90c
Name car (with snake) = 6/8
Not Name car (with snake) = 6/8

SIMPLE TRAINING OF GENERALIZATION TEST 4 STIMULI; TWO STIMULI; TWO INSTRUCTIONS. INTONATION OF INSTRUCTIONS;

42) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback. Plus intonation variation of instruction.
30/10/90a
Name car (with snake) = 7/8
Not Name car (with snake) = 5/8

43) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback. Plus intonation variation of instruction.
30/10/90b
Name car (with snake) = 8/8
Not Name car (with snake) = 6/8

44) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback. Plus intonation variation of instruction.
30/10/90c
Name car (with snake) = 7/8
Not Name car (with snake) = 8/8

45) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback. Plus intonation variation of instruction.
6/11/90a
Name car (with snake) = 8/8
Not Name car (with snake) = 5/8

46) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback. Plus intonation variation of instruction.
6/11/90b
Name car (with snake) = 8/8
Not Name car (with snake) = 6/8

47) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback. Plus intonation variation of instruction.
8/11/90a
Name car (with snake) = 7/8
Not Name car (with snake) = 8/8

48) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback.

Plus intonation variation of instruction.

8/11/90b

Name car (with snake) = 7/8

Not Name car (with snake) = 6/8

49) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback. Toy given at end of every trial block. Plus intonation variation of instruction.

12/11/90a

Name car (with snake) = 8/8

Not Name car (with snake) = 8/8

50) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback. Toy given at end of every trial block. Plus intonation variation of instruction.

12/11/90b

Name car (with snake) = 7/8

Not Name car (with snake) = 8/8

51) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback. Toy given at end of every trial block. Plus intonation variation of instruction.

12/11/90c

Name car (with snake) = 8/8

Not Name car (with snake) = 8/8

SIMPLE TRAINING OF GENERALIZATION TEST 4 STIMULI; TWO STIMULI; TWO INSTRUCTIONS; ELONGATED "NOT.." INSTRUCTION.

52) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback. Toy given at end of every trial block. Plus elongated "not..".

13/11/90a

Name car (with snake) = 5/8

Not Name car (with snake) = 2/8

53) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback. Toy given at end of every trial block. Plus elongated "not".

13/11/90b

Name car (with snake) = 7/8

Not Name car (with snake) = 1/8

54) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback. Toy given at end of every trial block. Plus elongated "not".

13/11/90c

Name car (with snake) = 2/8

Not Name car (with snake) = 5/8

55) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback. Toy given at end of every trial block. Plus elongated "not".

14/11/90a

Name car (with snake) = 4/8
Not Name car (with snake) = 5/8

56) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback. Toy given at end of every trial block. Plus elongated "not".

14/11/90b
Name car (with snake) = 4/8
Not Name car (with snake) = 4/8

57) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback. Toy given at end of every trial block. Plus elongated "not".

14/11/90c
Name car (with snake) = 7/8
Not Name car (with snake) = 3/8

58) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback. Toy given at end of every trial block. Plus elongated "not".

16/11/90a
Name car (with snake) = 7/8
Not Name car (with snake) = 2/8

59) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback. Toy given at end of every trial block. Plus elongated "not".

16/11/90b
Name car (with snake) = 5/8
Not Name car (with snake) = 0/8

60) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback. Toy given at end of every trial block. Plus elongated "not".

16/11/90c
Name car (with snake) = 6/8
Not Name car (with snake) = 3/8

RETURN TO SIMPLE TRAINING OF GENERALIZATION TEST 4 STIMULI; TWO STIMULI; TWO INSTRUCTIONS; INTONATION OF INSTRUCTIONS.

61) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback. Toy given at end of every trial block. Plus intonation variation of instruction.

21/11/90a
Name car (with snake) = 7/8
Not Name car (with snake) = 8/8

62) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback. Toy given at end of every trial block. Plus intonation variation of instruction.

21/11/90b
Name car (with snake) = 8/8
Not Name car (with snake) = 8/8

63) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback. Toy given at end of every trial block. Plus intonation variation of instruction.

21/11/90c

Name	car	(with snake) = 8/8
Not Name	car	(with snake) = 8/8

SIMPLE TRAINING OF GENERALIZATION TEST 4 STIMULI; TWO STIMULI; TWO INSTRUCTIONS; INTONATION OF INSTRUCTIONS. CORRECT AND INCORRECT STIMULI REVERSED.

64) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback. Toy given at end of every trial block. Plus intonation variation of instruction.

21/11/90d

Name	snake	(with car) = 8/8
Not Name	snake	(with car) = 8/8

SIMPLE TRAINING OF GENERALIZATION TEST 4 STIMULI; TWO STIMULI; TWO INSTRUCTIONS; INTONATION OF INSTRUCTIONS. CORRECT AND INCORRECT STIMULI REVERSED.

65) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback. Toy given at end of every trial block. Plus intonation variation of instruction.

21/11/90e

Name	car	(with snake) = 8/8
Not Name	car	(with snake) = 8/8

SIMPLE TRAINING OF GENERALIZATION TEST 4 STIMULI; TWO STIMULI; TWO INSTRUCTIONS; INTONATION OF INSTRUCTIONS. CORRECT AND INCORRECT STIMULI REVERSED.

66) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, only ONE of which was used in the instruction, with feedback. Toy given at end of every trial block. Plus intonation variation of instruction.

21/11/90f

Name	snake	(with car) = 8/8
Not Name	snake	(with car) = 8/8

RETURN TO SIMPLE TRAINING OF GENERALIZATION TEST 4 STIMULI; TWO STIMULI; NEGATED MANDS TRIALS MIXED WITH ORDINARY MAND TRIALS.

67) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, with feedback. Toy given at end of every trial block. Plus intonation variation of instruction.

22/11/90

Name	car	= 8/8

Name	snake	= 8/8
Not Name	car	= 8/8
Not Name	snake	= 8/8
Name	<u>mean</u>	= 8/8
Not Name	<u>mean</u>	= 8/8

TEST OF REMAINING GENERALIZATION TEST 4 STIMULI; TWO STIMULI; NEGATED MANDS TRIALS MIXED WITH ORDINARY MAND TRIALS.

68) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, with feedback. Plus intonation variation of instruction.

23/11/90

Name	flower	= 8/8
Name	bone	= 8/8
Not Name	flower	= 8/8
Not Name	bone	= 8/8
Name	<u>mean</u>	= 8/8
Not Name	<u>mean</u>	= 8/8

RETURN TO TRAINING OF ALL GENERALIZATION TEST 4 STIMULI; FOUR STIMULI; NEGATED MANDS TRIALS MIXED WITH ORDINARY MAND TRIALS.

69) "Name.." and "Not Name..", with 4 stimuli - 2 present at each trial, with feedback. Plus intonation variation of instruction.

26/11/90

Name	car	= 8/8
Name	snake	= 8/8
Name	bone	= 8/8
Name	flower	= 8/8
Not Name	car	= 8/8
Not Name	snake	= 8/8
Not Name	bone	= 8/8
Not Name	flower	= 8/8
Name	<u>mean</u>	= 8/8
Not Name	<u>mean</u>	= 8/8

TEST OF ALL GENERALIZATION TEST 4 STIMULI; FOUR STIMULI; NEGATED MANDS TRIALS MIXED WITH ORDINARY MAND TRIALS.

70) "Name.." and "Not Name..", with 4 stimuli - 2 present at each trial, NO feedback. Plus intonation variation of instruction.

26/11/90

Name	car	= 8/8
Name	snake	= 8/8
Name	bone	= 8/8
Name	flower	= 8/8
Not Name	car	= 7/8
Not Name	snake	= 8/8
Not Name	bone	= 8/8
Not Name	flower	= 8/8
Name	<u>mean</u>	= 8/8
Not Name	<u>mean</u>	= 7.75/8

GENERALIZATION TEST 5; FOUR STIMULI; NEGATED MANDS TRIALS MIXED WITH ORDINARY MAND TRIALS.

71) "Name.." and "Not Name..", with 2 stimuli - 2 present at each trial, NO feedback. Plus intonation variation of instruction.

29/11/90

Name	ball	= 8/8
Name	clock	= 8/8
Name	pencil	= 8/8
Name	shoe	= 8/8
Not Name	ball	= 7/8
Not Name	clock	= 8/8
Not Name	pencil	= 7/8
Not Name	shoe	= 8/8
Name	<u>mean</u>	= 8/8
Not Name	<u>mean</u>	= 7.5/8

SUBJECT: JENNY

DATE OF BIRTH: 7/2/88

AGE DURING STUDY: 2 years, 4 months to 2 years 5 months.

CHECK FOR MAND FUNCTION.

1) "Name..", with 4 stimuli - all present at once, with feedback.

25/6/90

Name	bus	= 8/8
Name	pig	= 8/8
Name	tent	= 8/8
Name	fork	= 8/8
Name	<u>mean</u>	= 8/8

NEGATED MAND TRAINING; NEGATED MAND TRIALS MIXED WITH ORDINARY MAND TRIALS.

2) "Name.." and "Not Name..", with 4 stimuli - 2 present at each trial, with feedback.

27/6/90

Name	bus	= 8/8
Name	pig	= 8/8
Name	tent	= 7/8
Name	fork	= 8/8
Not Name	bus	= 0/8
Not Name	pig	= 1/8
Not Name	tent	= 2/8
Not Name	fork	= 1/8
Name	<u>mean</u>	= 7.75/8
Not Name	<u>mean</u>	= 1/8

NEGATED MAND TRAINING; NEGATED MAND TRIALS ONLY.

3) "Not Name..", with 4 stimuli - 2 present at each trial, with feedback.

2/7/90a

Not Name	bus	= 3/8
Not Name	pig	= 2/8
Not Name	tent	= 1/8
Not Name	fork	= 1/8
Not Name	<u>mean</u>	= 1.75/8

SIMPLE NEGATED MAND TRAINING; TWO STIMULI; TWO INSTRUCTIONS.

4) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.

2/7/90b

Not Name	bus	= 2/8
Not Name	pig	= 2/8
Not Name	<u>mean</u>	= 2/8

5) "Not Name..", with 2 stimuli - 2 present at each
trial, with feedback.
2/7/90c

Not Name	bus	= 2/8
Not Name	pig	= 3/8
Not Name	mean	= 2.5/8

6) "Not Name..", with 2 stimuli - 2 present at each
trial, with feedback.
2/7/90d

Not Name	bus	= 3/8
Not Name	pig	= 4/8
Not Name	mean	= 3.5/8

7) "Not Name..", with 2 stimuli - 2 present at each
trial, with feedback.
2/7/90e

Not Name	bus	= 5/8
Not Name	pig	= 3/8
Not Name	mean	= 4/8

8) "Not Name..", with 2 stimuli - 2 present at each
trial, with feedback.
2/7/90f

Not Name	bus	= 4/8
Not Name	pig	= 3/8
Not Name	mean	= 3.5/8

9) "Not Name..", with 2 stimuli - 2 present at each
trial, with feedback.
2/7/90g

Not Name	bus	= 2/8
Not Name	pig	= 3/8
Not Name	mean	= 2.5/8

SIMPLE NEGATED MAND TRAINING; TWO STIMULI; ONE NEGATED MAND ONLY.

