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Analysing Relational Frames: Studying Language and Cognition in Young Children

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To Dermot

. . . you always believed in me

Steve was right as usual:

"Dermot is a brilliant light
that illuminates all around him"

*To **Siobhan and Conor**, we will always believe in you.*
*To **Bryan Roche** who has been very kind to us all.*
*To **Steve Hayes** for his mystical inspirations.*
*To **Behaviour Analysis** - you have always served us well.*

And finally, to all of the children, parents, and carers who gave so willingly of their time and effort in order that science could take this very small step forward!

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Abstract

The studies reported in the current thesis were concerned with generating repertoires of derived relational responding, as generalised operant behaviour, in young children, using interventions suggested by Relational Frame Theory (RFT).

The studies reported in Chapters 2 and 3 sought to determine which of two methods, exemplar training and name training, would most readily facilitate the derived transformation of functions in accordance with symmetry. Twenty one out of twenty four children, aged between four and five years old, failed to show derived object-action or action-object symmetry until they received explicit symmetry training. Thirteen of these children had received name training. Overall, the data are consistent with Relational Frame Theory, but not with Naming Theory.

The studies reported in Chapters 4 and 5 were concerned with establishing specific patterns of relational responding when they were found to be absent in children aged between four and six years old. Problem-solving tasks were developed to test and train patterns of relational responding in accordance with the relational frames of more-than, less-than and opposite. Interventions suggested by Relational Frame Theory were successfully used with all subjects to establish the target relational responses as well as increasingly complex patterns of relational responding. Generalisation tests demonstrated that the relational responding successfully generalised to novel stimuli and experimenters, and contingency reversals indicated that the trained and tested relational responding may usefully be considered a form of generalised operant behaviour. These findings once again lend positive support to Relational Frame Theory's approach

to derived relational responding, and to the functional analysis of human language and cognition.

The study reported in Chapter 6 argued that the emergence of deictic relations such as "I and you," "here and there" and "now and then" is critical to the development of perspective-taking. A testing and training protocol was developed to analyse responding in accordance with I-YOU and HERE-THERE relations. Two case studies that employed this protocol were presented in which complex forms of generalised perspective-taking were established for two young children. The findings suggest that Relational Frame Theory, and behaviour analysis more generally, may have an important contribution to make to the study of perspective-taking. Finally, Chapter 7 synthesises the empirical work presented in the preceding chapters and addresses a number of theoretical issues that arise from this work.

Chapter One

Chapter 1

General Introduction

Behavioural psychology has often been criticised for its apparent failure to explain complex human behaviour (Eysenck & Keane, 1997). Relatively recent developments within behaviour analysis, however, have begun to address this criticism. In particular, researchers in the area of derived stimulus relations, under the rubric of Relational Frame Theory (RFT), have attempted to mount a new research agenda in the experimental analysis of complex human behaviour. Although RFT has spawned a number of key studies that have been published over the past ten years (e.g., Dymond & Barnes, 1995, 1996; Lipkens, Hayes & Hayes, 1993; Roche & Barnes, 1996, 1997; Steele & Hayes, 1991), research in this area remains limited. The research outlined in the current thesis was designed to supplement the empirical work conducted within the conceptual framework of RFT, with a particular focus on experimental histories that give rise to specific patterns of relational framing in normally developing children. Relational frame theory emerged, in part, from research into stimulus equivalence, and thus the current chapter will begin with a brief description of the equivalence phenomenon.

STIMULUS EQUIVALENCE

Sidman (1971) was the first researcher to analyse systematically what he called 'stimulus equivalence' in a developmentally disabled individual. This was the first study to employ the matching-to-sample methodology as a medium in which to generate derived stimulus relations. (For an excellent historical account of Sidman's research into stimulus equivalence, see his 1994 book, *Equivalence relations and behavior: A research story*).

Commonly, the matching-to-sample task consists of training a series of conditional discriminations between arbitrary visual forms. Abstract shapes or nonsense syllables, among which no consistent formal relationship can be identified, are often used as stimuli. For the purposes of communication, these stimuli are designated using alphanumeric labels, which subjects never see. In a typical equivalence experiment, for example, subjects are trained to select stimulus B1 in the presence of A1, B2 in the presence of A2, and B3 in the presence of A3. In other words, the relations A1→ B1, A2 → B2 and A3 → B3 are explicitly reinforced. A further series of related conditional discriminations are then explicitly trained. For instance, subjects might be trained to select C1 in the presence of B1, C2 in the presence of B2, and C3 in the presence of B3. In other words, the relations B1→ C1, B2 → C2 and B3 → C3 are established. Given an explicit training history of this kind, language-able humans frequently respond in accordance with the reverse relations (i.e., B1→ A1, B2 → A2 and B3 → A3), even though these relations were not explicitly trained. This type of performance is described as responding in accordance with derived symmetrical relations. In addition, language-able humans frequently respond in accordance with derived equivalence relations (i.e., C1→ A1, C2 → A2 and C3 → A3) which were also not explicitly trained (Sidman, 1971, 1986; Sidman & Tailby, 1982).

The derived or emergent nature of the stimulus equivalence phenomenon constitutes a challenge to behaviour analysis. Specifically, equivalence cannot easily be explained or predicted using the traditional concept of conditional discrimination (see Barnes, 1994). For example, having trained 'A choose B,' 'B choose A' emerges without a history of reinforcement that could be used to explain this latter matching response. Relational frame theory aims to provide a behaviour-analytic explanation for this apparently unpredictable behavioural outcome. Furthermore, RFT sees the unpredicted properties of equivalence responding as being centrally important for developing a purely functional analysis of complex human behaviour, with a particular focus on language and cognition (Barnes, 1994; Barnes & Holmes, 1991; Barnes & Roche, 1996). The following section will outline the way in which RFT approaches this analysis.

RELATIONAL FRAME THEORY

Relational Frame Theory draws on the common behavioural idea that many species of animal can respond in accordance with formal or *non-arbitrary* relations between or among stimulus objects or events. For example, animals can be trained to select the *larger*, *smaller* or *dimmer* stimulus from a range of choices (see Reese, 1968). This effect demonstrates that the responding of complex organisms may be brought under the stimulus control of a particular formal property of a stimulus relationship. This well-established concept of non-arbitrary stimulus control has been extended by RFT in the construction of the concept of *arbitrarily applicable relational responding*. Language-able humans are said to respond relationally to stimulus events that are *not* defined solely by the formal or non-arbitrary properties of the relata. These types of relational responses are described as *arbitrary*, because they are governed by contextual cues established by a history of interactions within the verbal community. Consider the following example. A child is asked to choose between two coins, a two pence and a ten pence. Based solely on the formal properties of the stimuli, the child might select the two pence coin because it is physically larger than the ten pence coin. This constitutes a non-arbitrary relational response, because it is controlled by the comparative physical dimensions of the stimuli. If, however, the child selects the ten pence coin based on contextual cues established by the verbal community (ten pence is worth *more than* two pence), this constitutes an example of arbitrarily applicable relational responding, because the relation of *more than* is arbitrarily applied by the verbal community.

According to RFT, arbitrarily applicable relational responding (or relational framing) is established, in large part, by an appropriate history of exemplar training (see Barnes, 1994, 1996; Barnes & Holmes, 1991; Barnes & Roche, 1996; Hayes, 1991; 1994; Hayes & Hayes, 1989). Learning to name objects and events may be one of the earliest forms of arbitrarily applicable relational responding. For example, a caregiver will often name an object in the presence of a young child and will then reinforce any orienting response emitted by the child towards the object. This interaction may be described as hear name X → look at object Y. Similarly, the caregiver whilst holding, or pointing to, an object (Y) will utter the appropriate name (X) and ask the child to repeat the name. This interaction may be described as see object Y → hear and say name X. Early language training consists of a wealth of such interactions across an extensive range of objects and names. Each type of interaction (i.e., name → object and object → name) may require explicit reinforcement, such that a number of name → object and object → name exemplars must be trained. When this repertoire has been established, a generalised operant class of "derived naming" is said to have been created. According to RFT, the exemplar training *abstracts out* specific contextual cues as discriminative for the derived naming response. For illustrative purposes consider the following example. Imagine a child with an exemplar naming history who is told "Here is your doll." Contextual cues, such as the spoken word "is" and the naming context itself, are now discriminative for symmetrical responding between the name or spoken word "doll" and the object doll. In the absence of further training, therefore, the child will now point to the doll when asked "Where is your doll?" (name X → object Y) and will say "doll" when presented with the doll and asked "What's this?" (object Y → name X).

For RFT, a relational response, such as symmetry or derived naming, is considered to be part of a generalised, overarching or higher-order operant response class. In abstract terms, when a number of bi-directional relational responses have been explicitly reinforced (e.g., A-B and B-A, C-D and D-C, and so on), training a novel conditional discrimination in one direction only (e.g., X-Y) may produce the reverse relation (Y-X) without explicit reinforcement. In effect, the relational response (if X-Y, then Y-X) has been established as a generalised operant through differential reinforcement across multiple exemplars. As an aside, RFT employs the qualifiers generalised, higher-order and over-arching to specify the purely functional nature of relational operants. These qualifiers are not intended as technical terms, nor do they suggest the existence of additional mediational processes that extend beyond the "basic" operant. Instead, these terms are used simply to emphasise that relational operants cannot be described, even loosely, in topographical terms (Barnes-Holmes & Barnes-Holmes, 2000; Hayes & Wilson, 1996; see also Baer, Peterson, & Sherman, 1967; Gewirtz & Stengle, 1968; McIlvane, Dube, & Callahan, 1995; McIlvane, Dube, Kledaras, Iennaco, & Stoddard, 1990). In other words, the relational operant is not defined by the formal properties of the stimuli, as would be the case, for example, when stimuli are matched based largely on their physical similarity (e.g., matching red with red). Instead, a relational response may be controlled by a contextual cue, the function of which does not depend upon the formal properties of the stimuli in question.

According to RFT, any stimuli may participate in arbitrarily applicable relational responding, given the appropriate contextual cues. Furthermore, from the perspective of RFT, stimulus equivalence is viewed as an example of such relational responding. Imagine, for example, a young child who is exposed to a matching-to-sample task. The contextual cues provided by the task may be discriminative for equivalence responding, because such tasks were previously employed as educational tools to teach picture-to-word equivalences (see Barnes, 1994, and Barnes & Roche, 1996, for detailed discussions). According to RFT, therefore, stimulus equivalence is defined as a generalised operant response class that is established through a history of reinforcement across multiple exemplars, and once established, any stimulus event (regardless of form) may participate in an equivalence relation, given the relevant contextual cues.

As outlined above, RFT takes the position that equivalence may be viewed as a form of generalised operant behaviour. Relational Frame Theory also takes the view that other relational activities may be defined in this way. In fact, a growing body of data provide empirical support for the assumption that responding in accordance with the arbitrarily applicable relations of 'different,' 'opposite' and so forth may be seen as generalised operant responding. This assumption dramatically increases the range of behavioural phenomena that may be derived from explicitly trained relational responding (see Barnes & Hampson, 1993 a & b; Barnes & Keenan, 1993; Dymond & Barnes, 1994; Roche & Barnes, 1997; Steele & Hayes, 1991). However, the descriptive terms of stimulus equivalence do not readily capture the numerous behavioural patterns that are possible when non-equivalence relations are considered. Consequently, RFT employs a somewhat different nomenclature to that of stimulus equivalence. The various patterns of derived relational responding, or relational frames, are said to possess three properties: mutual entailment, combinatorial entailment and transformation of function.

1. *Mutual entailment*: Mutual entailment involves two events. For example, an explicitly trained relation between A and B, in a specific context, derives a relation between B and A. This is not unlike Sidman's concept of symmetry, which readily describes the bi-directional nature of relations involving equivalent stimuli (e.g., if 'A is equal to B' then 'B is equal to A'). There are, however, numerous instances where equivalent bi-directionality does not follow. For example, if A and B participate in a frame of comparison, such that 'A is *less than* B', it follows, in this instance, that 'B is *more than* A.' Accordingly, RFT adopts the broader term of mutual entailment that more readily captures the full range of relations that may be derived between two arbitrary stimuli.

2. *Combinatorial entailment*: Combinatorial entailment occurs among three or more events and also differs from mutual entailment in the specificity of the relations. For example, explicitly trained relations between A and B and between B and C, in a specific context, derive relations between A and C and C and A. In some instances, all of the relations between the events can be specified. For example, 'A more than B and B more than C', derives 'A more than C and C less than A', but if 'A is bigger than B and C is bigger than B' the entailed relation

between A and C is unspecified (i.e., either A or C may be bigger than the other or they may be equal).

3. *Transformation of function*: The final property of arbitrarily applicable relational responding is transformation of function. This refers to the changes that occur to stimulus functions by virtue of their participation in relational frames. Consider the following example. In the verbal community, a child learns that a ten pound note is worth 'more than' a five pound note. As a result of this, the child is likely to be more excited at the prospect of receiving a ten pound note than receiving a five pound note, despite having no direct experience of the former. In this case, the increased excitement displayed with the ten pound note is a direct result of its participation in the 'more than' relation with the five pound note.

At this point it should be made clear that transfer and transformation are sometimes used interchangeably in the literature. However, transformation is a generic term, whereas transfer is more specific. To illustrate, suppose that two stimuli, A and B, participate in an equivalence relation and a sexually arousing function is attached to stimulus B. Given an appropriate context, the previously neutral function of A may be transformed by its participation in this (A=B) relation, in that A acquires a sexually arousing function. It could also be said, however, that the sexual function of stimulus B simply *transfers* over to the equivalent stimulus A (see Dymond & Barnes, 1995, 1996). Although using the term *transfer* is acceptable in this instance, the term transformation is favoured by relational frame theorists, because functions do not simply transfer when stimuli participate in non-equivalence relations. If A is the opposite of B, for example, one would not expect a strong reinforcing function for B to simply transfer over to A.

Instead, the function of B would be transformed such that a substantially weaker reinforcing or even punishing function would be established for A in contexts that give rise to a transformation of derived stimulus functions. For a more concrete example, imagine that you are told that "schmerz" is opposite to "pleasure" (as it is in German). Because pleasure may be highly valued, asking the question "Do you want me to give you schmerz?" will probably evoke avoidance. For this reason, the term transformation is a generic term for RFT and is generally favoured by its proponents.

In addition to the foregoing technical terms (i.e., mutual entailment, combinatorial entailment and transformation of function), RFT also explicitly defines two terms that specify two forms of contextual control that operate within any instance of relational framing. These are referred to as *Crel* and *Cfunc* stimuli. Crels determine the relation that obtains among two or more events. The phrases "more than," "same as" and "comes before," for example, may function as Crels that determine the relational response to two or more stimuli (e.g., if you are told that 'A comes before B', then you may derive that 'B comes after A'). Cfunc stimuli determine the psychological functions that transform in accordance with derived stimulus relations. The phrases, or Cfuncs, "look at," "pick up" and "let go," for example, may determine the behavioural functions that are transformed in accordance with a derived stimulus relation. Imagine, for example, that you are told that "cupan" means cup in Irish. In this case, the word "means" functions as a Crel that establishes an equivalence relation between cupan, cup and actual cups. Various Cfuncs may now be used to transform a wide variety of behavioural functions in accordance with this new equivalence relation. For example, the mands, "pick up the cupan" and "let go of the cupan" each contain a different

Cfunc that transforms the function of an actual cup based on an equivalence relation between the cup and the Irish word "cupan." In the presence of either of the foregoing mands, for instance. the function of a cup may be transformed such that it controls a "picking up," or "letting go" response function. In effect, Crels and Cfuncs control *synergistically* the behavioural patterns that define any particular instance of relational framing.

Although the foregoing illustrates that RFT is concerned with equivalence and derived relational responding more generally, the theory has a broader research agenda. As indicated at the beginning of this chapter, RFT is also concerned with developing a modern behaviour-analytic approach to human language and cognition. This research agenda has been outlined many times before and not all of the details are necessary for present purposes (see Hayes, Barnes-Holmes & Roche. 2001; Hayes & Hayes, 1989). Nevertheless, I will briefly outline the main way in which RFT approaches this analysis. In essence, RFT takes the view that derived relational responding provides a functional analytic definition of verbal behaviour. Consider the following example. Suppose that a young boy hears that he is going to the "Doctor" (Stimulus A) and subsequently experiences a painful injection. The boy may then learn at school that a "Surgeon" (Stimulus B) is a type of doctor. In an appropriate context, the boy may then show signs of distress if he is told that he is going to see a surgeon, despite having had no direct experience with surgeons. This transformation of function phenomenon is based on the psychological function of A and the derived relation between A and B. In effect, the boy need not experience any aversive consequences when attending a surgeon in order to show signs of anxiety (see Hayes & Hayes, 1989, 1992; Hayes & Wilson, 1994). This hypothetical example illustrates one of the core assumptions of the relational frame approach to verbal events; *a stimulus or response is rendered verbal by its participation in an equivalence or other type of derived relation.* In this way, RFT provides a functional analytic definition of the term "verbal" in a way that previous behaviour-analytic treatments did not (see Hayes, 1994). This basic assumption forms the basis for much of the empirical work that will be considered in the next and following sections.

Relational Frame Theory: Empirical Evidence

Relational Frame Theory has thus far generated a range of studies that could all be described loosely as demonstration research. Some of these studies developed experimental procedures for demonstrating complex patterns of derived relational responding in human adult subjects (e.g., Dymond & Barnes, 1995, 1996; Roche & Barnes, 1996, 1997; Steele & Hayes, 1991; Wulfert & Hayes, 1988), whereas others attempted to demonstrate a correlation between relational framing and specific natural language abilities (Barnes, Browne, Smeets & Roche, 1995; Barnes, McCullagh & Keenan, 1990; Devany, Hayes & Nelson, 1986; Lipkens, Hayes & Hayes, 1993). This RFT research provides an important backdrop to the empirical work conducted in the current thesis, and the key studies that constitute the demonstration research mentioned above will now be reviewed.

Demonstration Research

Complex patterns of derived relational responding. A number of studies have demonstrated contextual control of relational responding in accordance with multiple stimulus relations and the transformation of function in accordance with these relations. I will briefly outline what appear to be the three seminal studies in this area.

Wulfert and Hayes (1988) demonstrated the transfer of a conditional ordering response through derived contextually controlled equivalence classes. Figure 1 presents a schematic representation of the trained and derived relations in this study. Three conditional discriminations were reinforced in the presence of a green background. That is, given a green background, selecting B1, C1 and D1 was reinforced in the presence of sample stimulus A1, whereas selecting B2, C2 and D2 was reinforced in the presence of sample A2. This led to the formation of two four-member equivalence classes (i.e., GREEN/A1→B1→C1→D1 and GREEN/A2→B2→C2→D2).

Subjects were then trained in a B1→ B2 sequential ordering response, such that when presented with B1 and B2, pressing B1 first and B2 second was reinforced. Subjects demonstrated the transfer of the ordering response through the predicted equivalence classes. That is, when shown A1-A2, C1-C2 and D1-D2, subjects consistently selected the stimuli from class 1 (A1, C1 and D1) before selecting those from class 2 (A2, C2 and D2).

Green Background/High Tone

A1 - B1 - C1 - D1 : A2 - B2 - C2 - D2

Sy Eq Sy Eq

|-------------1st-------------| |------------2nd--------------|

Red Background/High Tone

A1 - B1 - C2 - D2 : A2 - B2 - C1 - D1

Sy Eq Sy Eq

|-------------1st-------------| |------------2nd--------------|

Green Background/Low Tone

A2 - B2 - C2 - D2 : A1 - B1 - C1 - D1

Sy Eq Sy Eq

|-------------1st-------------| |------------2nd--------------|

Red Background/Low Tone

A2 - B2 - C1 - D1 : A1 - B1 - C2 - D2

Sy Eq Sy Eq

|-------------1st-------------| |------------2nd--------------|

Sy = Transfer via Symmetry
Eq = Transfer via Equivalence

Figure 1: Schematic representation of Phases 1, 2 and 3 from Wulfert and Hayes (1988). The study showed that both the ordering and conditional ordering responses transferred from the B stimuli to the A stimuli, via symmetry, and to the C and D stimuli, via equivalence. In total, one hundred and twenty untrained sequences (not all of these are illustrated above) emerged from eight trained sequences for all subjects (see text for details).

In Phase 2 of this study, subjects were trained in six second-order conditional discriminations, three in the presence of the green background and three in the presence of a red background (i.e., the colour backgrounds functioned as Crels). On the green background, all relations remained the same as in Phase 1. On the red background, two of the comparison pairs swapped classes (i.e., C1 and C2 moved to class 2 and C2 and D2 moved to class 1). In Phase 2, therefore, selecting C2 and D2 was now reinforced in the presence of A1 and selecting C1 and D1 was reinforced in the presence of A2. The new conditional equivalence classes were GREEN/A1-B1-C1-D1 and A2-B2-C2-D2, and RED/A1-B1-C2-D2 and A2-B2-C1-D1. After retraining in the B1-B2 ordering response, all subjects demonstrated the transfer of this ordering response through the new conditional equivalence classes. That is, in the presence of the green background, subjects selected A1 before A2, C1 before C2 and D1 before D2, but in the presence of the red background, subjects selected A1 before A2, C2 before C1 and D2 before D1.

In Phase 3 of this study, Wulfert and Hayes examined the transfer of a conditional sequential response through derived equivalence relations. In other words, the ordering response itself was brought under contextual control when the 'B1 first-B2 second' sequence was reinforced in the presence of a high-pitched tone, and a 'B2 first-B1 second' sequence was reinforced in the presence of a low-pitched tone (i.e., the tones functioned as Cfuncs). This training occurred in the presence of both green and red backgrounds with the conditional equivalence classes remaining unchanged. During testing, subjects showed a conditional transfer of the ordering response in accordance with the four contextually controlled equivalence classes. That is, given the high-tone and green background, subjects selected A1 before A2, C1 before C2 and D1 before D2, and in the presence of the high-tone and red background, subjects selected A1 before A2, C2 before C1 and D2 before D1. Given the low-tone and green background, subjects selected A2 before A1, C2 before C1 and D2 before D1, and in the presence of the low-tone and red background, subjects selected A2 before A1, C1 before C2, and D1 before D2. Overall, the results from this study demonstrated that both the ordering and conditional ordering response transferred through the four conditional equivalence classes. This early RFT study clearly demonstrated that it was possible to generate, in a laboratory setting, many complex patterns of derived relational responding based on minimal levels of explicit reinforcement. In fact, in the Wulfert and Hayes study, a total of one hundred and twenty untrained sequences emerged for all subjects from only eight trained sequences. However, this study focused on equivalence classes, and did not attempt to demonstrate relational responding in accordance with any non-equivalence relations.

Steele and Hayes (1991) were the first to provide evidence of responding in accordance with multiple stimulus relations. These authors demonstrated contextually-controlled matching-to-sample responding in accordance with the relational frames of 'same,' 'different' and 'opposite'. During a pretraining phase, teenage subjects were trained to relate same stimuli (e.g., a short line with a short line) in the presence of one contextual cue, opposite stimuli (e.g., a short line with a long line) in the presence of another contextual cue, and different stimuli (e.g., a short line with a square) in the presence of a third contextual cue. In other words, these three contextual cues (or Crels) were established as functionally equivalent to the words "SAME," "DIFFERENT" and "OPPOSITE". Subjects were then extensive network of conditional discriminations, with each conditional discrimination being made in the presence of one of the three contextual cues used in the pretraining. These are depicted in Figure 2.