10) "Not Name..", with 2 stimuli - 2 present at each
trial, only ONE of which was used as the instruction,
with feedback.
(here, each row represents one whole block of trials.)
4/7/90

Not Name	bus	(with pig)	= 7/8
Not Name	pig	(with bus)	= 5/8
Not Name	pig	(with bus)	= 8/8
Not Name	bus	(with pig)	= 5/8
Not Name	bus	(with pig)	= 5/8
Not Name	bus	(with pig)	= 5/8
Not Name	bus	(with pig)	= 5/8

5/7/90a

Not Name	bus	(with pig)	= 8/8
Not Name	pig	(with bus)	= 7/8

RETURN TO SIMPLE NEGATED MAND TRAINING; TWO STIMULI; TWO INSTRUCTIONS.

11) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.

5/7/90b

Not Name bus = 6/8

Not Name pig = 7/8

Not Name <u>mean</u> = 6.5/8

12) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.

5/7/90c

Not Name bus = 4/8

Not Name pig = 3/8

Not Name <u>mean</u> = 3.5/8

13) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.

5/7/90d

Not Name bus = 3/8

Not Name pig = 3/8

Not Name <u>mean</u> = 3/8

14) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.

9/7/90

Not Name bus = 8/8

Not Name pig = 5/8

Not Name <u>mean</u> = 6.5/8

15) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.

9/7/90b

Not Name bus = 5/8

Not Name pig = 6/8

Not Name <u>mean</u> = 5.5/8

16) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.

9/7/90c

Not Name bus = 4/8

Not Name pig = 4/8

Not Name <u>mean</u> = 4/8

17) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.

11/7/90a

Not Name bus = 8/8

Not Name pig = 5/8

Not Name <u>mean</u> = 6.5/8

18) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.

11/7/90b

Not Name bus = 6/8

Not Name pig = 7/8

Not Name <u>mean</u> = 6.5/8

19) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.

11/7/90c
Not Name bus = 7/8
Not Name pig = 7/8
Not Name mean = 7/8

20) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.
19/7/90a
Not Name bus = 6/8
Not Name pig = 8/8
Not Name mean = 7/8

21) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.
19/7/90b
Not Name bus = 8/8
Not Name pig = 7/8
Not Name mean = 7.5/8

TEST WITH REMAINING TWO STIMULI FROM BASELINE TASK.

22) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.
23/7/90a
Not Name fork = 8/8
Not Name tent = 7/8
Not Name mean = 7.5/8

TEST ALL BASELINE STIMULI; NEGATED INSTRUCTIONS ONLY.

23) "Not Name..", with 4 stimuli - 2 present at each trial, with feedback.
23/7/90b
Not Name bus = 4/8
Not Name pig = 4/8
Not Name tent = 7/8
Not Name fork = 5/8
Not Name mean = 5/8

RETURN TO SIMPLE NEGATED MAND TRAINING; TWO STIMULI; TWO INSTRUCTIONS.

24) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.
26/7/90a
Not Name bus = 4/8
Not Name pig = 5/8
Not Name mean = 4.5/8

25) "Not Name..", with 2 stimuli - 2 present at each trial, with feedback.
26/7/90b
Not Name bus = 5/8
Not Name pig = 5/8
Not Name mean = 5/8

EXPERIMENT TERMINATED BY CHILD'S MOTHER.

EXPERIMENT 3

<u>Performance on the trial types, for each block of trials.</u>

SUBJECT: CLAIRE

DATE OF BIRTH: 18/10/86

AGE DURING STUDY: 3 years, 3 months to 3 years, 6 months.

BASELINE TRIAL BLOCKS

1) 24/1/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 6/8
BELT - HOUSE	= 3/8
FLAG - CAT	= 4/8
FOOT - MOON	= 4/8
<u>mean</u>	= 4.25/8

2) 31/1/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 7/8
BELT - HOUSE	= 3/8
FLAG - CAT	= 6/8
FOOT - MOON	= 3/8
<u>mean</u>	= 6/8

3) 14/2/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 6/8
BELT - HOUSE	= 3/8
FLAG - CAT	= 0/8
FOOT - MOON	= 4/8
<u>mean</u>	= 3.25/8

PLUS PROMPT FROM EXPERIMENTER.

4) 18/2/90 & 25/2/90a
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 7/8
BELT - HOUSE	= 4/8
FLAG - CAT	= 6/8
FOOT - MOON	= 3/8
<u>mean</u>	= 5/8

5) 25/2/90b
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 8/8

BELT - HOUSE = 5/8
FLAG - CAT = 7/8
FOOT - MOON = 5/8
<u>mean</u> = 6.25/8

6) 28/2/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 8/8
BELT - HOUSE	= 7/8
FLAG - CAT	= 7/8
FOOT - MOON	= 8/8
<u>mean</u>	= 7.5/8

7) 1/3/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 8/8
BELT - HOUSE	= 7/8
FLAG - CAT	= 7/8
FOOT - MOON	= 8/8
<u>mean</u>	= 7.5/8

NO PROMPT FROM EXPERIMENTER.

8) 4/3/90
4 Instruction "When its the ..., touch the ...", with feedback.
Conditional stimulus pairs:

KING - BUCKET	= 8/8
BELT - HOUSE	= 8/8
FLAG - CAT	= 7/8
FOOT - MOON	= 8/8
<u>mean</u>	= 7.75/8

9) 7/3/90a
4 Instruction "When its the ..., touch the ...", with feedback.
Conditional stimulus pairs:

KING - BUCKET	= 8/8
BELT - HOUSE	= 7/8
FLAG - CAT	= 8/8
FOOT - MOON	= 8/8
<u>mean</u>	= 7.75/8

10) 7/3/90b
4 Instruction "When its the ..., touch the ...", with feedback.
Conditional stimulus pairs:

KING - BUCKET	= 8/8
BELT - HOUSE	= 7/8
FLAG - CAT	= 8/8
FOOT - MOON	= 8/8
<u>mean</u>	= 7.75/8

GENERALIZATION TEST 1, WITH FEEDBACK.

11) 14/3/90
Instruction "When its the ..., touch the ...", with feedback.

4 Conditional stimulus pairs:

CHAIR - MOUSE	= 3/8
SHEEP - HAND	= 5/8
DRUM - TAP	= 2/8
CUP - BED	= 4/8
<u>mean</u>	= 3.5/8

12) 15/3/90
4 Instruction "When its the ..., touch the ...", with feedback.
Conditional stimulus pairs:

CHAIR - MOUSE	= 7/8
SHEEP - HAND	= 6/8
DRUM - TAP	= 6/8
CUP - BED	= 8/8
<u>mean</u>	= 6.75/8

13) 20/3/90
4 Instruction "When its the ..., touch the ...", with feedback.
Conditional stimulus pairs:

CHAIR - MOUSE	= 7/8
SHEEP - HAND	= 8/8
DRUM - TAP	= 7/8
CUP - BED	= 8/8
<u>mean</u>	= 7.5/8

GENERALIZATION TEST 2, WITH FEEDBACK.

14) 27/3/90a
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

PIE - BUS	= 8/8
LEAF - FORK	= 8/8
BOAT - PIG	= 5/8
FROG - TENT	= 5/8
<u>mean</u>	= 6.5/8

15) 27/3/90B
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

PIE - BUS	= 8/8
LEAF - FORK	= 8/8
BOAT - PIG	= 8/8
FROG - TENT	= 8/8
<u>mean</u>	= 8/8

GENERALIZATION TEST 3, WITH FEEDBACK.

16) 28/3/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

SNAKE - CLOCK	= 7/8
FLOWER - SPOON	= 7/8
BONE - SHOE	= 8/8
CAR - PENCIL	= 8/8
<u>mean</u>	= 7.5/8

GENERALIZATION TEST 4, WITH FEEDBACK.

17) 29/3/90a
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

BALL - HAT	= 5/8
TRAIN - APPLE	= 8/8
BANANA - HORSE	= 7/8
TREE - BOOK	= 8/8
<u>mean</u>	= 7/8 (-)

18) 29/3/90b
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

BALL - HAT	= 8/8
TRAIN - APPLE	= 8/8
BANANA - HORSE	= 8/8
TREE - BOOK	= 8/8
<u>mean</u>	= 8/8

GENERALIZATION TEST 5, WITH FEEDBACK.

19) 3/4/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

SNAIL - GLASSES	= 7/8
PEG - WINDOW	= 7/8
DOG - STAR	= 8/8
CHICKEN - BIKE	= 7/8
<u>mean</u>	= 7.25/8

GENERALIZATION TEST 6, WITH FEEDBACK.

20) 4/4/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

LETTER - BATH	= 8/8
SUN - DUCK	= 8/8
PLANE - FISH	= 8/8
SCISSORS - CAMERA	= 8/8
<u>mean</u>	= 8/8

GENERALIZATION TEST 7, NO FEEDBACK.

21) 10/4/90
Instruction "When its the ..., touch the ...", NO feedback.
4 Conditional stimulus pairs:

MUSHROOM - TEAPOT	= 8/8
EGG - FIRE	= 8/8
ICECREAM - KNIFE	= 8/8
CHERRY - HAMMER	= 8/8
<u>mean</u>	= 8/8

GENERALIZATION TEST 8, NO FEEDBACK.

22) 18/4/90
Instruction "When its the ..., touch the ...", NO feedback.
4 Conditional stimulus pairs:

CASTLE - SNOWMAN	= 8/8
TV - SAW	= 8/8
KEY - RABBIT	= 7/8
BOTTLE - KITE	= 7/8
mean	= 7.5/8

GENERALIZATION TEST 9, NO FEEDBACK.

23) 29/4/90a
Instruction "When its the ..., touch the ...", NO feedback.
4 Conditional stimulus pairs:

PHONE - CARROT	= 7/8
CRAB - TRACTOR	= 8/8
IRON - WHALE	= 6/8
LADDER - BUTTERFLY	= 8/8
mean	= 7.25/8 (-)

24) 29/4/90b
Instruction "When its the ..., touch the ...", NO feedback.
4 Conditional stimulus pairs:

PHONE - CARROT	= 8/8
CRAB - TRACTOR	= 8/8
IRON - WHALE	= 7/8
LADDER - BUTTERFLY	= 8/8
mean	= 7.75/8

GENERALIZATION TEST 10, NO FEEDBACK.

25) 30/4/90
Instruction "When its the ..., touch the ...", NO feedback.
4 Conditional stimulus pairs:

CLOWN - BELL	= 8/8
BALLOON - DRESS	= 8/8
LADYBIRD - SAUSAGE	= 7/8
RAINBOW - COW	= 7/8
mean	= 7.5/8

GENERALIZATION TEST 11, NO FEEDBACK, BEHIND SCREEN.

26) 2/5/90
Instruction "When its the ..., touch the ...", No feedback.
4 Conditional stimulus pairs:

CANDLE - BRIDGE	= 8/8
ROCKET - TEDDY	= 8/8
AMBULANCE - PAINTBRUSH	= 8/8
SANDWICH - COAT	= 8/8
mean	= 8/8

GENERALIZATION TEST 12, NO FEEDBACK, BEHIND SCREEN.

27) 9/5/90
Instruction "When its the ..., touch the ...", NO feedback.
4 Conditional stimulus pairs:

BAT	- MONKEY	= 8/8
TOOTHBRUSH	- TEDDY	= 8/8
STRING	- BEE	= 8/8
LORRY	- GIRAFFE	= 8/8
mean		= 8/8

SUBJECT: OWEN

DATE OF BIRTH: 4/5/86

AGE DURING STUDY: 3 years, 4 months to 3 years, 11 months.