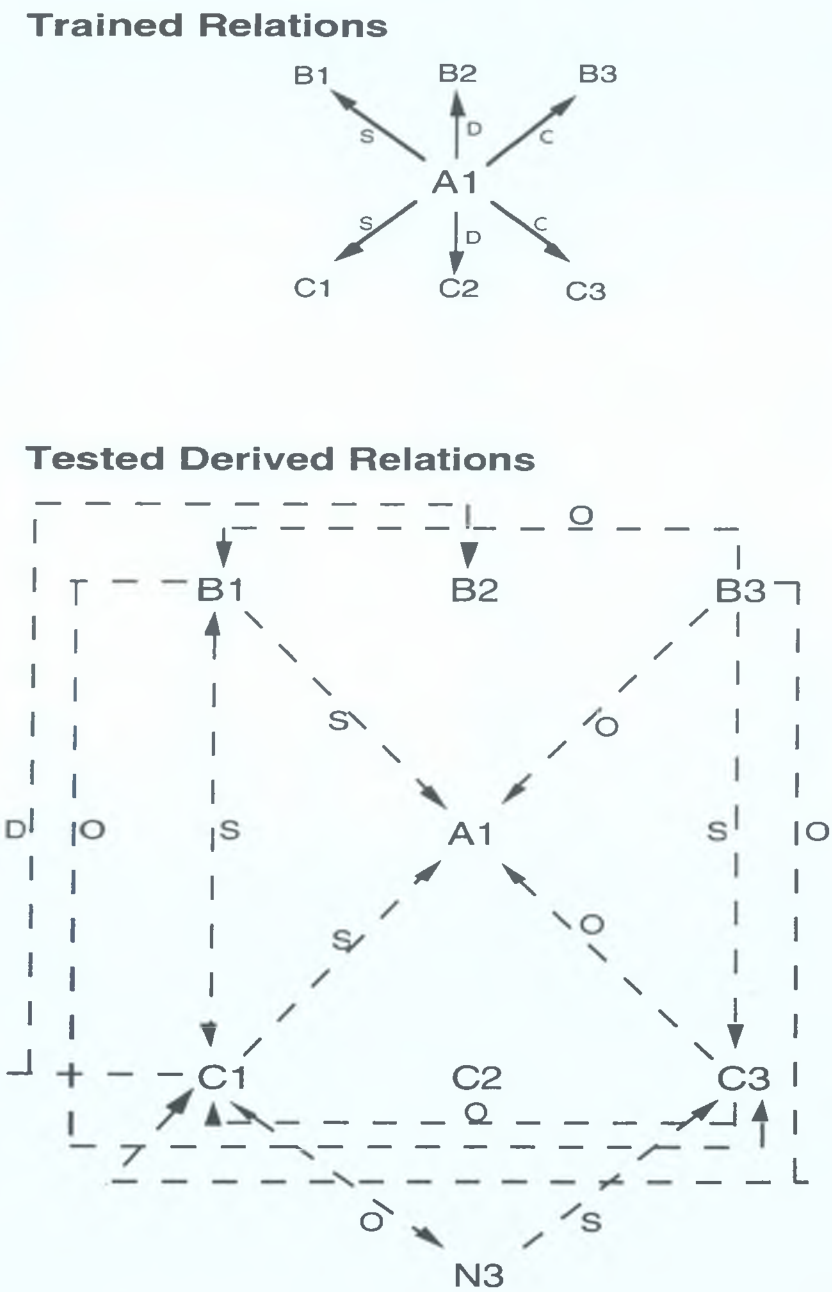

Figure 2: A schematic representation of the trained and tested relations in Steele and Hayes (1991). Letters S, O and D indicate the arbitrarily applicable relations of same, opposite and different.

There were six trained relations, and these were as follows; [S] A1/B1-B2-B3, [S] A1/C1-C2-C3, [O] A1/B1-B2-B3, [O] A1/C1-C2-C3, [D] A1/B1-B2, [D] A1/C1-C2. The letters S, O and D represent the visual forms that had been established as same, opposite and different contextual cues, respectively, during pretraining. The stimulus A1 was the sample and the B and C stimuli were the comparisons. Selecting B1 and C1 was reinforced in the presence of the 'same' stimulus, selecting B3 and C3 was reinforced in the presence of the 'opposite' stimulus, and selecting B2 and C2 was reinforced in the presence of the 'different' stimulus (reinforced comparisons are underlined). To get a flavour of the test performances that emerged, consider three of the fifteen tasks that were used to test for derived responding; [S] B1/C1-C2-C3, [S] B3/C1-C2-C3, [D] C1/B1-B2-N3 (N3 was a novel stimulus that had not been used during the training). Subjects selected C1, C3 and B2, respectively on these tasks, indicating response patterns in accordance with the frames of same, opposite and different (i.e., if B1 and C1 are the same as A1, then B1 and C1 are the same; if B3 and C3 are opposite to A1, then B3 and C3 are the same; if B2 is different from A1 and C1 is the same as A1, then B2 is also different from C1).

Dymond and Barnes (1995) extended the findings of Steele and Hayes (1991) by investigating "same," "opposite," "more-than" and "less-than" relations. This study was also concerned with establishing the transformation of self-discrimination functions in accordance with these derived relations. In Experiment 1, two subjects were exposed to a phase of non-arbitrary relational pretraining. This pretraining established non-arbitrary relational responding in accordance with four contextual cues; same, opposite, more-than and less-than. Responding in accordance with "same" and "opposite" involved training procedures similar to those employed by Steele and Hayes (1991). A similar training sequence was used to establish control by the "more-than" and "less-than" cues. This latter pattern of non-arbitrary relational responding was trained using comparisons that were either "more than" or "less than" the sample stimulus along some physical dimension. For example, in the presence of a three-star sample, subjects were trained to select a two-star comparison given the 'less-than' stimulus and a six-star comparison given the 'more-than' stimulus.

The subjects were then exposed to a phase of arbitrary relational training involving the same contextual cues. In this phase of the experiment, nonsense syllables replaced the figures and shapes that had been used in the non-arbitrary pretraining. All three subjects received training in six arbitrary relations, the most important of which were; SAME/A1-B1, SAME/A1-C1, LESS THAN/B2-A1 and MORE THAN/C2-A1. Having reached a mastery criterion in this training phase, all three subjects were then tested for responding in accordance with a number of derived relations, the three most important being; SAME/B1-C1, MORE-THAN/C2-B1 and LESS-THAN/B2-B1. Subjects demonstrated the predicted pattern of responding in accordance with all of the derived relations (see Figure 3 for a schematic representation of the trained and tested relations).

Schematic Representation of Trained and Tested Relations (Dymond & Barnes, 1995)

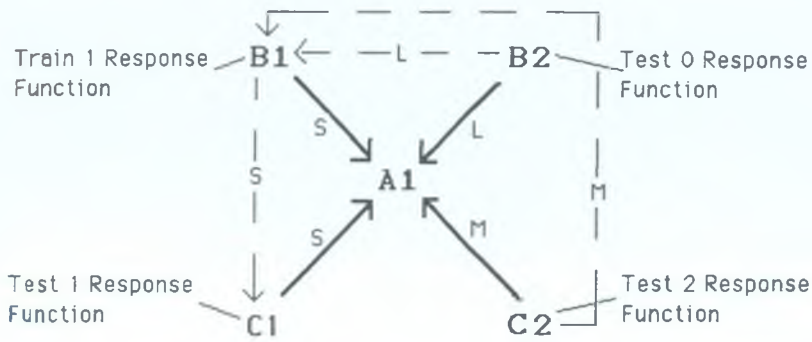

Figure 3: Schematic representations of the most important of the trained (solid lines) and tested (dashed lines) relations in the Dymond and Barnes (1995) study. Letters S, M and L indicate the arbitrarily applicable relations of same, more-than, and less-than. The relational network from the Dymond and Barnes study also shows that a one-response function was trained using the B1 stimulus and tests examined the transformation of the trained self-discrimination response function in accordance with the relations of same (C1, one response), more-than (C2, two responses) and less-than (B2, no response).

In the second phase of Experiment 1, Dymond and Barnes demonstrated that self-discrimination response functions could be transformed in accordance with the arbitrarily applicable relations of same, more-than and less-than. Three reinforcement schedules were used to establish three different response patterns; (a) no response, (b) one response only and (c) two responses. Subjects were also trained to choose different stimuli conditional upon which of the three patterns they had just produced on a given trial. Dymond and Barnes predicted that if reinforcement followed the selection of stimulus B1 after emitting one response, a subject, without further training, would make the following choices; (i) C1 following one response (i.e., C1 acquires the same function as B1), (ii) B2 following no response (i.e., B2 acquires a response function that is less-than the B1 function) and (iii) C2 following two responses (i.e., C2 acquires a response function that is more-than the B1 function) (see Figure 3).

All four subjects readily produced the predicted transformation of self-discrimination functions (see Dymond & Barnes, 1996, for related empirical research). This study was the first to demonstrate responding in accordance with the relations of more-than and less-than. Furthermore, the study also demonstrated the transformation of self-discrimination response functions in accordance with these specific relations.

Derived relational responding and language. The findings outlined above provide examples of the complex forms of derived stimulus control predicted by RFT. Such studies demonstrate that relational framing behaviours are possible, at least with adults and teenagers under strict laboratory conditions. Other studies, however, have attempted to demonstrate that derived relational responding overlaps functionally with human verbal behaviour. This research has employed young children (some with very limited verbal abilities) as a means of examining the nature of this functional overlap.

The first published study designed to investigate the relationship between language and stimulus equivalence was reported in the mid-eighties (Devany, Hayes & Nelson, 1986). In this study, three groups of children were used; normally developing preschoolers, developmentally delayed children with some language skills and developmentally delayed children with no language skills. All three groups of children were trained in two conditional discriminations (i.e., A1-

B1, A2-B2, A1-C1, A2-C2), followed by a test for equivalence (i.e., B1-C1, B2-C2, C1-B1, C2-B2). Devany et al. predicted that if language and equivalence are related, only the children with no verbal skills should fail to demonstrate equivalence responding. Indeed, all children in the verbally-able groups (both normally developing and developmentally delayed) readily demonstrated equivalence, compared to none of the children in the verbally-unskilled group, although all groups were matched for mental age. These findings showed that language abilities covary, to some extent, with the ability to demonstrate equivalence. The study also demonstrated that a child as young as twenty five months, possessing a basic verbal repertoire, was able to respond in accordance with equivalence relations. One criticism, however, of this study, is that the developmental disabilities of the group of children with no language skills may have been an additional variable affecting equivalence responding. Indeed, Devany et al. reported that the non-verbally-able group did require significantly more training trials to establish the baseline conditional discriminations than the other verbally-able children. Perhaps, therefore, the nonverbal children failed the test for equivalence, not because of their lack of language, but because of unspecified deficits (e.g., lack of attention) associated with their developmental delay.

A study published four years later attempted to control for developmental delay as a confounding variable (Barnes, McCullagh & Keenan, 1990). In this study, equivalence responding was examined in a group of children who exhibited a language deficit due to hearing-impairment rather than developmental delay. Barnes et al. compared three groups of children; normally developing children; hearing-impaired children with language skills above two years, and hearing-impaired children with language skills below two years. The results showed that all of the children with language skills above two years (normally developing and hearing-impaired) demonstrated equivalence, whereas the child with the lowest language age failed to do so (i.e., one to one and a half years). One interesting finding from this study was that the other child in the group with language skills below two years (i.e., one and a half to two years), contrary to expectation, demonstrated equivalence. However, there was an important difference in the language skills of these two children. Specifically, the child who showed equivalence readily engaged in symmetrical responding in accordance with common object-symbol relations, whereas the child who failed to show equivalence did not. This additional finding was used by Barnes et al. to support the RFT view that symbol-referent relations (in natural language) are functionally similar to equivalence relations in matching-to-sample contexts.

Relational frame research has also examined the relationship between equivalence and language using the transformation of function phenomenon (Barnes, Browne, Smeets & Roche, 1995). Specifically, this research aimed to demonstrate a transformation of stimulus functions through equivalence classes and contextual control over this transformation, using relatively young children as subjects. The rationale behind this research was as follows. From the perspective of RFT, the transformation of discriminative functions through equivalence relations is deemed to be functionally similar to the behaviour of a young child who responds appropriately to a symbol or word without a history of explicit training. Furthermore, for RFT, obtaining contextual control over such a transformation of functions is considered to be functionally similar to contextual control over semantic meaning in natural language (e.g., the word "bat" refers to different objects in the context of different sentences). Obviously, if RFT is correct in its interpretation of these language effects in terms of derived transfer and contextually controlled derived transfer, relatively young children should be capable of showing these effects in a laboratory setting. If, however, these forms of derived relational responding do not overlap functionally with natural language and require relatively advanced educational histories, then young children should fail to show these effects.

In the study by Barnes et al. (1995) six children, ranging between three and six years old, received conditional discrimination training and testing designed to establish two three-member equivalence classes (A1→ B1→ C1 and A2 → B2 → C2). A discriminative function was then established for one member of each stimulus class, such that clapping was reinforced in the presence of B1 and waving was reinforced in the presence of B2. This training was followed by a test for the transfer of functions to stimuli C1 and C2. As predicted, all of the subjects clapped in the presence of stimulus C1 and waved in the presence of C2.

In the next phase of the experiment, the subjects were exposed to conditional discriminative function training, involving the spoken words "YELLOW" and "BLUE." That is, given B1, clapping was reinforced in the presence of the spoken word "YELLOW", and waving was reinforced in the presence of the spoken word "BLUE." Given B2, waving was reinforced in the presence of "YELLOW", and clapping was reinforced in the presence of "BLUE." During subsequent testing, the contextual stimuli, 'yellow' and 'blue' were presented in visual form only rather than as spoken words. Three older subjects (two four year olds and one six year old) demonstrated the predicted conditional transfer of control through the equivalence relations to the C stimuli. In other words, given stimulus C1, these subjects clapped in the presence of 'yellow' and waved in the presence of 'blue'. Given stimulus C2, however, these subjects waved in the presence of 'yellow' and clapped in the presence of 'blue'. The three younger subjects (all three year olds) failed to complete the experiment due to lack of cooperation, and thus it remained uncertain as to whether they would have passed the transfer tests given additional exposure to the experimental procedures. Overall, these findings demonstrated the transfer and conditional transfer of discriminative functions through derived equivalence classes in young children, without highly advanced verbal repertoires.

The body of evidence reported above provides some empirical support for the RFT suggestion that derived stimulus relations and language are functionally similar. This evidence, however, is far from conclusive in that the data is largely correlational. If RFT is to provide a viable account of human language, then it must be shown that competence in relational responding forms part of the pattern of language development itself. Furthermore, it should be possible to examine this relationship within the naturalistic language context. There has been only one published study to date that has attempted this form of analysis (Lipkens, Hayes & Hayes, 1993).

In this study, a series of experiments examined the emergence of mutual and combinatorial entailment in a normally developing infant using naturalistic language interactions. In an effort to assess mutual entailment, the child was first trained in picture-name relations. That is, he was shown a picture (e.g., an octopus) and the experimenter asked "What is this?" When the child failed to utter a nonsense name for that picture (which, of course, he did on the first trial), he was asked to repeat the name by the experimenter who said: "This is TAK. Can you say TAK? Say TAK." The experimenter recorded whether or not the child repeated the name on each training trial in the presence of the picture. The child was subsequently tested for derived mutually entailed name-picture relations. For example, during one type of test trial, the experimenter presented the two pictures employed in the training and asked "Where is TAK?" in response to which the child was required to point to the named picture. One of the key findings in this part of the study was that the child successfully showed derived name-picture relational responding, although he did not reliably tact the pictures (e.g., he selected the picture of the octopus when asked "Where is TAK?" but failed to utter the name "TAK" when presented with the picture and asked "What is this?").

In a subsequent part of the study, the researchers attempted to establish appropriate tacting. First, they trained the child to select the appropriate picture in the presence of the name. In other words, the experimenter presented two pictures and asked, for example, "Where is KIEKIE?" and the child was required to point to the appropriate picture. In a subsequent test trial, the child was presented with a picture and asked "What is this?" which required that he tact the picture. Although the child had previously selected the appropriate picture given the name, he still did not tact the pictures. At this point, the researchers exposed the child to a limited form of echoic training (i.e., reinforcement was made contingent on the child repeating the name uttered by the experimenter). After echoic responding had been trained in this way; the child successfully tacted the pictures. In other words, when presented with a picture and asked "What is this?" the child uttered the correct name. These findings led to a number of important suggestions; (i) that auditory comprehension (i.e., name-picture relations) develops before naming (i.e., picture-name relations); (ii) that producing the names of pictures or tacting is not always necessary for the derivation of name-picture relations; and (iii) that tacting is facilitated by echoic training.

In yet another part of the study, the child was tested for the derivation of combinatorially entailed relations. Two sets of conditional discriminations were explicitly trained using the procedures described above. As well as being retrained on the old picture-name relations, the child was also trained on picture-sound relations. That is, in the presence of a picture, the child was asked "What does this say?" When the child failed to emit the appropriate sound (as would be expected on the first trial), the experimenter said "This says WOOH. Can you say WOOH? This says WOOH." Subsequent test procedures examined the derivation of mutually and combinatorially entailed relations. The child produced almost perfect responding on the derived mutually entailed (i.e., name-picture and sound-picture) relations. For example, when the experimenter presented two pictures and asked "Where is TAK?" (name) or "What goes WOOH?" (sound), the child pointed to the correct picture. In contrast, the child did not initially respond in accordance with combinatorially entailed relations. That is, having been explicitly trained to form picture-name and picture-sound relations with the same pictures, the child was not able to derive name-sound or sound-name relations between these stimuli. For example, when the child was asked "What does TAK say?" (name) he did not produce the appropriate sound. Similarly, when asked "Listen, WOOH. What do you hear?" (sound), the child did not produce the appropriate name. Although this pattern of failure persisted for some time, the child's performance gradually improved so that by the end of the study he was demonstrating nearly perfect responding on all test trials for combinatorial entailment.

These findings suggest that derived relational responding shows a developmental trend, not unlike language itself. Clearly, the study by Lipkens et al. constitutes another important contribution to the RFT approach to human language in terms of derived relational responding. There are, however, a number of important limitations to the study. First, only one experimental subject was employed. Second, only a limited number of arbitrary relations were investigated. Third, the exact nature of the behavioural history required to generate such patterns of relational responding remains unspecified. Clearly, any future work in this area should address these limitations.

So far, I have examined the main body of RFT research. In summary, all of the studies reviewed demonstrated patterns of derived relational responding that are consistent with RFT, including some evidence to support a functional overlap between relational framing and language as traditionally defined. In the remainder of this chapter the rationale for the studies conducted in the current thesis will be outlined. The research presented in this thesis consists primarily of studies in which specific deficits in derived relational responding are targeted for remediation using interventions suggested by RFT. Although the research reviewed in the previous sections has provided evidence in favour of RFT, there have been no published studies concerned with how a repertoire of relational framing might be established when it is found to be absent. For example, Devany et al. (1996) and Barnes et al. (1990) showed that equivalence was absent in language-disabled children, but no attempt was made to generate a repertoire of equivalencing using interventions suggested by RFT. In a similar vein, Lipkens et al. (1993) tracked the emergence of a simple repertoire of relational framing in a single child, but again no serious attempt was made to remediate deficits in relational framing (except for one instance of echoic training). Furthermore, there is only limited evidence to demonstrate that these performances, once established, display the properties of generalised operant behaviour. An important new research agenda in RFT, therefore, would involve the systematic analysis of the types of history that are necessary to establish relational framing in the behaviour of young children, when it is found to be absent. Conducting this research will also examine the suggestion by RFT that derived relational responding may be approached usefully as generalised operant behaviour. Positive evidence in this regard would provide firm support for RFT's analysis of derived relational responding and for its purely functional approach to human language and cognition.

Based on this reasoning, the research reported in the current thesis focused on three areas in which deficits in relational responding were remediated using RFT-based interventions. Specifically, naming and derived relational responding, relational framing in accordance with more-than, less-than and opposite, and relational framing in perspective-taking were targeted for investigation (although there are clearly many other areas of human behaviour that could be addressed from the perspective of RFT). Two recurrent themes run throughout this empirical work. First, in order to model the history of natural language interactions that supposedly give rise to relational framing in children, where possible, procedures were adopted that analogue naturalistic speaker-listener exchanges. Second, the research examined whether interventions derived from RFT, and behaviour analysis more generally, can be used to establish or facilitate specific repertoires of relational framing in children.

To summarise, the two core research aims of the current thesis may be stated as follows. First, can effective RFT-based interventions be designed that establish or facilitate derived relational responding in children? Second, does derived relational responding display the properties of generalised operant behaviour? The next five chapters will report the empirical work conducted in three research areas that attempts to answer these questions.

Chapter Two

Chapter 2

Name Training vs. Exemplar Training in the Derived Transformation of Function in Accordance with Symmetry

Experiments 1-4

INTRODUCTION

In Sidman's (1971) seminal study of stimulus equivalence, a learning disabled individual was trained and tested in a series of conditional discriminations. Specifically, the subject was trained to pick stimulus B (picture of a car) in the presence of a sample stimulus A (dictated word "CAR"). In this way, a relation between the stimuli A and B, or relation A-B, was trained. An A-C relation was similarly trained when picking stimulus C (printed word 'car') in the presence of sample stimulus A (dictated word "CAR") was reinforced. Following this type of explicit training in AB and AC relations, the subject picked stimulus C (printed word 'car') from a range of comparison stimuli (other printed words) in the presence of sample stimulus B (picture of a car). Thus a B-C relation emerged without having been trained directly. Similarly, the subject chose stimulus B from a range of comparisons when presented with stimulus C as a sample, thus demonstrating an untrained emergent C-B relation. The derived relations of B-C and C-B in this instance constituted what Sidman has called a test for stimulus equivalence.

In the years that followed, Sidman conducted a range of related studies (see Sidman, 1994) and developed his mathematical set theory of the emergent behaviours that are typically observed in equivalence-type research. A core assumption of Sidman's account is that equivalence responding constitutes another basic stimulus function similar, for example, to reinforcement, discriminative control, or stimulus generalisation. Other researchers, such as relational frame theorists, however, have been less than satisfied with this assumption. They have argued that equivalence may not be a newly-discovered basic or fundamental behavioural process, but rather may be generated from already-established basic behavioural processes (Hayes, Barnes-Holmes & Roche, 2001).

As noted in Chapter 1, although a number of studies have provided evidence in favour of RFT, there have been no published studies concerned specifically with remediating deficits in relational framing. The absence of any published RFT-based intervention research is rather surprising, given that RFT considers relational framing to be a type of generalised operant that is produced by a history of exemplar training. Surely a theory that emphasises a history of reinforcement across exemplars, as the main basis for derived relational responding, should attempt to show that this type of history is indeed crucial for relational framing. The four experiments outlined in the current chapter constitute a first step towards addressing this issue.

The current study involved a non-matching-to-sample procedure that allowed training and testing for a derived transformation of functions in accordance with symmetry. A conventional matching-to-sample preparation was avoided because this procedure, it has been argued, may itself function as a contextual cue for symmetry and equivalence, based on its use in preschool education exercises to teach picture-word equivalences. More informally, when a child is presented with a matching-to-sample task, this very format may be discriminative for matching things "that go together" (see Barnes, 1994, and

Barnes & Roche, 1996, for detailed discussions). Insofar as this is the case, matching-to-sample would not allow the effects of exemplar training to be analysed independently of the contextual functions provided by matching-to-sample itself.

The basic procedure involved training four to five year old children to engage in listening, echoic, and tacting behaviours appropriate to particular actions and objects (i.e., name training). This name training served to establish that the children could clearly discriminate all of the actions and objects employed in the four experiments. The children were then taught to pick one of two previously named objects conditional upon the previously named action of the experimenter (action-object training). During a subsequent test, the objects were presented to the subjects to determine whether they would show a transformation of function in accordance with symmetry. In effect, having been trained to pick object A when the experimenter waved, would the function of object A be transformed in accordance with symmetry during the test, such that it would now control waving (i.e., object-action testing)? In Experiment 1 subjects were provided with name training (i.e., training in listening, echoic, and tacting behaviours), both before and after the action-object training. Experiment 2 replicated Experiment 1, except that the name training was omitted after the action-object training. Experiment 3 replicated Experiment 1, except that subjects were also trained to tact all of the objects and actions *during* the action-object training and object-action testing (to ensure that the appropriate discriminations were maintained during the critical test phase). Experiment 4 replicated Experiment 1, except that the training and testing trial-types were reversed. In effect, subjects were trained to emit specific responses in the presence of particular objects (i.e., object-action training) and were then tested for a transformation of functions in accordance with symmetry (i.e., action-object testing). The reader should note, that for ease of communication the term *symmetry* will sometimes be used instead of *transformation of function in accordance with symmetry* (see Barnes, 1996, for a detailed discussion of why the latter term is more accurate from a relational frame perspective).