BASELINE TRIAL BLOCKS

1) 2/10/89
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 4/8
BELT - HOUSE	= 4/8
FLAG - CAT	= 4/8
FOOT - MOON	= 4/8
mean	= 4/8

2) 6/10/89
Instruction "When its the ..., touch the ...", with feedback.
Correction for a right hand side preference was given on 4 trials.
4 Conditional stimulus pairs:

KING - BUCKET	= 7/8
BELT - HOUSE	= 4/8
FLAG - CAT	= 4/8
FOOT - MOON	= 4/8
mean	= 4.75/8

3) 9/10/89
Instruction "When its the ..., touch the ...", with feedback.
Correction for a left hand side preference was given on 4 trials.
4 Conditional stimulus pairs:

KING - BUCKET	= 7/8
BELT - HOUSE	= 1/8
FLAG - CAT	= 2/8
FOOT - MOON	= 4/8
mean	= 3.5/8

4) 11/10/89
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 3/8
BELT - HOUSE	= 5/8
FLAG - CAT	= 4/8
FOOT - MOON	= 3/8
mean	= 3.75/8

5) 16/10/89
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 3/8
BELT - HOUSE	= 5/8
FLAG - CAT	= 5/8
FOOT - MOON	= 4/8
mean	= 4.25/8

PLUS PROMPT FROM EXPERIMENTER.

6) 24/10/89 & 27/10/89
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 7/8
BELT - HOUSE	= 4/8
FLAG - CAT	= 5/8
FOOT - MOON	= 6/8
mean	= 5.5/8

7) 6/11/89 & 7/11/89a
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 8/8
BELT - HOUSE	= 7/8
FLAG - CAT	= 8/8
FOOT - MOON	= 8/8
mean	= 7.75/8

8) 7/11/89b & 27/11/89a
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 8/8
BELT - HOUSE	= 8/8
FLAG - CAT	= 8/8
FOOT - MOON	= 8/8
mean	= 8/8

9) 27/11/89b & 30/11/89 & 6/12/89
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 8/8
BELT - HOUSE	= 8/8
FLAG - CAT	= 8/8
FOOT - MOON	= 8/8
mean	= 8/8

NO PROMPT FROM EXPERIMENTER.

10) 15/12/89
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 8/8
BELT - HOUSE	= 8/8
FLAG - CAT	= 8/8
FOOT - MOON	= 8/8
mean	= 8/8

11) 18/12/89
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 8/8
BELT - HOUSE	= 8/8
FLAG - CAT	= 8/8
FOOT - MOON	= 8/8
mean	= 8/8

12) 12/1/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 8/8
BELT - HOUSE	= 8/8
FLAG - CAT	= 8/8
FOOT - MOON	= 8/8
<u>mean</u>	= 8/8

GENERALIZATION TEST 1, WITH FEEDBACK

13) 17/1/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

CHAIR - MOUSE	= 7/8
SHEEP - HAND	= 8/8
DRUM - TAP	= 8/8
CUP - BED	= 8/8
<u>mean</u>	= 7.75/8

GENERALIZATION TEST 2, WITH FEEDBACK.

14) 30/1/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

PIE - BUS	= 8/8
LEAF - FORK	= 6/8
BOAT - PIG	= 5/8
FROG - TENT	= 7/8
<u>mean</u>	= 6.5/8

15) 6/2/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

PIE - BUS	= 8/8
LEAF - FORK	= 8/8
BOAT - PIG	= 8/8
FROG - TENT	= 8/8
<u>mean</u>	= 8/8

GENERALIZATION TEST 3, WITH FEEDBACK.

16) 19/2/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

SNAKE - CLOCK	= 8/8
FLOWER - SPOON	= 8/8
BONE - SHOE	= 8/8
CAR - PENCIL	= 8/8
<u>mean</u>	= 8/8

GENERALIZATION TEST 4, NO FEEDBACK.

17) 21/2/90

Instruction "When its the ..., touch the ...", NO feedback.
4 Conditional stimulus pairs:

BALL	HAT	= 7/8
TRAIN	APPLE	= 8/8
BANANA	HORSE	= 8/8
TREE	BOOK	= 8/8
<u>mean</u>		= 7.75/8

GENERALIZATION TEST 5, NO FEEDBACK.

18) 28/2/90
Instruction "When its the ..., touch the ...", NO feedback.
4 Conditional stimulus pairs:

SNAIL	GLASSES	= 7/8
PEG	WINDOW	= 8/8
DOG	STAR	= 7/8
CHICKEN	BIKE	= 8/8
<u>mean</u>		= 7.5/8

GENERALIZATION TEST 6, NO FEEDBACK.

19) 2/3/90
Instruction "When its the ..., touch the ...", NO feedback.
4 Conditional stimulus pairs:

LETTER	BATH	= 7/8
SUN	DUCK	= 7/8
PLANE	FISH	= 4/8
SCISSORS	CAMERA	= 7/8
<u>mean</u>		= 6.25/8

20) 5/3/90
Instruction "When its the ..., touch the ...", NO feedback.
4 Conditional stimulus pairs:

LETTER	BATH	= 8/8
SUN	DUCK	= 8/8
PLANE	FISH	= 7/8
SCISSORS	CAMERA	= 8/8
<u>mean</u>		= 7.75/8

GENERALIZATION TEST 7, NO FEEDBACK.

21) 21/3/90a
Instruction "When its the ..., touch the ...", NO feedback.
4 Conditional stimulus pairs:

MUSHROOM	TEAPOT	= 8/8
EGG	FIRE	= 8/8
ICECREAM	KNIFE	= 2/8
CHERRY	HAMMER	= 8/8
<u>mean</u>		= 6.5/8

22) 21/3/90b
Instruction "When its the ..., touch the ...", NO feedback.
4 Conditional stimulus pairs:

MUSHROOM	TEAPOT	= 8/8
EGG	FIRE	= 8/8

ICECREAM - KNIFE = 8/8
CHERRY - HAMMER = 8/8
mean = 8/8

GENERALIZATION TEST 8, NO FEEDBACK, BEHIND SCREEN.

23) 28/3/90
Instruction "When its the ..., touch the ...", NO feedback.
4 Conditional stimulus pairs:

CASTLE	- SNOWMAN	= 8/8
TV	- SAW	= 8/8
KEY	- RABBIT	= 8/8
BOTTLE	- KITE	= 8/8
mean		= 8/8

GENERALIZATION TEST 9, NO FEEDBACK, BEHIND SCREEN.

24) 21/5/90
Instruction "When its the ..., touch the ...", NO feedback.
4 Conditional stimulus pairs:

PHONE	- CARROT	= 8/8
CRAB	- TRACTOR	= 8/8
IRON	- WHALE	= 8/8
LADDER	- BUTTERFLY	= 8/8
mean		= 8/8

SUBJECT: NIEL

DATE OF BIRTH: 18/6/86

AGE DURING STUDY: 3 years, 4 months to 3 years, 10 months.

BASELINE TRIAL BLOCKS

1) 31/10/89 & 12/12/89
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 3/8
FLAG - CAT	= 4/8
FOOT - MOON	= 6/8
BELT - HOUSE	= 2/8
<u>mean</u>	= 3.75/8

2) 13/12/89
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 2/8
FLAG - CAT	= 3/8
FOOT - MOON	= 3/8
BELT - HOUSE	= 2/8
<u>mean</u>	= 2.5/8

3) 14/12/89
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 2/8
FLAG - CAT	= 7/8
FOOT - MOON	= 1/8
BELT - HOUSE	= 5/8
<u>mean</u>	= 3.75/8

4) 15/12/89
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 4/8
FLAG - CAT	= 4/8
FOOT - MOON	= 5/8
BELT - HOUSE	= 3/8
<u>mean</u>	= 4/8

5) 20/12/89
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 4/8
FLAG - CAT	= 5/8
FOOT - MOON	= 4/8
BELT - HOUSE	= 3/8
<u>mean</u>	= 4/8

6) 18/12/89a
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 5/8

FLAG - CAT = 3/8
FOOT - MOON = 5/8
BELT - HOUSE = 3/8
mean = 4/8

7) 18/12/89b
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 4/8
FLAG - CAT	= 4/8
FOOT - MOON	= 1/8
BELT - HOUSE	= 5/8
mean	= 3.5/8

PLUS PROMPT FROM EXPERIMENTER

8) 19/2/90 & 20/2/90a
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 4/8
FLAG - CAT	= 0/8
FOOT - MOON	= 4/8
BELT - HOUSE	= 5/8
mean	= 3.25/8

9) 20/2/90b & 23/2/90a
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 3/8
FLAG - CAT	= 5/8
FOOT - MOON	= 6/8
BELT - HOUSE	= 5/8
mean	= 4.75/8

10) 23/2/90b
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 5/8
FLAG - CAT	= 3/8
FOOT - MOON	= 3/8
BELT - HOUSE	= 3/8
mean	= 3.5/8

11) 23/2/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 4/8
FLAG - CAT	= 5/8
FOOT - MOON	= 6/8
BELT - HOUSE	= 5/8
mean	= 5/8

12) 4/3/90a
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 2/8
FLAG - CAT	= 6/8

FOOT - MOON = 6/8
BELT - HOUSE = 4/8
<u>mean</u> = 4.5/8

13) 4/3/90b
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:
KING - BUCKET = 3/8
FLAG - CAT = 4/8
FOOT - MOON = 4/8
BELT - HOUSE = 6/8
<u>mean</u> = 4.25/8

SIMPLIFICATION OF BASELINE TASK, PLUS PROMT FROM EXPERIMENTER.

14) 5/3/90a
Instruction "When its the ..., touch the ...", with feedback.
2 Conditional stimulus pairs:
FLAG - CAT = 5/8
BELT - HOUSE = 4/8
<u>mean</u> = 4.5/8

15) 5/3/90b
Instruction "When its the ..., touch the ...", with feedback.
2 Conditional stimulus pairs:
FLAG - CAT = 3/8
BELT - HOUSE = 5/8
<u>mean</u> = 4/8

16) 6/3/90a
Instruction "When its the ..., touch the ...", with feedback.
2 Conditional stimulus pairs:
FLAG - CAT = 5/8
BELT - HOUSE = 5/8
<u>mean</u> = 5/8

17) 6/3/90b
Instruction "When its the ..., touch the ...", with feedback.
2 Conditional stimulus pairs:
FLAG - CAT = 4/8
BELT - HOUSE = 7/8
<u>mean</u> = 5.5/8

18) 6/3/90c
Instruction "When its the ..., touch the ...", with feedback.
2 Conditional stimulus pairs:
FLAG - CAT = 4/8
BELT - HOUSE = 4/8
<u>mean</u> = 4/8

19) 6/3/90d
Instruction "When its the ..., touch the ...", with feedback.
2 Conditional stimulus pairs:
FLAG - CAT = 5/8
BELT - HOUSE = 5/8
<u>mean</u> = 5/5

20) 6/3/90e
instruction "When its the ..., touch the ...", with feedback.
2 Conditional stimulus pairs:

FLAG - CAT	= 7/8
BELT - HOUSE	= 8/8
mean	= 7.5/8

21) 6/3/90f
Instruction "When its the ..., touch the ...", with feedback.
2 Conditional stimulus pairs:

FLAG - CAT	= 8/8
BELT - HOUSE	= 8/8
mean	= 8/8

22) 15/3/90a
Instruction "When its the ..., touch the ...", with feedback.
2 Conditional stimulus pairs:

FLAG - CAT	= 8/8
BELT - HOUSE	= 7/8
mean	= 7.5/8

23) 15/3/90b
Instruction "When its the ..., touch the ...", with feedback.
2 Conditional stimulus pairs:

FLAG - CAT	= 8/8
BELT - HOUSE	= 7/8
mean	= 7.5/8

TEST WITH REMAINING TWO STIMULUS PAIRS FROM BASELINE TASK, PLUS PROMPT FROM EXPERIMENTER.