GENERAL METHOD

Subjects

Sixteen children, eight male and eight female, aged between four and five years old participated in the study. Each of the four experiments employed four children (see Table 1). They were enrolled in Primary One classes in two separate public schools in Cork. The children were selected from volunteers following classroom announcements, and were chosen on the basis that neither their mainstream schoolteachers nor parents had identified them as presenting a learning difficulty.

Table 1

Details of subjects who participated in Experiments 1-4

Experiment	Subject	Sex	Age (Yrs/Mths)
1	1	Female	5/2
	2	Female	4/9
	3	Male	4/3
	4	Male	4/9
2	5	Male	5/1
	6	Male	4/6
	7	Male	4/11
	8	Female	4/3
3	9	Male	4/6
	10	Female	4/8
	11	Female	5
	12	Female	4/5
4	13	Female	4/10
	14	Male	5/1
	15	Female	4/6
	16	Male	4/4

Apparatus

The experimental room contained one desk and two chairs. Subjects sat at the desk facing the experimenter. Experimental stimuli and actions employed in Session 1 of each experiment included a toy car and a doll, and waving and clapping. Henceforth, the stimuli are referred to using alphanumeric labels (e. g., toy car may be referred to as A1 and doll as A2). Experimental stimuli and actions employed in the other sessions of the experiments are described in Table 2. The allocation of stimuli to alphanumeric labels was counterbalanced across subjects; for instance, for two subjects A1 was the car and A2 was the doll, whereas for the other two these labels were reversed. Subjects never saw these labels. Additional materials were also placed near the child. These included a tray with beads and an upright glass jar, showing a mark. Filling the glass jar to the level of the mark required 50 beads.

Table 2

Stimuli, actions and tacts employed in each session for Experiments 1-4

Session No.	Stimuli /Actions	Description of Stimuli/Actions	Correct Tact
I	A1 and A2	Toy Doll: approx. 4 in. tall. Toy Car: approx. 4 in. in length.	"Doll" "Car"
	Waving Clapping	Waving hand or arm through air. Clapping both hands together.	"Waving" "Clapping"
II	B1 and B2	Storybook: children's, approx. 4x4 in. Flower: plastic, approx. 3 in. in length.	"Book" "Flower"
	Arms Out Arms In	Holding both arms out perpendicular to body. Holding both arms at sides of body.	"Arms Out" "Arms In"
III	C1 and C2	Toy Bear: approx. 4 in. tall. Building Brick: approx. 2 in. square.	"Bear" "Brick"
	Pulling Ear Pulling Nose	Pulling either left or right ear with fingers. Touching nose with fingers.	"Pulling Ear" "Touching Nose"
IV	D1 and D2	Cup: plastic, approx. 4 in. tall. Shoe: children's, approx. 5 in. in length.	"Cup" "Shoe"
	Rubbing Head Scratching Tummy	Rubbing the top of the head with hand. Scratching tummy with fingers.	"Rubbing Head" "Scratching Tummy"
V	E1 and E2	Pencil: wooden, approx. 6 in. in length. Schoolbag: approx. 12 x 12 in.	"Pencil" "Bag"
	Touching Feet Flapping Arms	Touching both feet with fingers. Flapping arms outward and inward from body.	"Touching Feet" "Flapping Arms"
VI (F/Up)	F1 and F2	Hat: woollen, approx. 12 in. round. Plate: plastic, approx. 6 in. wide.	"Hat" "Plate"
	Hands Behind Back Hands Over Eyes	Placing both hands behind back. Placing both hands over both eyes.	"Behind Back" "Over Eyes"

Experimental Design

The intervention in the current series of experiments involved explicit symmetry training across one or more exemplars. This training was introduced according to a multiple-baseline design across subjects in each of the four experiments. Assuming that subjects failed the test for a transformation of function in accordance with symmetry, the first subject in each experiment was introduced to the explicit symmetry training after the first failure, the second subject after the second failure, the third subject after the third failure, and the fourth subject after the fourth failure.

Inter-observer reliability. Twenty five percent of training and testing trials across all experiments were observed by an independent observer, who had no knowledge of experimental psychology. The observer could not see the experimenter's data sheet during the experimental sessions. Agreement between the observer's and the experimenter's recordings was 100%.

EXPERIMENT 1

Procedure

Experimental sequence. Subjects completed all experimental procedures individually. They were exposed to between one and six sessions of training and testing. Each session consisted of between four and five phases, with each phase lasting between 5 and 30 minutes. Subjects were exposed to between one and three phases per day, with 5-min. breaks between phases (the children were allowed to play in an adjacent room during these breaks). Each child continued with the next phase, or with the first phase of the next session, on the next weekday (availability permitting). The follow-up session, however, was conducted approximately two months after the first sequence of training and testing. In Experiment 1, one subject required only one session of training and testing. The three remaining subjects required multiple sessions.

Programmed consequences. At the beginning of Session 1, the experimenter placed the bead container on the table and the subject was told that; (a) s/he was going to play a game in which a bead would be awarded for each correct response, and (b) the beads could be exchanged for a pre-selected picture when the mark on the glass jar (50 beads) had been reached (Smeets, Barnes & Luciano, 1995). A correct response during all training trials was reinforced with the words "Yes, you are correct. Good girl/boy. Take a bead." Punishment during training trials consisted of the experimenter saying: "No, this is not right. No bead." No beads could be selected after an incorrect response had been emitted. No programmed consequences followed any test trial.

Session I: Phase 1. Name training. All subjects were individually trained in the naming of two gross motor activities, waving and clapping, and in the naming of two objects, A1 and A2. To ensure that all of the actions and objects could be readily discriminated, name training involved explicitly reinforcing appropriate listening, echoic, and tacting behaviours. For objects, this involved reinforcing choosing an object when given its name (listening), reinforcing uttering the name of the object when asked, for example, to "Say car" (echoic behaviour), and reinforcing uttering the name of the object when asked "What is this?" (tacting). For actions, this involved reinforcing an action when asked to demonstrate it (listening), reinforcing repeating the name of the action in the presence of the name (echoic behaviour), and reinforcing uttering the name of the action when asked, "What am I doing?" (tacting). The name training (Phase 1) and retraining (Phase 3), therefore, consisted of twelve different trial-types, four listening, four tacting, and four echoic trials with respect to the two actions and the two objects.

Six of these trial-types involved training listening, echoic and tacting behaviours with respect to waving and clapping. These trials were presented randomly for each subject and were as follows. During a wave-listening trial, the child was asked "Show me waving". A correct listening response consisted of the child demonstrating the waving action. During a wave-echoic training trial, the experimenter said to the child, "Can you say 'waving'?" A correct echoic response consisted of the child repeating the word "waving" back to the experimenter within 3s. During a wave-tacting trial, the experimenter waved her arm in a left-right-left sequence at the child whilst asking "What am I doing?" A correct tact response consisted of the child saying "waving" or any phrase containing the word "waving".

Listening, echoic and tacting trial-types were similarly conducted for the clapping action. That is, on a clap-listening trial the child was asked "Show me clapping", on a clap-echoic trial, the child was asked "Can you say clapping?", and on a clap-tacting trial the experimenter clapped her hands and asked concurrently "What am I doing?" Correct responses again consisted of the child emitting the clapping action (for listening), saying "clapping" (for echoing and tacting) or a phrase containing this word, respectively.

The remaining six trial-types involved training listening, echoic, and tacting behaviours with respect to two objects, and these trials were conducted as follows. On an object-listening trial, the stimulus A1 was placed on the table with A2, and the child was asked, for example, "Can you point to (A1) (e.g., the car)?" A correct listening response involved the child pointing to the correct object (i.e., A1). On an object-echoic trial, the experimenter asked, for example, "Can you say 'car'"? A correct echoic response here consisted of the child repeating the word "car" or any phrase containing this word. On an object-tacting trial, the experimenter pointed to A1, for example, and the child was asked "What is this?" A correct tact response involved the child saying the appropriate name (e.g., "car") or any such phrase containing this word. The same procedure was adopted for training listening, echoic, and tacting behaviours with respect to stimulus A2. Again, correct responses consisted of the child pointing to the correct object (on listening trials), repeating the name of A2 (on echoic trials), or providing the correct tact for A2 (on tacting trials). Programmed consequences were provided on all trials. The twelve trial-types were presented randomly, without replacement, in blocks of twelve trials until a subject completed an entire block without error.

Phase 2. Action-object training. Following the name training, subjects were introduced to the action-object conditional discrimination training. This training consisted of two trial-types. These were presented in a quasi-random order, with each trial-type presented four times in each block of eight trials. Stimuli A1 and A2 were placed horizontally across the table from one another (the left-right positions of these stimuli were randomised across trials). The instructions were as follows: "When I wave/clap at you, I want you to pick (e.g., the car) (A1) or (e.g., the doll) (A2). I will tell you if you have chosen the right or wrong one." The same procedure was used for all subsequent training trials, except that the verbal instruction was omitted after the first four trials. Selecting A1 in the presence of the experimenter waving (wave-A1) and A2 in the presence of the experimenter clapping (clap-A2) were reinforced. When subjects responded correctly on eight consecutive trials, it was assumed that the action-object relations were established.

Phase 3. Name retraining. Following the explicit training of the two action-object relations, each child was re-exposed to Phase 1 to ensure that the naming discriminations were still intact.

Phase 4. Test for derived object-action relations. The test for derived object-action relations consisted of two trial-types, each of which was presented four times in a quasi-random order across a block of eight trials. Stimulus A1 (or A2) was placed in the centre of the table. The experimenter remained silent, and looked directly down at the near edge of the table, so that the subject could not see the experimenter's face. The experimenter only looked up when the child initiated a response. A 10s interval was allowed for the child to respond (i.e., clap or wave). If the subject failed to clap or wave during this interval the trial was recorded as incorrect (this rarely occurred; see Discussion). Because this was a test phase, no feedback was given. Stimulus A2 (or A1) was then presented, and the procedure was repeated appropriately. If eight consecutively correct responses (A1-wave and A2-clap) were demonstrated, it was assumed that the derived object-action relations were established, and the subject's participation in the experiment was terminated for the time being. If, however, eight consecutively correct trials were not achieved, the multiple-baseline design required that Subjects 2, 3, and 4 were immediately re-exposed to Phase 2 (i.e., the action-object training) before proceeding to the next session (in fact, all subjects in the current study who were re-exposed to Phase 2, always completed this training in the minimum number of trials). If Subject 1 failed the test, however, she was exposed immediately to Phase 5.

Phase 5. Explicit object-action (symmetry) training. The test procedure outlined above for the derived object-action relations was repeated, but programmed consequences were now delivered after each response, or at the end of the 10s interval if no response occurred. In other words, object-action relations (A1-wave and A2-clap) were explicitly trained. Note however, that no instructions were provided (i.e., the child was not told what to do at the beginning of a trial). This constituted the first exemplar in symmetry training. Eight consecutively correct trials were required to complete this phase.

Session II. The procedures outlined in Phases 1, 2, 3, and 4 of Session I were repeated, but novel stimuli and actions, and their respective names were employed. Waving was replaced by *Arms Out* and clapping was replaced by *Arms In*. A1 was replaced by B1 (e.g., storybook) and A2 was replaced by B2 (e.g., flower) (see Tables 2 & 3). Thus, the action-object relations Arms Out-B1 and Arms In-B2 were trained explicitly in Phase 2. After retraining for naming in Phase 3, the derived object-action relations (B1-Arms Out and B2-Arms In) were tested in Phase 4. If a subject achieved eight consecutively correct trials in the symmetry test in Phase 4 of Session II, her/his participation in the experiment was terminated for the time being. At this point in the experiment, the multiple-baseline design required that Subjects 3 and 4 were immediately re-exposed to Phase 2 (i.e., the action-object training) before proceeding to the next session. If Subjects 1 and/or 2 failed the test, however, they were exposed immediately to Phase 5 (symmetry training).