24) 20/3/90
Instruction "When its the ..., touch the ...", with feedback.
2 Conditional stimulus pairs:

KING - BUCKET	= 8/8
FOOT - MOON	= 8/8
mean	= 8/8

25) 22/3/90a
Instruction "When its the ..., touch the ...", with feedback.
2 Conditional stimulus pairs:

KING - BUCKET	= 8/8
FOOT - MOON	= 8/8
mean	= 8/8

RETEST WITH ALL OF THE BASELINE STIMULUS PAIRS. PLUS PROMPT FROM EXPERIMENTER.

26) 22/3/90b
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 8/8
FLAG - CAT	= 8/8
FOOT - MOON	= 8/8
BELT - HOUSE	= 8/8
mean	= 8/8

27) 22/3/90c
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 8/8
FLAG - CAT	= 8/8
FOOT - MOON	= 8/8
BELT - HOUSE	= 8/8
<u>mean</u>	= 8/8

28) 23/3/90a
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 8/8
FLAG - CAT	= 8/8
FOOT - MOON	= 8/8
BELT - HOUSE	= 8/8
<u>mean</u>	= 8/8

NO PROMPT FROM EXPERIMENTER.

29) 23/3/90b
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 8/8
FLAG - CAT	= 8/8
FOOT - MOON	= 8/8
BELT - HOUSE	= 8/8
<u>mean</u>	= 8/8

30) 27/3/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 8/8
FLAG - CAT	= 8/8
FOOT - MOON	= 8/8
BELT - HOUSE	= 8/8
<u>mean</u>	= 8/8

GENERALIZATION TEST 1, WITH FEEDBACK.

31) 28/3/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

CHAIR - MOUSE	= 8/8
SHEEP - HAND	= 8/8
DRUM - TAP	= 7/8
CUP - BED	= 8/8
<u>mean</u>	= 7.75/8

GENERALIZATION TEST 2, WITH FEEDBACK.

32) 4/4/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

PIE - BUS = 8/8
LEAF - FORK = 8/8
BOAT - PIG = 8/8
FROG - TENT = 8/8
mean = 8/8

GENERALIZATION TEST 3, WITH FEEDBACK.

33) 5/4/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:
SNAKE - CLOCK = 8/8
FLOWER - SPOON = 8/8
BONE - SHOE = 7/8
CAR - PENCIL = 8/8
mean = 7.75/8

GENERALIZATION TEST 4, NO FEEDBACK.

34) 6/4/90
Instruction "When its the ..., touch the ...", NO feedback.
4 Conditional stimulus pairs:
BALL - HAT = 8/8
TRAIN - APPLE = 8/8
BANANA - HORSE = 8/8
TREE - BOOK = 8/8
mean = 8/8

GENERALIZATION TEST 5, NO FEEDBACK.

35) 10/4/90
Instruction "When its the ..., touch the ...", NO feedback.
4 Conditional stimulus pairs:
SNAIL - GLASSES = 8/8
PEG - WINDOW = 8/8
DOG - STAR = 7/8
CHICKEN - BOOK = 8/8
mean = 7.75/8

GENERALIZATION TEST 6, NO FEEDBACK.

36) 26/4/90
Instruction "When its the ..., touch the ...", NO feedback.
4 Conditional stimulus pairs:
LETTER - BATH = 8/8
SUN - DUCK = 8/8
PLANE - FISH = 8/8
SCISSORS - CAMERA = 7/8
mean = 7.75/8

GENERALIZATION TEST 7, NO FEEDBACK, BEHIND SCREEN.

37) 2/5/90

Instruction "When its the ..., touch the ...", NO feedback.
4 Conditional stimulus pairs:

MUSHROOM	- TEAPOT	= 7/8
EGG	- FIRE	= 8/8
ICECREAM	- KNIFE	= 8/8
CHERRY	- HAMMER	= 8/8
<u>mean</u>		= 7.75/8

GENERALIZATION TEST 8, NO FEEDBACK, BEHIND SCREEN.

38) 11/5/90
Instruction "When its the ..., touch the ...", NO feedback.
4 Conditional stimulus pairs:

CASTLE	- SNOWMAN	= 8/8
TV	- SAW	= 7/8
KEY	- RABBIT	= 7/8
BOTTLE	- KITE	= 7/8
<u>mean</u>		= 7.25/8

SUBJECT: STEVEN

DATE OF BIRTH: 11/4/87

AGE DURING STUDY: 2 years, 7 months to 3 years, 2 months.

(NOTE THAT STEVEN WAS GIVEN A PROMPT RIGHT FROM THE BEGINNING)

BASELINE TRIAL BLOCKS, PLUS PROMPT FROM EXPERIMENTER.

1) 19/12/89
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 3/8
BELT - HOUSE	= 6/8
FLAG - CAT	= 3/8
FOOT - MOON	= 6/8
<u>mean</u>	= 4.5/8

2) 5/1/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 7/8
BELT - HOUSE	= 5/8
FLAG - CAT	= 2/8
FOOT - MOON	= 4/8
<u>mean</u>	= 4.5/8

3) 19/1/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 6/8
BELT - HOUSE	= 4/8
FLAG - CAT	= 5/8
FOOT - MOON	= 3/8
<u>mean</u>	= 4.5/8

4) 26/1/90 & 30/1/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 7/8
BELT - HOUSE	= 4/8
FLAG - CAT	= 6/8
FOOT - MOON	= 4/8
<u>mean</u>	= 5.25/8

5) 13/2/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 5/8
BELT - HOUSE	= 5/8
FLAG - CAT	= 3/8
FOOT - MOON	= 6/8
<u>mean</u>	= 4.75/8

6) 14/2/90a & 21/2/90a

Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 6/8
BELT - HOUSE	= 4/8
FLAG - CAT	= 6/8
FOOT - MOON	= 7/8
<u>mean</u>	= 5.75/8

7) 21/2/90b & 23/2/90 & 2/3/90a
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 6/8
BELT - HOUSE	= 6/8
FLAG - CAT	= 3/8
FOOT - MOON	= 6/8
<u>mean</u>	= 5.25/8

8) 2/3/90 & 6/3/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 7/8
BELT - HOUSE	= 6/8
FLAG - CAT	= 6/8
FOOT - MOON	= 3/8
<u>mean</u>	= 5.5/8

SIMPLIFICATION OF BASELINE TASK TO 2 INSTRUCTIONS, PLUS PROMPT FROM EXPERIMENTER.

9) 8/3/90a
Instruction "When its the ..., touch the ...", with feedback.
2 Conditional stimulus pairs:

BELT - HOUSE	= 5/8
FLAG - CAT	= 6/8
<u>mean</u>	= 5.5/8

10) 8/3/90b
Instruction "When its the ..., touch the ...", with feedback.
2 Conditional stimulus pairs:

BELT - HOUSE	= 6/8
FLAG - CAT	= 5/8
<u>mean</u>	= 5.5/8

11) 16/3/90a
Instruction "When its the ..., touch the ...", with feedback.
2 Conditional stimulus pairs:

BELT - HOUSE	= 6/8
FLAG - CAT	= 4/8
<u>mean</u>	= 5/8

12) 16/3/90b
Instruction "When its the ..., touch the ...", with feedback.
2 Conditional stimulus pairs:

BELT - HOUSE	= 4/8
FLAG - CAT	= 5/8
<u>mean</u>	= 4.5/8

13) 19/3/90a
Instruction "When its the ..., touch the ...", with feedback.
2 Conditional stimulus pairs:

BELT - HOUSE	= 6/8
FLAG - CAT	= 6/8
<u>mean</u>	= 6/8

14) 19/3/90b
Instruction "When its the ..., touch the ...", with feedback.
2 Conditional stimulus pairs:

BELT - HOUSE	= 7/8
FLAG - CAT	= 6/8
<u>mean</u>	= 6.5/8

15) 27/3/90a
Instruction "When its the ..., touch the ...", with feedback.
2 Conditional stimulus pairs:

BELT - HOUSE	= 8/8
FLAG - CAT	= 1/8
<u>mean</u>	= 4.5/8

16) 27/3/90b
Instruction "When its the ..., touch the ...", with feedback.
2 Conditional stimulus pairs:

BELT - HOUSE	= 6/8
FLAG - CAT	= 3/8
<u>mean</u>	= 4.5/8

17) 27/3/90c
Instruction "When its the ..., touch the ...", with feedback.
2 Conditional stimulus pairs:

BELT - HOUSE	= 6/8
FLAG - CAT	= 4/8
<u>mean</u>	= 5/8

18) 29/3/90a
Instruction "When its the ..., touch the ...", with feedback.
2 Conditional stimulus pairs:

BELT - HOUSE	= 5/8
FLAG - CAT	= 5/8
<u>mean</u>	= 5/8

19) 29/3/90b
Instruction "When its the ..., touch the ...", with feedback.
2 Conditional stimulus pairs:

BELT - HOUSE	= 5/8
FLAG - CAT	= 7/8
<u>mean</u>	= 6/8

20) 3/4/90a
Instruction "When its the ..., touch the ...", with feedback.
2 Conditional stimulus pairs:

BELT - HOUSE	= 6/8
FLAG - CAT	= 4/8
<u>mean</u>	= 5/8

21) 3/4/90b
Instruction "When its the ..., touch the ...", with feedback.

2 Conditional stimulus pairs:

BELT - HOUSE	= 4/8
FLAG - CAT	= 6/8
<u>mean</u>	= 5/8

22) 4/4/90a
Instruction "When its the ..., touch the ...", with feedback.
Toys given for approx. every 1 in 4 correct responses.
Every incorrect response resulted in a prize being removed.
2 Conditional stimulus pairs:

BELT - HOUSE	= 4/8
FLAG - CAT	= 8/8
<u>mean</u>	= 6/8

23) 4/4/90b
Instruction "When its the ..., touch the ...", with feedback.
Toys given for approx. every 1 in 4 correct responses.
Every incorrect response resulted in a prize being removed.
2 Conditional stimulus pairs:

BELT - HOUSE	= 5/8
FLAG - CAT	= 6/8
<u>mean</u>	= 5.5/8

24) 4/4/90c
Instruction "When its the ..., touch the ...", with feedback.
Toys given for approx. every 1 in 4 correct responses.
Every incorrect response resulted in a prize being removed.
2 Conditional stimulus pairs:

BELT - HOUSE	= 6/8
FLAG - CAT	= 6/8
<u>mean</u>	= 6/8

25) 5/4/90a
Instruction "When its the ..., touch the ...", with feedback.
Toys given for approx. every 1 in 4 correct responses.
Every incorrect response resulted in a prize being removed.
2 Conditional stimulus pairs:

BELT - HOUSE	= 8/8
FLAG - CAT	= 6/8
<u>mean</u>	= 7/8 (-)

26) 5/4/90b
Instruction "When its the ..., touch the ...", with feedback.
Toys given for approx. every 1 in 4 correct responses.
Every incorrect response resulted in a prize being removed.
2 Conditional stimulus pairs:

BELT - HOUSE	= 4/8
FLAG - CAT	= 3/8
<u>mean</u>	= 3.5/8

27) 5/4/90c
Instruction "When its the ..., touch the ...", with feedback.
Toys given for approx. every 1 in 4 correct responses.
Every incorrect response resulted in a prize being removed.
2 Conditional stimulus pairs:

BELT - HOUSE	= 4/8
FLAG - CAT	= 5/8
<u>mean</u>	= 4.5/8

28) 10/4/90a
Instruction "When its the ..., touch the ...", with feedback.
A toy was given for every correct response.
Every incorrect response resulted in a prize being removed.
2 Conditional stimulus pairs:

BELT - HOUSE	= 6/8
FLAG - CAT	= 7/8
<u>mean</u>	= 6.5/8

29) 10/4/90b
Instruction "When its the ..., touch the ...", with feedback.
Toys given for approx. every 1 in 2 correct responses.
Every incorrect response resulted in a prize being removed.
2 Conditional stimulus pairs:

BELT - HOUSE	= 8/8
FLAG - CAT	= 6/8
<u>mean</u>	= 7/8 (-)

30) 17/4/90a
Instruction "When its the ..., touch the ...", with feedback.
Toys given for approx. every 1 in 2 correct responses.
Every incorrect response resulted in a prize being removed.
2 Conditional stimulus pairs:

BELT - HOUSE	= 0/8
FLAG - CAT	= 7/8
<u>mean</u>	= 3.5/8

31) 17/4/90b
Instruction "When its the ..., touch the ...", with feedback.
Toys given for approx. every 1 in 2 correct responses.
Every incorrect response resulted in a prize being removed.
2 Conditional stimulus pairs:

BELT - HOUSE	= 0/8
FLAG - CAT	= 8/8
<u>mean</u>	= 4/8

32) 18/4/90a
Instruction "When its the ..., touch the ...", with feedback.
Toys given for approx. every 1 in 2 correct responses.
Every incorrect response resulted in a prize being removed.
2 Conditional stimulus pairs:

BELT - HOUSE	= 6/8
FLAG - CAT	= 4/8
<u>mean</u>	= 5/8

33) 18/4/90b
Instruction "When its the ..., touch the ...", with feedback.
Toys given for approx. every 1 in 2 correct responses.
Every incorrect response resulted in a prize being removed.
2 Conditional stimulus pairs:

BELT - HOUSE	= 3/8
FLAG - CAT	= 7/8
<u>mean</u>	= 5/8

FURTHER SIMPLIFICATION OF BASELINE TASK TO 1 INSTRUCTION, PLUS PROMPT FROM EXPERIMENTER.

34)
Instruction "When its the ..., touch the ...", with feedback.
2 Conditional stimulus pairs, only ONE of which was used with the instruction. Each row represents one whole block of trials.

25/4/90a Toys given initally for approx. every 1 in 2 correct responses (See each trial block for details). Every incorrect response resulted in a prize being removed.

BELT - HOUSE	= 4/8	
BELT - HOUSE	= 4/8	
BELT - HOUSE	= 8/8	
BELT - HOUSE	= 8/8	«Toys every 1 in 4 correct.
FLAG - CAT	= 4/8	«Toys every 1 in 2 correct.
FLAG - CAT	= 4/8	«Toys every 1 in 2 correct.
FLAG - CAT	= 8/8	«Toys every 1 in 2 correct.
FLAG - CAT	= 7/8	«Toys every 1 in 2 correct.

26/4/90 Toys given for approx. every 1 in 4 correct responses. Every incorrect response resulted in a prize being removed.

BELT - HOUSE	= 8/8
FLAG - CAT	= 4/8
FLAG - CAT	= 8/8
BELT - HOUSE	= 5/8
BELT - HOUSE	= 8/8
FLAG - CAT	= 7/8
BELT - HOUSE	= 8/8

30/4/90 Toys given for approx. every 1 in 4 correct responses. Every incorrect response resulted in a prize being removed.

FLAG - CAT	= 7/8
BELT - HOUSE	= 8/8
FLAG - CAT	= 5/8
FLAG - CAT	= 8/8
BELT - HOUSE	= 8/8
FLAG - CAT	= 7/8

1/5/90a Toys given for approx. every 1 in 4 correct responses. Every incorrect response resulted in a prize being removed.

BELT - HOUSE	= 8/8
FLAG - CAT	= 8/8

RETEST ON 2 INSTRUCTION SIMPLIFICATION OF THE BASELINE TASK, PLUS PROMPT FROM EXPERIMENTER.

35) 1/5/90b
Instruction "When its the ..., touch the ...", with feedback.
Toys given for approx. every 1 in 4 correct responses.
Every incorrect response resulted in a prize being removed.
2 Conditional stimulus pairs:

BELT - HOUSE	= 8/8
FLAG - CAT	= 8/8
<u>mean</u>	= 8/8

36) 1/5/90c
Instruction "When its the ..., touch the ...", with feedback.
Toys given for approx. every 1 in 8 correct responses.
Every incorrect response resulted in a prize being removed.
2 Conditional stimulus pairs:

BELT - HOUSE	= 8/8
FLAG - CAT	= 7/8
<u>mean</u>	= 7.5/8

TEST WITH REMAINING TWO STIMULUS PAIRS AND 1 INSTRUCTION FROM THE BASELINE TASK, PLUS PROMPT FROM EXPERIMENTER.

37)
Instruction "When its the ..., touch the ...", with feedback.
2 Conditional stimulus pairs, only ONE of which was used with the instruction. Each row represents one whole block of trials.
2/5/90a Toys given for approx. every 1 in 4 correct responses.
Every incorrect response resulted in a prize being removed.

KING - BUCKET	= 8/8
FOOT - MOON	= 8/8

TEST WITH REMAINING TWO STIMULUS PAIRS AND 2 INSTRUCTIONS FROM THE BASELINE TASK, PLUS PROMPT FROM EXPERIMENTER.

38) 2/5/90b
Instruction "When its the ..., touch the ...", with feedback.
Toys given for approx. every 1 in 4 correct responses.
Every incorrect response resulted in a prize being removed.
2 Conditional stimulus pairs:

KING - BUCKET	= 8/8
FOOT - MOON	= 8/8
<u>mean</u>	= 8/8

RETEST WITH ALL OF THE BASELINE STIMULUS PAIRS. PLUS PROMPT FROM EXPERIMENTER.

39) 3/5/90
Instruction "When its the ..., touch the ...", with feedback.
Toys given for approx. every 1 in 4 correct responses.
Every incorrect response resulted in a prize being removed.
2 Conditional stimulus pairs:

KING - BUCKET	= 6/8
BELT - HOUSE	= 2/8
FLAG - CAT	= 5/8
FOOT - MOON	= 6/8
<u>mean</u>	= 4.75/8

TEST WITH FIRST TWO STIMULUS PAIRS AND 2 INSTRUCTIONS FROM THE BASELINE TASK, PLUS PROMPT FROM EXPERIMENTER.

40) 10/5/90a

Instruction "When its the ..., touch the ...", with feedback.
Toys given for approx. every 1 in 4 correct responses.
Every incorrect response resulted in a prize being removed.
2 Conditional stimulus pairs:

BELT - HOUSE	= 8/8
FLAG - CAT	= 8/8
mean	= 8/8

TEST WITH REMAINING TWO STIMULUS PAIRS AND 2 INSTRUCTIONS FROM THE BASELINE TASK, PLUS PROMPT FROM EXPERIMENTER.

41) 10/5/90b
Instruction "When its the ..., touch the ...", with feedback.
Toys given for approx. every 1 in 4 correct responses.
Every incorrect response resulted in a prize being removed.
2 Conditional stimulus pairs:

KING - BUCKET	= 7/8
FOOT - MOON	= 8/8
mean	= 7.5/8

TEST WITH FIRST TWO STIMULUS PAIRS AND 2 INSTRUCTIONS FROM THE BASELINE TASK, PLUS PROMPT FROM EXPERIMENTER.

42) 11/5/90a
Instruction "When its the ..., touch the ...", with feedback.
Toys given for approx. every 1 in 4 correct responses.
Every incorrect response resulted in a prize being removed.
2 Conditional stimulus pairs:

BELT - HOUSE	= 8/8
FLAG - CAT	= 8/8
mean	= 8/8

TEST WITH REMAINING TWO STIMULUS PAIRS AND 2 INSTRUCTIONS FROM THE BASELINE TASK, PLUS PROMPT FROM EXPERIMENTER.

43) 11/5/90b
Instruction "When its the ..., touch the ...", with feedback.
Toys given for approx. every 1 in 4 correct responses.
Every incorrect response resulted in a prize being removed.
2 Conditional stimulus pairs:

KING - BUCKET	= 8/8
FOOT - MOON	= 7/8
mean	= 7.5/8

RETEST WITH ALL OF THE BASELINE STIMULUS PAIRS. PLUS PROMPT FROM EXPERIMENTER.

44) 17/5/90a
Instruction "When its the ..., touch the ...", with feedback.
Special introduction, with the first pair introduced, and 4 practise trials given using this pair, then the second pair inroduced and 4 practice trials given using the latter pair.
Toys given initially for approx. every 1 in 2 correct responses, and later reduced to 1 in 4 correct responses. Every incorrect response

resulted in a prize being removed.
4 Conditional stimulus pairs:

KING - BUCKET	= 8/8
BELT - HOUSE	= 8/8
FLAG - CAT	= 7/8
FOOT - MOON	= 7/8
<u>mean</u>	= 7.5/8

45) 17/5/90b
Instruction "When its the ..., touch the ...", with feedback.
Toys given initially for approx. every 1 in 4 correct responses, and later reduced to 1 in 8 correct responses. Every incorrect response resulted in a prize being removed.
4 Conditional stimulus pairs:

KING - BUCKET	= 8/8
BELT - HOUSE	= 8/8
FLAG - CAT	= 8/8
FOOT - MOON	= 8/8
<u>mean</u>	= 8/8

46) 17/5/90c
Instruction "When its the ..., touch the ...", with feedback.
Toys given for approx. every 1 in 16 correct responses.
Every incorrect response resulted in a prize being removed.
4 Conditional stimulus pairs:

KING - BUCKET	= 8/8
BELT - HOUSE	= 8/8
FLAG - CAT	= 8/8
FOOT - MOON	= 8/8
<u>mean</u>	= 8/8

47) 18/5/90a
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 8/8
BELT - HOUSE	= 8/8
FLAG - CAT	= 8/8
FOOT - MOON	= 8/8
<u>mean</u>	= 8/8

48) 18/5/90b
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 8/8
BELT - HOUSE	= 8/8
FLAG - CAT	= 8/8
FOOT - MOON	= 8/8
<u>mean</u>	= 8/8

NO PROMPT FROM EXPERIMENTER.

49) 21/5/90a
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 8/8
BELT - HOUSE	= 8/8

FLAG - CAT = 8/8
FOOT - MOON = 8/8
mean = 8/8

50) 21/5/90b
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 8/8
BELT - HOUSE	= 7/8
FLAG - CAT	= 8/8
FOOT - MOON	= 8/8
mean	= 7.75/8

51) 31/5/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 8/8
BELT - HOUSE	= 7/8
FLAG - CAT	= 8/8
FOOT - MOON	= 8/8
mean	= 7.75/8

52) 1/6/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

KING - BUCKET	= 8/8
BELT - HOUSE	= 8/8
FLAG - CAT	= 8/8
FOOT - MOON	= 8/8
mean	= 8/8

GENERALIZATION TEST 1, WITH FEEDBACK.

53) 4/6/90a
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

CHAIR - MOUSE	= 8/8
SHEEP - HAND	= 6/8
DRUM - TAP	= 7/8
CUP - BED	= 7/8
mean	= 7/8 (-)

54) 4/6/90b
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

CHAIR - MOUSE	= 7/8
SHEEP - HAND	= 8/8
DRUM - TAP	= 6/8
CUP - BED	= 7/8
mean	= 7/8 (-)

55) 4/6/90c
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

CHAIR - MOUSE	= 8/8
SHEEP - HAND	= 8/8
DRUM - TAP	= 8/8

CUP - BED = 8/8
<u>mean</u> = 8/8

GENERALIZATION TEST 2, WITH FEEDBACK.

56) 6/6/90a
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

PIE - BUS	= 8/8
LEAF - FORK	= 6/8
BOAT - PIG	= 8/8
FROG - TENT	= 8/8
<u>mean</u>	= 7.5/8 (-)

57) 6/6/90b
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

PIE - BUS	= 8/8
LEAF - FORK	= 8/8
BOAT - PIG	= 8/8
FROG - TENT	= 8/8
<u>mean</u>	= 8/8

GENERALIZATION TEST 3, WITH FEEDBACK.

58) 7/6/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

SNAKE - CLOCK	= 5/8
FLOWER - SPOON	= 6/8
BONE - SHOE	= 8/8
CAR - PENCIL	= 6/8
<u>mean</u>	= 6.25/8

59) 8/6/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

SNAKE - CLOCK	= 8/8
FLOWER - SPOON	= 8/8
BONE - SHOE	= 7/8
CAR - PENCIL	= 8/8
<u>mean</u>	= 7.75/8

GENERALIZATION TEST 4, WITH FEEDBACK.

60) 11/6/90a
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

BALL - HAT	= 8/8
TRAIN - APPLE	= 6/8
BANANA - HORSE	= 7/8
TREE - BOOK	= 6/8
<u>mean</u>	= 6.75/8

61) 11/6/90b
Instruction "When its the ..., touch the ...", with feedback.

4 Conditional stimulus pairs:

BALL	- HAT	= 8/8
TRAIN	- APPLE	= 8/8
BANANA	- HORSE	= 8/8
TREE	- BOOK	= 8/8
mean		= 8/8

GENERALIZATION TEST 4, WITH FEEDBACK.

62) 12/6/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

SNAIL	- GLASSES	= 8/8
PEG	- WINDOW	= 8/8
DOG	- STAR	= 8/8
CHICKEN	- BIKE	= 7/8
mean		= 7.75/8

GENERALIZATION TEST 5, WITH FEEDBACK.

63) 13/6/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

LETTER	- BATH	= 7/8
SUN	- DUCK	= 8/8
PLANE	- FISH	= 8/8
SCISSORS	- CAMERA	= 7/8
mean		= 7.5/8

GENERALIZATION TEST 6, WITH FEEDBACK.

64) 14/6/90a
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

MUCHROOM	- TEAPOT	= 6/8
EGG	- FIRE	= 7/8
ICECREAM	- KNIFE	= 7/8
CHERRY	- HAMMER	= 7/8
mean		= 6.75/8

65) 14/6/90b
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

MUCHROOM	- TEAPOT	= 8/8
EGG	- FIRE	= 8/8
ICECREAM	- KNIFE	= 8/8
CHERRY	- HAMMER	= 8/8
mean		= 8/8

GENERALIZATION TEST 7, WITH FEEDBACK.

66) 18/6/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

CASTLE	- SNOWMAN	= 8/8
TV	- SAW	= 8/8
KEY	- RABBIT	= 7/8
BOTTLE	- KITE	= 7/8
<u>mean</u>		= 7.5/8

GENERALIZATION TEST 8, WITH FEEDBACK.

67) 22/6/90
Instruction "When its the ..., touch the ...", with feedback.
4 Conditional stimulus pairs:

PHONE	- CARROT	= 7/8
CRAB	- TRACTOR	= 8/8
IRON	- WHALE	= 7/8
LADDER	- BUTTERFLY	= 7/8
<u>mean</u>		= 7.25/8

GENERALIZATION TEST 9, NO FEEDBACK.

68) 25/6/90
Instruction "When its the ..., touch the ...", NO feedback.
4 Conditional stimulus pairs:

CLOWN	- BELL	= 8/8
BALLOON	- DRESS	= 8/8
LADYBIRD	- SAUSAGE	= 8/8
RAINBOW	- COW	= 8/8
<u>mean</u>		= 8/8

GENERALIZATION TEST 10, NO FEEDBACK, BEHIND SCREEN.

69) 28/6/90
Instruction "When its the ..., touch the ...", NO feedback.
4 Conditional stimulus pairs:

CANDLE	- BRIDGE	= 7/8
ROCKET	- TEDDY	= 8/8
AMBULANCE	- PAINTBRUSH	= 8/8
SANDWICH	- COAT	= 8/8
<u>mean</u>		= 7.75/8

GENERALIZATION TEST 11, NO FEEDBACK, BEHIND SCREEN.

70) 29/6/90a
Instruction "When its the ..., touch the ...", NO feedback.
4 Conditional stimulus pairs:

BAT	- MONKEY	= 5/8
TOOTHBRUSH	- CUSHION	= 8/8
STRING	- BEE	= 6/8
LORRY	- GIRAFFE	= 7/8
<u>mean</u>		= 6.5/8

71) 29/6/90b
Instruction "When its the ..., touch the ...", NO feedback.
4 Conditional stimulus pairs:

BAT	- MONKEY	= 7/8

TOOTHBRUSH	- CUSHION	= 8/8
STRING	- BEE	= 8/8
LORRY	- GIRAFFE	= 8/8
<u>mean</u>		= 7.75/8

EXPERIMENT 4

<u>Performance on the trial types, for each block of trials.</u>

SUBJECT: CLAIRE

DATE OF BIRTH: 18/10/86

AGE DURING STUDY: 3 years, 7 months to 3 years, 9 months

BIDIRECTIONALITY TEST 1

1) 3/6/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

MUSHROOM - TEAPOT	= 8/8	A-B TRAINING
EGG - FIRE	= 8/8	
ICECREAM - KNIFE	= 8/8	
CHERRY - HAMMER	= 8/8	
<u>mean</u>	= 8/8	

2) 10/6/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

MUSHROOM - TEAPOT	= 8/8	A-B TRAINING 1
EGG - FIRE	= 8/8	
ICECREAM - KNIFE	= 8/8	
CHERRY - HAMMER	= 8/8	
<u>mean</u>	= 8/8	
MUSHROOM - TEAPOT	= 8/8	A-B TRAINING 2
EGG - FIRE	= 8/8	
ICECREAM - KNIFE	= 8/8	
CHERRY - HAMMER	= 8/8	
<u>mean</u>	= 8/8	
TEAPOT - MUSHROOM	= 8/8	B-A TEST TRIALS
FIRE - EGG	= 8/8	
KNIFE - ICECREAM	= 7/8	
HAMMER - CHERRY	= 8/8	
<u>mean</u>	= 7.75/8	

BIDIRECTIONALITY TEST 2

3) 17/6/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CASTLE - SNOWMAN	= 8/8	A-B TRAINING
TV - SAW	= 8/8	
KEY - RABBIT	= 8/8	
BOTTLE - KITE	= 8/8	
<u>mean</u>	= 8/8	

4) 19/6/90

Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CASTLE	- SNOWMAN	= 8/8	A-B TRAINING 1
TV	- SAW	= 8/8	
KEY	- RABBIT	= 8/8	
BOTTLE	- KITE	= 8/8	
mean		= 8/8	
CASTLE	- SNOWMAN	= 8/8	A-B TRAINING 2
TV	- SAW	= 8/8	
KEY	- RABBIT	= 8/8	
BOTTLE	- KITE	= 8/8	
mean		= 8/8	
SNOWMAN	- CASTLE	= 8/8	B-A TEST TRIALS
SAW	- TV	= 8/8	
RABBIT	- KEY	= 8/8	
KITE	- BOTTLE	= 8/8	
mean		= 8/8	

BIDIRECTIONALITY TEST 3, BEHIND SCREEN.

5) 20/6/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CANDLE	- BRIDGE	= 8/8	A-B TRAINING
ROCKET	- TEDDY	= 8/8	
AMBULANCE	- PAINTBRUSH	= 8/8	
SANDWICH	- COAT	= 8/8	
mean		= 8/8	

6) 24/6/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CANDLE	- BRIDGE	= 8/8	A-B TRAINING 1
ROCKET	- TEDDY	= 8/8	
AMBULANCE	- PAINTBRUSH	= 8/8	
SANDWICH	- COAT	= 8/8	
mean		= 8/8	
CANDLE	- BRIDGE	= 8/8	A-B TRAINING 2
ROCKET	- TEDDY	= 8/8	
AMBULANCE	- PAINTBRUSH	= 8/8	
SANDWICH	- COAT	= 8/8	
mean		= 8/8	
BRIDGE	- CANDLE	= 8/8	B-A TEST TRIALS
TEDDY	- ROCKET	= 8/8	
PAINTBRUSH	- AMBULANCE	= 8/8	
COAT	- SANDWICH	= 8/8	
mean		= 8/8	

'EQUIVALENCE' TEST, MAINLY BEHIND SCREEN.

(A-B TRIALS ALREADY AT CRITERION)

7) 3/7/90

Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CANDLE - BAT	= 8/8	A-C TRAINING
ROCKET - TOOTHBRUSH	= 8/8	
AMBULANCE - STRING	= 8/8	
SANDWICH - LORRY	= 7/8	
mean	= 7.75/8	

8) 5/7/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CANDLE - BRIDGE	= 8/8	A-B TRAINING
ROCKET - TEDDY	= 8/8	
AMBULANCE - PAINTBRUSH	= 8/8	
SANDWICH - COAT	= 8/8	
mean	= 8/8	
CANDLE - BAT	= 7/8	A-C TRAINING
ROCKET - TOOTHBRUSH	= 6/8	
AMBULANCE - STRING	= 8/8	
SANDWICH - LORRY	= 8/8	
mean	= 7.25/8 (-)	

9) 10/7/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CANDLE - BRIDGE	= 8/8	A-B TRAINING
ROCKET - TEDDY	= 8/8	
AMBULANCE - PAINTBRUSH	= 8/8	
SANDWICH - COAT	= 8/8	
mean	= 8/8	
CANDLE - BAT	= 8/8	A-C TRAINING
ROCKET - TOOTHBRUSH	= 8/8	
AMBULANCE - STRING	= 8/8	
SANDWICH - LORRY	= 8/8	
mean	= 8/8	

10) 11/7/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CANDLE - BRIDGE	= 8/8	A-B TRAINING
ROCKET - TEDDY	= 7/8	
AMBULANCE - PAINTBRUSH	= 8/8	
SANDWICH - COAT	= 8/8	
mean	= 7.75/8	
CANDLE - BAT	= 6/8	A-C TRAINING
ROCKET - TOOTHBRUSH	= 6/8	
AMBULANCE - STRING	= 8/8	
SANDWICH - LORRY	= 7/8	
mean	= 7.75/8	
BRIDGE - BAT	= 7/8	B-C TEST TRIALS
TEDDY - TOOTHBRUSH	= 7/8	
PAINTBRUSH - STRING	= 3/8	
COAT - LORRY	= 5/8	
mean	= 5.5/8	

11) 13/7/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CANDLE	- BRIDGE	= 7/8	A-B TRAINING
ROCKET	- TEDDY	= 8/8	
AMBULANCE	- PAINTBRUSH	= 8/8	
SANDWICH	- COAT	= 8/8	
<u>mean</u>		= 7.75/8	