Table 3

Stimulus labels, and trained and tested relations employed in each session of each of Experiments 1-4

Session No.	Trained Action-Object Relations	Tested Object-Action Relations
I	Wave-A1 & Clap-A2	A1-Wave & A2-Clap
II	Arms Out-B1 & Arms In-B2	B1-Arms Out & B2-Arms In
III	Pulling Ear-C1 & Pulling Nose-C2	C1-Pulling Ear & C2-Pulling Nose
IV	Rubbing Head-D1 & Scratching Tummy-D2	D1-Rubbing Head & D2-Scratching Tummy
V	Touching Feet-E1 & Flapping Arms-E2	E1-Touching Feet & E2-Flapping Arms
VI (Follow-up)	Hands Behind Back-F1 & Hands Over Eyes-F2	F1-Hands Behind Back & F2-Hands Over Eyes

<u>Session III</u>. The procedures outlined in Phases 1, 2, 3, and 4 of Sessions I and II were repeated, but Arms Out was replaced by *Pulling Ear* and Arms In was replaced by *Pulling Nose*. B1 was replaced by C1 (e.g., toy bear) and B2 was replaced by C2 (e.g., toy building brick). Thus, the action-object relations Pulling Ear-C1 and Pulling Nose-C2 were trained explicitly in Phase 2, and C1-Pulling Ear and C2-Pulling Nose were tested in Phase 4. If a subject achieved eight consecutively correct trials in the symmetry test in Phase 4 of Session III, her/his participation in the experiment was terminated for the time being. At this point, in the experiment the multiple-baseline design required that Subject 4 was immediately re-exposed to Phase 2 (i.e., the action-object training) before

proceeding to the next session. If Subjects 1, 2, and/or 3 failed the test, however, they were exposed immediately to Phase 5 (symmetry training).

Session IV. Session IV was identical to Session III, but novel stimuli and actions, and their respective names, were employed. The action-object relations *Rubbing Head*-D1 (e.g., cup) and *Scratching Tummy*-D2 (e.g., shoe) were trained explicitly, and the object-action relations D1-Rubbing Head and D2-Scratching Tummy were tested. If a subject passed the symmetry test, her/his participation in the experiment was terminated for the time being. The multiple-baseline design required that Subject 4 was exposed immediately to Phase 5 (explicit symmetry training), before proceeding to the next session. If Subjects 1, 2, and/or 3 failed the test, they were also exposed immediately to Phase 5 (symmetry training). At this point in the experiment, therefore, no subjects were to re-exposed to Phase 2.

Session V. Phases 1, 2, 3, and 4 were repeated, but novel stimuli and actions, and their respective names, were employed. The action-object relations *Touching Feet*-E1 (e.g., pencil) and *Flapping Arms*-E2 (e.g., bag) were trained explicitly, and E1-Touching Feet and E2-Flapping Arms were tested. Session V did not contain Phase 5.

Session VI (two month follow-up). Two of the subjects were available to participate in the Follow-Up Session. This was identical to Session V, but novel stimuli and actions, and their respective names, were employed. The action-object relations *Hands Behind Back*-F1 (e.g., hat) and *Hands Over Eyes*-F2 (e.g., plate) were trained explicitly, and F1-Hands Behind Back and F2-Hands Over Eyes were tested. This was the end of Experiment 1.

RESULTS

The data from Experiment 1 are presented in Table 4. Only one subject (1) demonstrated derived symmetry (i.e., object-action relations) without first receiving explicit symmetry training. The remaining three subjects showed derived symmetry only after explicit symmetry training. A detailed description of the data for these three subjects is provided subsequently.

Table 4
Number of training trials and number of correct responses during the test trials
for each subject in Experiment 1

Subjects:	1	2	3	4
Session I				
Ph. 1 - Name training:	24	24	24	12
Ph. 2 - Action-object training:	14	16	9	10
Ph. 3 - Name retraining:	12	12	12	12
Ph. 4 - Test derived object-action:	8/8	5/8	1/8	6/8
Ph. 5 - Object-action training:	--	--*	--*	--*
Session II				
Ph. 1 - Name training:	--	24	24	24
Ph. 2 - Action-object training:	--	9	11	10
Ph. 3 - Name retraining:	--	12	12	12
Ph. 4 - Test derived object-action:	--	4/8	5/8	4/8
Ph. 5 - Object-action training:	--	9	--*	--*
Session III				
Ph. 1 - Name training:	--	24	24	12
Ph. 2 - Action-object training:	--	11	13	9
Ph. 3 - Name retraining:	--	12	12	12
Ph. 4 - Test derived object-action:	--	8/8	3/8	0/8
Ph. 5 - Object-action training:	--	--	9	--*
Session IV				
Ph. 1 - Name training:	--	--	12	12
Ph. 2 - Action-object training:	--	--	12	10
Ph. 3 - Name retraining:	--	--	24	12
Ph. 4 - Test derived object-action:	--	--	7/8	3/8
Ph. 5 - Object-action training:	--	--	8	9
Session V				
Ph. 1 - Name training:	--	--	12	12
Ph. 2 - Action-object training:	--	--	10	9
Ph. 3 - Name retraining:	--	--	12	12
Ph. 4 - Test derived object-action:	--	--	8/8	8/8
Session VI (Two Month Follow-Up)				
Ph. 1 - Name training:	--	12	--	24
Ph. 2 - Action-object training:	--	12	--	11
Ph. 3 - Name retraining:	--	12	--	12
Ph. 4 - Test derived object-action:	--	8/8	--	8/8

* Indicates that the subject was re-exposed to action-object training.
In all cases, subjects completed the training in 8 trials (i.e., the minimum number required).

Subject 2

Subject 2 completed the name training with waving and clapping and A1 and A2 in 24 trials (i.e., two blocks of 12 trials). The conditional discrimination training of the action-object relations was completed in 16 trials. On name retraining, she produced 12 out of 12 consecutively correct naming responses. Subsequently, Subject 2 was tested for the derivation of object-action relations, but failed to pass, producing only 5 correct responses. She was then re-exposed to the conditional discrimination (action-object) training with the stimuli employed in Session I.

In Session II, Subject 2 successfully demonstrated naming of novel actions and novel objects in 24 trials. Training of the new action-object relations was completed in a total of 9 trials, after which she produced 12 consecutively correct responses during name retraining.

She was then tested (for the second time) for the derivation of the novel object-action relations and again failed by producing 4 correct responses. At this point, Subject 2 was exposed to explicit symmetry (object-action) training for the first time involving the stimuli employed in Session II. She completed this object-action training in only 9 trials.

Subject 2 began Session III using another novel set of actions and objects. She completed the name training in 24 trials. She required 11 trials of conditional discrimination training, and completed the name retraining in the minimum number of trials. She then immediately passed the test for derived object-action symmetry, producing no errors. Subject 2 did not, therefore, require Sessions IV and V. Two months later, she was exposed to the Follow-up Session involving a new set of actions and objects. In this session she passed the name training in the minimum number of trials. She required 12 trials to complete the conditional discrimination training, and then passed the name retraining in the minimum number of trials. She immediately passed the test for the transformation of function in accordance with symmetry without error.

Subject 4

Subject 4 completed the name training in the minimum number of trials in Session 1. He required only 10 trials to complete the action-object training. He produced no errors on name retraining. Subsequently, Subject 4 failed the test for the derivation of object-action relations by producing 6 correct responses. He was then re-exposed to the conditional discrimination training with the stimuli employed in Session 1.

In Session II, Subject 4 successfully demonstrated naming of novel actions and novel objects in 24 trials. He required 10 trials to complete the new action-object training, after which he produced no errors on the name retraining. He was then tested (for the second time) for the derivation of the novel object-action relations and his performance deteriorated to only 4 correct responses. At this point, Subject 4 was re-exposed to the conditional discrimination training with the stimuli employed in Session II.

In Session III, Subject 4 produced no errors on the novel name training. He required only 9 trials to complete the new action-object conditional discriminations, and produced no errors on the name retraining. On the (third) test for derived object-action relations, the performance of this subject deteriorated again, and he now produced no correct responses. After this test, he was again re-exposed to the conditional discrimination training involving the stimuli and actions employed in Session III.

In Session IV, he produced no errors in the name training with a novel set of actions and objects. He required only 10 trials to complete the new action-object training, and he produced no errors on the name retraining. He again failed the test for derived object-action relations, by producing only 3 correct responses. At this point, after three failures on the transformation of function test, and four sessions of name, and conditional discrimination training, he was exposed to the first exemplar of explicit symmetry training, which he completed in 9 trials.

In the subsequent session (V), he produced perfect responding on the name training involving a novel set of actions and objects. He completed the new conditional discrimination training in 9 trials, and made no errors on the name retraining. He immediately passed the transformation of function test with no errors. Two months later, he was exposed to the Follow-up Session involving a new set of actions and objects. In this session he required 24 trials to complete the name training. He completed the novel action-object training in 11 trials, after which he passed the name retraining without error. He immediately passed the test for the transformation of function in accordance with symmetry by producing no errors.

<u>Subject 3</u>

The performance of Subject 3 was similar to that produced by Subjects 2 and 4, with one minor difference. After one exemplar of explicit symmetry training in Session III, Subject 3 proceeded to Session IV involving a new set of actions and objects. On the test for derived object-action relations, this subject narrowly missed the pass criterion by producing 1 error. He was then immediately re-exposed to another exemplar of explicit symmetry training involving the same stimuli employed in Session IV. In Session V, he subsequently passed the test for derived object-actions relations without error.

DISCUSSION

Only one of the four children involved in this experiment passed the initial test for the derived transformation of function in accordance with symmetry. For the three subjects who failed, a multiple-baseline design was employed which staggered the introduction of explicit symmetry training. All subjects passed the transformation of function test after one or two exemplars of explicit symmetry training. One subject (4), who had four sessions of name, and conditional discrimination training, failed to demonstrate derived transformation of function, but immediately did so after only one exemplar of symmetry training. The results of this multiple-baseline experiment provide strong evidence that explicit training in symmetry responding is a powerful method for establishing derived symmetry within the context of the current procedure.

One possible criticism of Experiment 1 might be that the name retraining hindered the emergence of symmetry, because this retraining was placed between the conditional discrimination training and the symmetry test. For example, perhaps the stimulus control established during the name retraining competed in some undefined way with the previously trained conditional discriminations. If this was the case, then removing the name retraining should improve test performances before the introduction of explicit symmetry training. Experiment 2 tested this suggestion.

EXPERIMENT 2

Procedure

Experiment 2 replicated Experiment 1, with some minor modifications. The name retraining was omitted, and subjects were required to produce 24 (i.e., 2 blocks of 12) consecutively correct responses during the name training (i.e., in Phase 1). All other aspects of the procedure were the same.

RESULTS AND DISCUSSION.

The data from Experiment 2 are presented in Table 5. None of the subjects in this experiment passed the first symmetry test. Overall, the patterns of responding were similar to those observed in the previous experiment, in that all four subjects showed derived symmetry only after explicit symmetry training. Subject 7 was the only subject who required two separate exposures to this explicit training (note, however, that this subject failed the first exposure by only 1 incorrect response). The two subjects (7 & 8) who were available for the Follow-up Session replicated their earlier successful performances on the symmetry test. These data therefore indicate that the name retraining was not responsible for the subjects' failures on the symmetry tests observed in Experiment 1.

Table 5
Number of training trials and number of correct responses during the test trials for each subject in Experiment 2

Subjects:	5	6	7	8
Session I				
Ph. 1 - Name training:	36	36	36	48
Ph. 2 - Action-object training:	12	11	16	11
Ph. 3 - Test derived object-action:	6/8	6/8	2/8	5/8
Ph. 4 - Object-action training:	8	--*	--*	--*
Session II				
Ph. 1 - Name training:	36	36	48	36
Ph. 2 - Action-object training:	9	11	16	12
Ph. 3 - Test derived object-action:	8/8	4/8	0/8	7/8
Ph. 4 - Object-action training:	--	11	--*	--*
Session III				
Ph. 1 - Name training:	--	36	48	36
Ph. 2 - Action-object training:	--	10	19	10
Ph. 3 - Test derived object-action:	--	8/8	2/8	3/8
Ph. 4 - Object-action training:	--	--	32	--*
Session IV				
Ph. 1 - Name training:	--	--	48	36
Ph. 2 - Action-object training:	--	--	18	9
Ph. 3 - Test derived object-action:	--	--	7/8	2/8
Ph. 4 - Object-action training:	--	--	11	9
Session V				
Ph. 1 - Name training:	--	--	36	36
Ph. 2 - Action-object training:	--	--	16	11
Ph. 3 - Test derived object-action:	--	--	8/8	8/8
Session VI (Two Month Follow-Up)				
Ph. 1 - Name training:	--	--	36	24
Ph. 2 - Action-object training:	--	--	14	12
Ph. 3 - Test derived object-action:	--	--	8/8	8/8

* Indicates that the subject was re-exposed to action-object training.
In all cases, subjects completed the training in 8 trials (i.e., the minimum number required.)