CANDLE	- BAT	= 8/8	A-C TRAINING
ROCKET	- TOOTHBRUSH	= 6/8	
AMBULANCE	- STRING	= 8/8	
SANDWICH	- LORRY	= 8/8	
<u>mean</u>		= 7.5/8 (-)	

BRIDGE	- BAT	= 5/8	B-C TEST TRIALS
TEDDY	- TOOTHBRUSH	= 6/8	
PAINTBRUSH	- STRING	= 5/8	
COAT	- LORRY	= 8/8	
<u>mean</u>		= 6/8	

12) 14/7/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CANDLE	- BRIDGE	= 8/8	A-B TRAINING
ROCKET	- TEDDY	= 8/8	
AMBULANCE	- PAINTBRUSH	= 8/8	
SANDWICH	- COAT	= 8/8	
<u>mean</u>		= 8/8	

CANDLE	- BAT	= 8/8	A-C TRAINING
ROCKET	- TOOTHBRUSH	= 7/8	
AMBULANCE	- STRING	= 8/8	
SANDWICH	- LORRY	= 8/8	
<u>mean</u>		= 7.75/8	

BRIDGE	- BAT	= 8/8	B-C TEST TRIALS
TEDDY	- TOOTHBRUSH	= 7/8	
PAINTBRUSH	- STRING	= 7/8	
COAT	- LORRY	= 7/8	
<u>mean</u>		= 7.25/8	

13) 18/7/90 & 24/7/90 FIRST HALF OF SESSIONS BEHIND SCREEN.
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CANDLE	- BRIDGE	= 8/8	A-B TRAINING
ROCKET	- TEDDY	= 8/8	
AMBULANCE	- PAINTBRUSH	= 8/8	
SANDWICH	- COAT	= 8/8	
<u>mean</u>		= 8/8	

CANDLE	- BAT	= 8/8	A-C TRAINING
ROCKET	- TOOTHBRUSH	= 3/8	
AMBULANCE	- STRING	= 8/8	
SANDWICH	- LORRY	= 8/8	
<u>mean</u>		= 6.75/8	

BAT	- BRIDGE	= 8/8	C-B TEST TRIALS
TOOTHBRUSH	- TEDDY	= 8/8	

STRING	- PAINTBRUSH	= 6/8	
LORRY	- COAT	= 8/8	
mean		= 7.5/8 (-)	

14) 25/7/90 & 30/7/90 NOT BEHIND SCREEN
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CANDLE	- BRIDGE	= 8/8	A-B TRAINING
ROCKET	- TEDDY	= 8/8	
AMBULANCE	- PAINTBRUSH	= 8/8	
SANDWICH	- COAT	= 8/8	
mean		= 8/8	
CANDLE	- BAT	= 8/8	A-C TRAINING
ROCKET	- TOOTHBRUSH	= 8/8	
AMBULANCE	- STRING	= 8/8	
SANDWICH	- LORRY	= 8/8	
mean		= 8/8	
BAT	- BRIDGE	= 8/8	C-B TEST TRIALS
TOOTHBRUSH	- TEDDY	= 8/8	
STRING	- PAINTBRUSH	= 8/8	
LORRY	- COAT	= 8/8	
mean		= 8/8	

SUBJECT: OWEN

DATE OF BIRTH: 4/5/86

AGE DURING STUDY: 4 years, 1 month to 4 years, 2 months

BIDIRECTIONALITY TEST 1

1) 6/6/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

BALL	- HAT	= 8/8	A-B TRAINING
TRAIN	- APPLE	= 8/8	
BANANA	- HORSE	= 8/8	
TREE	- BOOK	= 8/8	
mean		= 8/8	

2) 8/6/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

BALL	- HAT	= 8/8	A-B TRAINING 1
TRAIN	- APPLE	= 8/8	
BANANA	- HORSE	= 8/8	
TREE	- BOOK	= 8/8	
mean		= 8/8	
BALL	- HAT	= 8/8	A-B TRAINING 2
TRAIN	- APPLE	= 8/8	
BANANA	- HORSE	= 8/8	
TREE	- BOOK	= 8/8	
mean		= 8/8	
HAT	- BALL	= 8/8	B-A TEST TRIALS
APPLE	- TRAIN	= 8/8	
HORSE	- BANANA	= 8/8	
BOOK	- TREE	= 8/8	
mean		= 8/8	

BIDIRECTIONALITY TEST 2

3) 12/6/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

SNAIL	- GLASSES	= 8/8	A-B TRAINING
PEG	- WINDOW	= 8/8	
DOG	- STAR	= 8/8	
CHICKEN	- BIKE	= 8/8	
mean		= 8/8	

4) 14/6/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

SNAIL	- GLASSES	= 8/8	A-B TRAINING 1
PEG	- WINDOW	= 8/8	
DOG	- STAR	= 8/8	
CHICKEN	- BIKE	= 8/8	
mean		= 8/8	

SNAIL	- GLASSES	= 8/8	A-B TRAINING 2
PEG	- WINDOW	= 8/8	
DOG	- STAR	= 8/8	
CHICKEN	- BIKE	= 8/8	
<u>mean</u>		= 8/8	
GLASSES	- SNAIL	= 8/8	B-A TEST TRIALS
WINDOW	- PEG	= 8/8	
STAR	- DOG	= 8/8	
BIKE	- CHICKEN	= 8/8	
<u>mean</u>		= 8/8	

BIDIRECTIONALITY TEST 3, BEHIND SCREEN.

5) 18/6/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CASTLE	- SNOWMAN	= 8/8	A-B TRAINING
TV	- SAW	= 8/8	
KEY	- RABBIT	= 8/8	
BOTTLE	- KITE	= 8/8	
<u>mean</u>		= 8/8	

6) 19/6/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CASTLE	- SNOWMAN	= 8/8	A-B TRAINING 1
TV	- SAW	= 8/8	
KEY	- RABBIT	= 8/8	
BOTTLE	- KITE	= 8/8	
<u>mean</u>		= 8/8	
CASTLE	- SNOWMAN	= 8/8	A-B TRAINING 2
TV	- SAW	= 8/8	
KEY	- RABBIT	= 8/8	
BOTTLE	- KITE	= 8/8	
<u>mean</u>		= 8/8	
SNOWMAN	- CASTLE	= 8/8	B-A TEST TRIALS
SAW	- TV	= 8/8	
RABBIT	- KEY	= 8/8	
KITE	- BOTTLE	= 8/8	
<u>mean</u>		= 8/8	

'EQUIVALENCE' TEST, BEHIND SCREEN.

(A-B TRIALS ALREADY AT CRITERION.)

7) 4/7/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CASTLE	- PHONE	= 8/8	A-C TRAINING
TV	- CRAB	= 8/8	
KEY	- IRON	= 8/8	
BOTTLE	- LADDER	= 8/8	
<u>mean</u>		= 8/8	

8) 5/7/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CASTLE	- SNOWMAN	= 8/8	A-B TRAINING
TV	- SAW	= 8/8	
KEY	- RABBIT	= 8/8	
BOTTLE	- KITE	= 8/8	
<u>mean</u>		= 8/8	

CASTLE	- PHONE	= 8/8	A-C TRAINING
TV	- CRAB	= 8/8	
KEY	- IRON	= 8/8	
BOTTLE	- LADDER	= 8/8	
<u>mean</u>		= 8/8	

9) 10/7/90 & 11/7/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CASTLE	- SNOWMAN	= 8/8	A-B TRAINING
TV	- SAW	= 8/8	
KEY	- RABBIT	= 8/8	
BOTTLE	- KITE	= 8/8	
<u>mean</u>		= 8/8	

CASTLE	- PHONE	= 8/8	A-C TRAINING
TV	- CRAB	= 8/8	
KEY	- IRON	= 8/8	
BOTTLE	- LADDER	= 8/8	
<u>mean</u>		= 8/8	

SNOWMAN	- PHONE	= 8/8	B-C TEST TRIALS
SAW	- CRAB	= 8/8	
RABBIT	- IRON	= 8/8	
KITE	- LADDER	= 6/8	
<u>mean</u>		= 7.5/8 (-)	

10) 11/7/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CASTLE	- SNOWMAN	= 8/8	A-B TRAINING
TV	- SAW	= 8/8	
KEY	- RABBIT	= 8/8	
BOTTLE	- KITE	= 8/8	
<u>mean</u>		= 8/8	

CASTLE	- PHONE	= 8/8	A-C TRAINING
TV	- CRAB	= 8/8	
KEY	- IRON	= 8/8	
BOTTLE	- LADDER	= 8/8	
<u>mean</u>		= 8/8	

SNOWMAN	- PHONE	= 8/8	B-C TEST TRIALS
SAW	- CRAB	= 8/8	
RABBIT	- IRON	= 8/8	
KITE	- LADDER	= 8/8	
<u>mean</u>		= 8/8	

11) 12/7/90

Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CASTLE	- SNOWMAN	= 8/8	A-B TRAINING
TV	- SAW	= 8/8	
KEY	- RABBIT	= 8/8	
BOTTLE	- KITE	= 8/8	
<u>mean</u>		= 8/8	
CASTLE	- PHONE	= 8/8	A-C TRAINING
TV	- CRAB	= 8/8	
KEY	- IRON	= 8/8	
BOTTLE	- LADDER	= 8/8	
<u>mean</u>		= 8/8	
PHONE	- SNOWMAN	= 8/8	C-B TEST TRIALS
CRAB	- SAW	= 8/8	
IRON	- RABBIT	= 8/8	
LADDER	- KITE	= 8/8	
<u>mean</u>		= 8/8	

SUBJECT: NIALL

DATE OF BIRTH: 18/6/86

AGE DURING STUDY: 3 years, 11 months to 4 years 2 months

BIDIRECTIONALITY TEST 1

1) 6/6/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

BALL - HAT	= 8/8	A-B TRAINING
TRAIN - APPLE	= 8/8	
BANANA - HORSE	= 8/8	
TREE - BOOK	= 8/8	
<u>mean</u>	= 8/8	

2) 7/6/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

BALL - HAT	= 8/8	A-B TRAINING 1
TRAIN - APPLE	= 8/8	
BANANA - HORSE	= 8/8	
TREE - BOOK	= 8/8	
<u>mean</u>	= 8/8	
BALL - HAT	= 8/8	A-B TRAINING 2
TRAIN - APPLE	= 8/8	
BANANA - HORSE	= 8/8	
TREE - BOOK	= 8/8	
<u>mean</u>	= 8/8	
HAT - BALL	= 8/8	B-A TEST TRIALS
APPLE - TRAIN	= 8/8	
HORSE - BANANA	= 8/8	
BOOK - TREE	= 8/8	
<u>mean</u>	= 8/8	

BIDIRECTIONALITY TEST 2

3) 12/6/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

SNAIL - GLASSES	= 7/8	A-B TRAINING
PEG - WINDOW	= 8/8	
DOG - STAR	= 8/8	
CHICKEN - BIKE	= 8/8	
<u>mean</u>	= 7.75/8	

4) 14/6/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

SNAIL - GLASSES	= 8/8	A-B TRAINING 1
PEG - WINDOW	= 8/8	
DOG - STAR	= 8/8	
CHICKEN - BIKE	= 8/8	
<u>mean</u>	= 8/8	

SNAIL	- GLASSES	= 8/8	A-B TRAINING 2
PEG	- WINDOW	= 8/8	
DOG	- STAR	= 8/8	
CHICKEN	- BIKE	= 8/8	
mean		= 8/8	

GLASSES	- SNAIL	= 8/8	B-A TEST TRIALS
WINDOW	- PEG	= 8/8	
STAR	- DOG	= 8/8	
BIKE	- CHICKEN	= 8/8	
mean		= 8/8	

BIDIRECTIONALITY TEST 3, BEHIND CURTAIN.