One criticism of the two previous experiments might be that the children were not required to engage in any naming behaviours *during* the action-object training or during the object-action symmetry test. Perhaps, if subjects were provided with the name training, *and* were required to tact (i.e., discriminate) the actions and objects during the training and testing trials, this might facilitate derived symmetry responding in the absence of explicit symmetry training (see Dugdale & Lowe, 1990; Eikeseth & Smith, 1992). To address this concern, Experiment 3 was conducted.

EXPERIMENT 3

Procedure

Experiment 3 replicated Experiment 1, except that subjects were required to tact the stimuli and actions on *all* conditional discrimination training and symmetry test trials. During a training trial, the experimenter may have waved at the child, for example, whilst asking "What am I doing?" After the tacting response, the child was asked to pick one of the two objects presented as comparisons (e.g., the doll), and then tact the chosen comparison. Feedback contingent on comparison choice (but not naming) was then presented. During a test trial, the experimenter may have placed the doll, for example, in front of the child and asked "What's this?" After the child tacted the object, the experimenter waited in silence for 10s for the child to emit an action. If and when the child emitted an action, the experimenter asked, "What are you doing", and when the child tacted the action, that completed the test trial. All tacting responses were recorded, but no corrective feedback was provided for this naming behaviour on either training or test trials. No tacting errors were produced by any of the four children during training or testing.

RESULTS AND DISCUSSION

The data from Experiment 3 are presented in Table 6, and are remarkably similar to those from the previous experiments. Only one subject (11) passed the first symmetry test. The other three subjects demonstrated derived symmetry only after explicit symmetry training, despite the fact that they successfully tacted the objects and actions on all conditional discrimination training and testing trials. In addition, subjects in this experiment required approximately the same number of conditional discrimination training trials as previous subjects, although they successfully tacted the actions and objects during the training. Finally, the follow-up data taken from two of the subjects (9 & 10) indicated that derived symmetry responding remained in the children's repertoires. These results provide yet further evidence that explicit symmetry training is a powerful method of generating derived symmetry.

Table 6
Number of training trials and number of correct responses during the test trials for each subject in Experiment 3

Subjects:	9	10	11	12
Session I				
Ph. 1 - Name training:	12	24	24	12
Ph. 2 - Action-object training:	20	18	17	12
Ph. 3 - Name retraining:	12	24	12	12
Ph. 4 - Test derived object-action:	3/8	6/8	8/8	5/8
Ph. 5 - Object-action training:	9	--*	--	--*
Session II				
Ph. 1 - Name training:	24	12	--	24
Ph. 2 - Action-object training:	10	9	--	13
Ph. 3 - Name retraining:	12	12	--	12
Ph. 4 - Test derived object-action:	8/8	4/8	--	3/8
Ph. 5 - Object-action training:	--	9	--	--*
Session III				
Ph. 1 - Name training:	--	24	--	24
Ph. 2 - Action-object training:	--	11	--	12
Ph. 3 - Name retraining:	--	12	--	12
Ph. 4 - Test derived object-action:	--	8/8	--	4/8
Ph. 5 - Object-action training:	--	--	--	--*
Session IV				
Ph. 1 - Name training:	--	--	--	12
Ph. 2 - Action-object training:	--	--	--	10
Ph. 3 - Name retraining:	--	--	--	12
Ph. 4 - Test derived object-action:	--	--	--	3/8
Ph. 5 - Object-action training:	--	--	--	11
Session V				
Ph. 1 - Name training:	--	--	--	12
Ph. 2 - Action-object training:	--	--	--	10
Ph. 3 - Name retraining:	--	--	--	12
Ph. 4 - Test derived object-action:	--	--	--	8/8
Session VI (Two Month Follow-Up)				
Ph. 1 - Name training:	12	14	--	--
Ph. 2 - Action-object training:	10	12	--	--
Ph. 3 - Name retraining:	12	12	--	--
Ph. 4 - Test derived object-action:	8/8	8/8	--	--

* Indicates that the subject was re-exposed to action-object training.
In all cases, subjects completed the training in 8 trials (i.e., the minimum number required).

Another possible question that arose at this point in the research programme was whether a different pattern of responding would emerge if object-action relations were trained directly in the conditional discrimination training, and derived action-object relations were tested (i.e., reverse the trained and tested relations). The literature on cross-modal generalisation from receptive to expressive language and vice versa, suggests that the direction in which subjects are trained and tested in such verbal skills has an effect on performance. For example, a study by Smeets and Striefel (1976) demonstrated that for a deaf developmentally delayed woman, training of expressive signs produced transfer to receptive signing, but there was not always transfer from receptive to expressive signing.

Although, there have also been arguments to the contrary (Grant & Evans, 1994), it was deemed important at this stage to examine the possible effects of reversing the direction of training and testing within the experimental protocol employed here. Concern for this issue arose from the idea that action-object relations may be functionally similar to receptive signing, whereas the object-action relations may be functionally similar to expressive signing. Experiment 4 was designed to address this issue.

EXPERIMENT 4

Procedure

Experiment 4 replicated Experiment 1, except that the trained and tested relations were reversed. In effect, object-action relations were now trained and action-object relations were tested. On the first training trial, the experimenter presented a doll, for example, and said "When I show you this, I want you to either clap or wave. I will tell you if you have done the right or wrong thing." The appropriate programmed consequences followed all training trials. The same procedure was used for all subsequent training trials, except that the verbal instruction was omitted after the first four trials. During all action-object test trials, the experimenter placed two objects (e.g., A1 and A2) horizontally across the table from one another, looked down at the near edge of the table (i.e., the subject could not see the experimenter's face), emitted one of two actions (e.g., clapping or waving), and then waited for 10s. If the subject picked one of the two objects, or failed to emit a choice response within 10s (in fact, this never occurred), the experimenter removed the objects from the table, before commencing the next test trial. During action-object test trials, no programmed consequences were presented, but during explicit symmetry training, the appropriate programmed consequences followed these trials.

RESULTS AND DISCUSSION

The data from Experiment 4 are presented in Table 7. One subject (16) passed the first object-action symmetry test (i.e., without explicit symmetry training). The patterns of responding emitted by the other three subjects were consistent with the previous experiments in that all three showed derived symmetry only after explicit symmetry training. All three subjects received only one exemplar of explicit symmetry training before passing the test. Follow-up data from two subjects (14 & 15) indicated that deriving symmetry was stable across time. The results of this experiment indicate that reversing the direction of trained and tested relations did not affect the subjects' test performances.

Table 7
Number of training trials and number of correct responses during the test trials for each subject in Experiment 4

Subjects:	13	14	15	16
Session I				
Ph. 1 - Name training:	24	12	24	24
Ph. 2 - Object-action training:	22	12	19	11
Ph. 3 - Name retraining:	24	12	12	12
Ph. 4 - Test derived action-object:	5/8	2/8	1/8	8/8
Ph. 5 - Action-object training:	9	--*	--*	--
Session II				
Ph. 1 - Name training:	12	24	12	--
Ph. 2 - Object-action training:	11	9	9	--
Ph. 3 - Name retraining:	24	12	12	--
Ph. 4 - Test derived action-object:	8/8	6/8	3/8	--
Ph. 5 - Action-object training:	--	8	--*	--
Session III				
Ph. 1 - Name training:	--	24	12	--
Ph. 2 - Object-action training:	--	12	9	--
Ph. 3 - Name retraining:	--	12	12	--
Ph. 4 - Test derived action-object:	--	8/8	5/8	--
Ph. 5 - Action-object training:	--	--	11	--
Session IV				
Ph. 1 - Name training:	--	--	24	--
Ph. 2 - Object-action training:	--	--	10	--
Ph. 3 - Name retraining:	--	--	12	--
Ph. 4 - Test derived action-object:	--	--	8/8	--
Session V (Two Month Follow-Up)				
Ph. 1 - Name training:	--	24	12	--
Ph. 2 - Object-action training:	--	12	9	--
Ph. 3 - Name retraining:	--	12	12	--
Ph. 4 - Test derived action-object:	--	8/8	8/8	--

* Indicates that the subject was re-exposed to object-action training.
In all cases, subjects completed the training in 8 trials (i.e., the minimum number required.)

GENERAL DISCUSSION

The main purpose of the present study was to determine whether exemplar training would facilitate the transformation of functions in accordance with symmetry, in the context of an action-object relations task. Experiments 1, 2, and 3 clearly showed that explicit symmetry training across one or two exemplars was extremely effective in this regard. Experiment 4 produced similar results when the trained and tested relations were reversed. In summary, Experiments 1 to 4 repeatedly showed that symmetry training across one or two exemplars was extremely effective in establishing derived symmetry responding. The multiple-baseline design employed in each of the experiments allows the researcher to be reasonably confident that the exemplar training was the effective variable in this study. Furthermore, follow-up data across all four experiments indicated that the repertoires of derived symmetry responding, established in the context of the current procedures, remained stable across time. Relational frame theory predicts that exemplar training should be a powerful method for facilitating a derived transformation of functions in accordance with symmetry, and the current data therefore appear to support this view.

An interesting feature of the data from all of the experiments is that only one or two exemplars of explicit symmetry training were required before subjects showed symmetry on a subsequent set of actions and objects. These findings contrast with those reported by Schusterman and Kastak (1993) in which many exemplars were used to establish derived stimulus relations in a sea lion. The limited number of exemplars needed in the current study could be taken to indicate that the exemplar training was in some way discriminative for an already established behavioural repertoire (i.e., bi-directional stimulus relations were not established for the first time in the current study). This interpretation is entirely consistent with the aims of the current research. As indicated previously, a traditional matching-to-sample preparation for both training and testing was deliberately avoided, because this procedure likely possesses contextual cues for symmetry responding. The current procedure clearly did not possess these cues, and thus it allowed a systematic examination of the effectiveness of exemplar training in generating derived symmetry in the context of the current experimental preparation. From the perspective of RFT, therefore, the current study almost certainly did not establish a repertoire of symmetry responding *ab initio* (much younger children would be required for this purpose), but the exemplar training *did* establish the experimental context as a cue for producing the pre-experimentally established repertoire of symmetry responding. One interesting implication of this RFT interpretation is that it may be possible to facilitate symmetry in the context of the current experimental procedures with means other than explicit symmetry training. For example, perhaps for some children the explicit symmetry training established the procedure as a cue for symmetry simply by providing a history of reinforcement for responding on a task that was formally similar to one that was used during testing. More informally, the children may not have realised that they were required to emit one of two actions when presented with an object, for example, until after they had received the explicit symmetry training. Indeed, the fact that the experimenter did not face the subject during test trials (i.e., she looked down at the edge of the table) may have increased the ambiguity of the task. If this was the case, however, then one would expect a high number of "no-response" errors during the test phases (i.e., because the children did not know what to do). Although no systematic, trial-by-trial record of these errors was kept, the experimenter and independent observer reported that only three subjects ever failed to respond, and then on no more than one trial in any given session. Thus, it seems likely that most of the children discriminated that one of two previously trained responses was required on each of the test trials.

The current data suggest that explicit exemplar training (in this case explicit symmetry training) is a reliable means by which to facilitate a derived transformation of functions in accordance with symmetry. Now that this effect has clearly been demonstrated, future research is needed to examine the exact way in which exemplar training facilitates the production of symmetry. For example, one important question that arises from the work reported in this chapter concerns the role played by the name training in establishing the transformation of functions in accordance with symmetry. In short, would the exemplar training have the same facilitative effect if the name training was removed? The research reported in the next chapter addresses this question.

Chapter Three

Chapter 3

Exemplar Training and the Derived Transformation of Function in Accordance with Symmetry

Experiments 5-7

INTRODUCTION

In the four experiments described in the previous chapter, an attempt was made to determine whether exemplar training would offer a more powerful intervention than name training in facilitating the transformation of function in accordance with symmetry. The results from these experiments indicated that 13 out of 16 subjects, who had received explicit name training, failed to show derived object-action (Experiments 1-3) or action-object (Experiment 4) symmetry until they received explicit symmetry training.