5) 20/6/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

MUSHROOM	- TEAPOT	= 8/8
EGG	- FIRE	= 8/8
ICECREAM	- KNIFE	= 8/8
CHERRY	- HAMMER	= 8/8
mean		= 8/8

6) 24/6/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

MUSHROOM	- TEAPOT	= 8/8	A-B TRAINING 1
EGG	- FIRE	= 8/8	
ICECREAM	- KNIFE	= 8/8	
CHERRY	- HAMMER	= 8/8	
mean		= 8/8	

MUSHROOM	- TEAPOT	= 8/8	A-B TRAINING 2
EGG	- FIRE	= 8/8	
ICECREAM	- KNIFE	= 8/8	
CHERRY	- HAMMER	= 8/8	
mean		= 8/8	

TEAPOT	- MUSHROOM	= 8/8	B-A TEST TRIALS
FIRE	- EGG	= 8/8	
KNIFE	- ICECREAM	= 8/8	
HAMMER	- CHERRY	= 8/8	
mean		= 8/8	

'EQUIVALENCE' TEST, BEHIND SCREEN.

(A-B TRIALS ALREADY AT CRITERION.)

7) 3/7/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

MUSHROOM	- CASTLE	= 8/8	A-C TRAINING
EGG	- TELLY	= 8/8	
ICECREAM	- KEY	= 7/8	
CHERRY	- BOTTLE	= 8/8	
mean		= 7.75/8	

8) 5/7/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

MUSHROOM	- TEAPOT	= 8/8	A-B TRAINING
EGG	- FIRE	= 8/8	
ICECREAM	- KNIFE	= 8/8	
CHERRY	- HAMMER	= 8/8	
mean		= 8/8	
MUSHROOM	- CASTLE	= 8/8	A-C TRAINING
EGG	- TELLY	= 8/8	
ICECREAM	- KEY	= 8/8	
CHERRY	- BOTTLE	= 8/8	
mean		= 8/8	

9) 8/7/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

MUSHROOM	- TEAPOT	= 8/8	A-B TRAINING
EGG	- FIRE	= 8/8	
ICECREAM	- KNIFE	= 8/8	
CHERRY	- HAMMER	= 8/8	
mean		= 8/8	
MUSHROOM	- CASTLE	= 8/8	A-C TRAINING
EGG	- TELLY	= 8/8	
ICECREAM	- KEY	= 8/8	
CHERRY	- BOTTLE	= 8/8	
mean		= 8/8	
TEAPOT	- CASTLE	= 7/8	B-C TEST TRIALS
FIRE	- TELLY	= 6/8	
KNIFE	- KEY	= 1/8	
HAMMER	- BOTTLE	= 2/8	
mean		= 4/8	

10) 9/7/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

MUSHROOM	- TEAPOT	= 8/8	A-B TRAINING
EGG	- FIRE	= 8/8	
ICECREAM	- KNIFE	= 8/8	
CHERRY	- HAMMER	= 8/8	
mean		= 8/8	
MUSHROOM	- CASTLE	= 8/8	A-C TRAINING
EGG	- TELLY	= 8/8	
ICECREAM	- KEY	= 8/8	
CHERRY	- BOTTLE	= 8/8	
mean		= 8/8	
TEAPOT	- CASTLE	= 7/8	B-C TEST TRIALS
FIRE	- TELLY	= 6/8	
KNIFE	- KEY	= 0/8	
HAMMER	- BOTTLE	= 6/8	
mean		= 4.75/8	

11) 16/7/90

Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

MUSHROOM - TEAPOT	= 8/8	A-B TRAINING
EGG - FIRE	= 8/8	
ICECREAM - KNIFE	= 8/8	
CHERRY - HAMMER	= 8/8	
mean	= 8/8	
MUSHROOM - CASTLE	= 8/8	A-C TRAINING
EGG - TELLY	= 7/8	
ICECREAM - KEY	= 7/8	
CHERRY - BOTTLE	= 8/8	
mean	= 7.5/8	
TEAPOT - CASTLE	= 6/8	B-C TEST TRIALS
FIRE - TELLY	= 5/8	
KNIFE - KEY	= 1/8	
HAMMER - BOTTLE	= 4/8	
mean	= 4/8	

SUBJECT: STEVEN

DATE OF BIRTH: 11/4/87

AGE DURING STUDY: 3 years, 2 months to 3 years, 3 months

BIDIRECTIONALITY TEST 1

1) 3/7/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CLOWN - BELL	= 8/8	A-B TRAINING	
BALLOON - DRESS	= 8/8		
LADYBIRD - SAUSAGE	= 8/8		
RAINBOW - COW	= 8/8		
<u>mean</u>	= 8/8		

2) 4/7/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CLOWN - BELL	= 8/8	A-B TRAINING 1
BALLOON - DRESS	= 8/8	
LADYBIRD - SAUSAGE	= 8/8	
RAINBOW - COW	= 8/8	
<u>mean</u>	= 8/8	
CLOWN - BELL	= 8/8	A-B TRAINING 2
BALLOON - DRESS	= 8/8	
LADYBIRD - SAUSAGE	= 8/8	
RAINBOW - COW	= 8/8	
<u>mean</u>	= 8/8	
BELL - CLOWN	= 8/8	B-A TEST TRIALS
DRESS - BALLOON	= 8/8	
SAUSAGE - LADYBIRD	= 8/8	
COW - RAINBOW	= 6/8	
<u>mean</u>	= 7.5/8 (-)	

3) 9/7/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CLOWN - BELL	= 8/8	A-B TRAINING 1
BALLOON - DRESS	= 8/8	
LADYBIRD - SAUSAGE	= 8/8	
RAINBOW - COW	= 8/8	
<u>mean</u>	= 8/8	
CLOWN - BELL	= 8/8	A-B TRAINING 2
BALLOON - DRESS	= 8/8	
LADYBIRD - SAUSAGE	= 8/8	
RAINBOW - COW	= 8/8	
<u>mean</u>	= 8/8	
BELL - CLOWN	= 8/8	B-A TEST TRIALS
DRESS - BALLOON	= 8/8	
SAUSAGE - LADYBIRD	= 8/8	
COW - RAINBOW	= 8/8	
<u>mean</u>	= 8/8	

BIDIRECTIONALITY TEST 2, BEHIND SCREEN.

4) 10/7/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CANDLE	- BRIDGE	= 8/8	A-B TRAINING
ROCKET	- TEDDY	= 8/8	
AMBULANCE	- PAINTBRUSH	= 8/8	
SANDWICH	- COAT	= 8/8	
mean		= 8/8	

5) 12/7/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CANDLE	- BRIDGE	= 8/8	A-B TRAINING 1
ROCKET	- TEDDY	= 8/8	
AMBULANCE	- PAINTBRUSH	= 8/8	
SANDWICH	- COAT	= 7/8	
mean		= 7.75/8	
CANDLE	- BRIDGE	= 7/8	A-B TRAINING 2
ROCKET	- TEDDY	= 8/8	
AMBULANCE	- PAINTBRUSH	= 7/8	
SANDWICH	- COAT	= 8/8	
mean		= 7.5/8	
BRIDGE	- CANDLE	= 8/8	B-A TEST TRIALS
TEDDY	- TEDDY	= 8/8	
PAINTBRUSH	- AMBULANCE	= 8/8	
COAT	- SANDWICH	= 8/8	
mean		= 8/8	

'EQUIVALENCE' TEST, NOT BEHIND SCREEN.

(A-B TRIALS ALREADY AT CRITERION)

6) 23/7/90a
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CANDLE	- BAT	= 8/8	A-C TRAINING
ROCKET	- TOOTHBRUSH	= 6/8	
AMBULANCE	- STRING	= 8/8	
SANDWICH	- LORRY	= 8/8	
mean		= 7.5/8 (-)	

7) 23/7/90b
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CANDLE	- BAT	= 7/8	A-C TRAINING
ROCKET	- TOOTHBRUSH	= 8/8	
AMBULANCE	- STRING	= 7/8	
SANDWICH	- LORRY	= 8/8	
mean		= 7.5/8	

8) 24/7/90 & 27/7/90
Instruction "When its the ..., touch the ...", NO feedback.

Conditional stimulus pairs:

CANDLE - BRIDGE	= 8/8	A-B TRAINING
ROCKET - TEDDY	= 8/8	
AMBULANCE - PAINTBRUSH	= 8/8	
SANDWICH - COAT	= 8/8	
<u>mean</u>	= 8/8	

CANDLE - BAT	= 8/8	A-C TRAINING
ROCKET - TOOTHBRUSH	= 8/8	
AMBULANCE - STRING	= 8/8	
SANDWICH - LORRY	= 8/8	
<u>mean</u>	= 8/8	

9) 26/7/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CANDLE - BRIDGE	= 7/8	A-B TRAINING
ROCKET - TEDDY	= 8/8	
AMBULANCE - PAINTBRUSH	= 7/8	
SANDWICH - COAT	= 7/8	
<u>mean</u>	= 7.25/8	

CANDLE - BAT	= 8/8	A-C TRAINING
ROCKET - TOOTHBRUSH	= 7/8	
AMBULANCE - STRING	= 8/8	
SANDWICH - LORRY	= 8/8	
<u>mean</u>	= 7.75/8	

BRIDGE - BAT	= 7/8	B-C TEST TRIALS
TEDDY - TOOTHBRUSH	= 2/8	
PAINTBRUSH - STRING	= 3/8	
SANDWICH - LORRY	= 6/8	
<u>mean</u>	= 4.5/8	

10) 31/7/90 & 1/8/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CANDLE - BRIDGE	= 8/8	A-B TRAINING
ROCKET - TEDDY	= 8/8	
AMBULANCE - PAINTBRUSH	= 8/8	
SANDWICH - COAT	= 7/8	
<u>mean</u>	= 7.75/8	

CANDLE - BAT	= 8/8	A-C TRAINING
ROCKET - TOOTHBRUSH	= 7/8	
AMBULANCE - STRING	= 8/8	
SANDWICH - LORRY	= 8/8	
<u>mean</u>	= 7.75/8	

BRIDGE - BAT	= 5/8	B-C TEST TRIALS
TEDDY - TOOTHBRUSH	= 3/8	
PAINTBRUSH - STRING	= 2/8	
SANDWICH - LORRY	= 7/8	
<u>mean</u>	= 4.25/8	

11) 3/8/90 & 6/8/90 & 7/8/90
Instruction "When its the ..., touch the ...", NO feedback.
Conditional stimulus pairs:

CANDLE - BRIDGE	= 8/8	A-B TRAINING

ROCKET	- TEDDY	= 8/8	
AMBULANCE	- PAINTBRUSH	= 8/8	
SANDWICH	- COAT	= 8/8	
<u>mean</u>		= 8/8	
CANDLE	- BAT	= 8/8	A-C TRAINING
ROCKET	- TOOTHBRUSH	= 8/8	
AMBULANCE	- STRING	= 8/8	
SANDWICH	- LORRY	= 8/8	
<u>mean</u>		= 8/8	
BRIDGE	- BAT	= 4/8	B-C TEST TRIALS
TEDDY	- TOOTHBRUSH	= 5/8	
PAINTBRUSH	- STRING	= 2/8	
SANDWICH	- LORRY	= 7/8	
<u>mean</u>		= 4.5/8	