Although a clear facilitative effect for the exemplar training on derived symmetry was shown, two important questions were raised by the previous study. First, given that all of the subjects were trained to name the actions and objects used in the experiments, one might ask whether the name training played an important role in the clearly facilitative effect of the exemplar training. Some researchers, such as Horne and Lowe (1996), have argued that naming constitutes the key process in symmetry and equivalence responding, and thus one might expect name training to promote the production of symmetry. An important question arising from Experiments 1-4, therefore, is whether subjects, in the absence of name training, would still show derived symmetry only after exemplar training? Experiments 5 and 6 of the current chapter were designed to address this question.

The second question that arose from Experiments 1-4 was as follows. An interesting feature of that data, is that only one or two training exemplars were required before subjects showed symmetry on a subsequent set of actions and objects. The absence of an acquisition curve for symmetry responding across many exemplars could be taken to indicate that the exemplar training was in some way discriminative for an already established behavioural repertoire (i.e., bi-directional stimulus relations were not established for the first time in Experiments 1-4). Indeed, as argued in the discussion of the previous chapter, from the perspective of RFT, the study almost certainly did *not* establish a repertoire of symmetry responding *ab initio*, but the exemplar training *did* establish the experimental context as a cue for producing the pre-experimentally established repertoire of symmetry responding. One interesting implication of this RFT interpretation, therefore, is that it may be possible to facilitate symmetry in the context of those experimental procedures with means other than explicit symmetry training. For example, perhaps for some children the explicit symmetry training established the procedure as a cue for symmetry simply by providing a history of reinforcement for responding on a task that was formally similar to one that was used during testing. More informally, the children may not have realised that they were required to emit one of two actions when presented with an object, for example, until after they had received the explicit symmetry training. If this was the case, then it may be possible to establish symmetry responding in at least some children by pretraining object-action relations *alone* (i.e., not symmetry relations) before exposure to the experimental procedures using *novel* actions and objects. Experiment 7 of the current study was designed to address this issue.

The basic procedure employed in Experiments 5-7 was similar to that employed in the previous study, except that the name training was removed in all three experiments. However, in order to avoid the reader having to refer back and forth between this and the previous chapter, some of the procedural details will be repeated.

Experiment 5 in the current study once again involved training four to five year old children to pick one of two familiar objects conditional upon the action of the experimenter (action-object training). During a subsequent test, the objects were presented to the subjects to determine whether they would show a transformation of function in accordance with symmetry. In effect, having been trained to pick object A when the experimenter waved, would the function of object A be transformed in accordance with symmetry during the test, such that it would now control waving (i.e., object-action testing)? Experiment 6 replicated Experiment 5, except that the training and testing trial-types were reversed (as had been done in Experiment 4). In effect, subjects were trained to emit specific responses in the presence of particular objects (i.e., object-action training) and were then tested for a transformation of functions in accordance with symmetry (i.e., action-object testing). Once again, for ease of communication the term *symmetry* will sometimes be used instead of *transformation of function in accordance with symmetry*.

GENERAL METHOD

<u>Subjects</u>

Sixteen children, eight male and eight female, aged from 4 years and 1 month to 5 years and 2 months participated in the study. Experiments 5 and 6 each employed four children (two males and two females), and Experiment 7 employed eight children (four males and four females). The children were enrolled in Primary One classes in two separate public schools in Cork. The children were selected from volunteers following classroom announcements, and were chosen on the basis that neither their mainstream schoolteachers nor parents had identified them as presenting a learning difficulty.

Apparatus

The experimental room contained one desk and two chairs. Subjects sat at the desk facing the experimenter. All of the experimental stimuli and actions employed across Experiments 5 to 7 are described in Table 8. The allocation of stimuli to alphanumeric labels was counterbalanced across subjects; for instance, for 2 subjects A1 was the car and A2 was the doll, whereas for the other two these labels were reversed. Henceforth, the stimuli are referred to using alphanumeric labels (e.g., toy car may be referred to as A1 and doll as A2), and subjects never saw these labels. Additional materials were also placed near the child. These included a tray with beads and an upright glass jar, showing a mark. Filling the glass jar to the level of the mark required 50 beads.

Table 8
Stimuli and actions and trained and tested relations employed across Experiments 5-7

Session No.	**Stimuli /Actions**	**Description of Stimuli/Actions**	**Trained Action-Object Relations**	**Tested Object-Action Relations**
I	A1 and A2 Waving Clapping	Toy Doll: approx. 4 in. tall. Toy Car: approx. 4 in. in length. Waving hand or arm through air. Clapping both hands together.	Wave-A1 & Clap-A2	A1-Wave & A2-Clap
II	B1 and B2 Arms Out Arms In	Storybook: children's, approx. 4x4 in. Flower: plastic, approx. 3 in. in length. Holding both arms out perpendicular to body. Holding both arms at sides of body.	Arms Out-B1 & Arms In-B2	B1-Arms Out & B2-Arms In
III	C1 and C2 Pulling Ear Pulling Nose	Toy Bear: approx. 4 in. tall. Building Block: approx. 2 in. square. Pulling either left or right ear with fingers. Touching nose with fingers.	Pulling Ear-C1 & Pulling Nose-C2	C1-Pulling Ear & C2-Pulling Nose
IV	D1 and D2 Rubbing Head Scratching Tummy	Cup: plastic, approx. 4 in. tall. Shoe: children's, approx. 5 in. in length. Rubbing the top of the head with hand. Scratching tummy with fingers.	Rubbing Head-D1 & Scratching Tummy-D2	D1-Rubbing Head & D2-Scratching Tummy
V	E1 and E2 Touching Feet Flapping Arms	Pencil: wooden, approx. 6 in. in length. Schoolbag: approx. 12 x 12 in. Touching both feet with fingers. Flapping arms outward and inward from body.	Touching Feet-E1 & Flapping Arms-E2	E1-Touching Feet & E2-Flapping Arms
VI	F1 and F2 Hands Behind Back Hands Over Eyes	Hat: woollen, approx. 12 in. round. Plate: plastic, approx. 6 in. wide. Placing both hands behind back. Placing both hands over both eyes.	Hands Behind Back-F1 & Hands Over Eyes-F2	F1-Hands Behind Back & F2-Hands Over Eyes

Experimental Design

The intervention in the current series of experiments involved explicit symmetry training across one or more exemplars. This training was introduced according to a multiple-baseline design across subjects in each of the three experiments. Assuming that subjects failed the test for a transformation of function in accordance with symmetry, the first subject was introduced to the explicit symmetry training after the first failure, the second subject after the second failure, the third subject after the third failure, and the fourth subject after the fourth failure. A variation of this experimental design was employed in Experiment 7. The exemplar training was introduced according to a multiple-baseline design to determine whether symmetry would emerge only after explicit symmetry training (and not simply following repeated exposures to the experimental procedures).

Inter-observer reliability. Twenty five percent of training trials and all testing trials across all experiments were observed by two independent observers, who had no knowledge of experimental psychology. The observers were positioned on either side of the room, slightly to the rear of the child. The observers could not see each other's data sheets during the experimental sessions. They each recorded the subjects' responses, in terms of the actions they engaged in or the objects they selected, and scored these as either correct or incorrect responses. Agreement between the observers' recordings was always 100%

EXPERIMENT 5

Procedure

Experimental sequence. Subjects completed all experimental procedures individually. They were exposed to between one and six sessions of training and testing. Each session consisted of between two and four phases, with each phase lasting between 5 and 20 minutes. Subjects were exposed to between one and four phases per day, with 5-min. breaks between phases (the children were allowed to play in an adjacent room during these breaks). Each child continued with the next phase, or with the first phase of the next session, on the next weekday (availability permitting). The Follow-Up Session, however, was conducted approximately two months after the first sequence of training and testing (except in Experiment 7, where the Follow-Up Session was conducted one month later). In Experiment 5, all subjects required two or more sessions.

Programmed consequences. At the beginning of Session 1, the experimenter placed the bead container on the table and the subject was told that; (a) s/he was going to play a game in which a bead would be awarded for each correct response, and (b) the beads could be exchanged for a pre-selected picture when the mark on the glass jar (50 beads) had been reached. Correct responses during all training trials were followed by the words "Yes, you are correct. Good girl/boy. Take a bead." Incorrect responses during training were followed by the experimenter saying: "No, this is not right. No bead." No beads could be selected after an incorrect response had been emitted. No programmed consequences followed any test trial.

Session I: Phase 1. Action-object training. Subjects were first introduced to the action-object conditional discrimination training. This training consisted of two trial-types. These were presented in a quasi-random order, with each trial-type presented four times in each block of eight trials. Stimuli A1 and A2 were placed horizontally across the table from one another (the left-right positions of these stimuli were randomised across trials). The instructions were as follows: "When I wave/clap at you, I want you to pick (e.g., the car) (A1) or (e.g., the doll) (A2). I will tell you if you have chosen the right or wrong one." The same procedure was used for all subsequent training trials, except that the verbal instruction was omitted after the first four trials. Selecting A1 in the presence of the experimenter waving (wave-A1) and A2 in the presence of the experimenter clapping (clap-A2) were reinforced. When subjects responded correctly on eight consecutive trials, it was assumed that the action-object relations were established, and they proceeded to Phase 2.

Phase 2. Test for derived object-action relations. The test for derived object-action relations consisted of two trial-types, each of which was presented four times in a quasi-random order across a block of eight trials. Stimulus A1 (or A2) was placed in the centre of the table. The experimenter remained silent, and looked directly down at the near edge of the table, so that the subject could not see the experimenter's face. During all test trials, two independent observers, seated to the rear of the child, recorded the subject's responses (the observers could not see each other's data sheets). The experimenter only looked up when a response had been recorded (an independent observer signaled the end of each trial by saying "Continue"). A 10s interval was allowed for the child to respond (i.e., clap or wave). If the subject failed to clap or wave during this interval the trial was recorded as incorrect (in fact, this rarely occurred across any of the three experiments). Because this was a test phase, no feedback was given. Stimulus

A2 (or A1) was then presented, and the procedure was repeated appropriately. If eight consecutively correct responses (A1-wave and A2-clap) were demonstrated, it was assumed that the derived object-action relations were established, and the subject's participation in the experiment was terminated for the time being. If, however, eight consecutively correct trials were not achieved, the multiple-baseline design required that Subjects 2, 3, and 4 were immediately reexposed to Phase 1 (i.e., the action-object training) before proceeding to the next session (in fact, all subjects in the current study who were re-exposed to Phase 1, always completed this training in the minimum number of trials). If Subject 1 failed the test, however, she was exposed immediately to Phase 3.

Phase 3. Explicit object-action (symmetry) training. The test procedure outlined above for the derived object-action relations was repeated, but programmed consequences were now delivered after each response, or at the end of the 10s interval if no response occurred. In other words, object-action relations (A1-wave and A2-clap) were explicitly trained. Note however, that no instructions were provided (i.e., the child was not told what to do at the beginning of a trial). This constituted the first exemplar in symmetry training. Eight consecutively correct trials were required to complete this phase. After re-exposure to Phase 1 (Subjects 2, 3, and 4) or exposure to Phase 3, the subjects then proceeded to Session II.

Sessions II, III, IV, V, and VI. The procedures outlined in Phases 1 and 2 of Session I were repeated in Session II, but novel stimuli and actions were employed (see Table 8). Assuming that subjects did not pass the symmetry test, the multiple-baseline design required that Subjects 3 and 4 were immediately re-exposed to Phase 1 (i.e., the action-object training) before proceeding to the next session. If Subjects 1 and/or 2 failed the test, however, they were exposed immediately to Phase 3 (symmetry training). The same general strategy was adopted for Sessions III and IV, except that; (i) novel stimuli and actions were employed for each session and (ii) Subject 3 and then Subject 4 were provided with explicit symmetry training (assuming that they failed the symmetry tests). Session V, like the others, contained novel stimuli and actions, but it did not contain Phase 3 (see Table 8).

Three of the subjects were available to participate in Session VI, a two-month Follow-Up Session. This was identical to Session V, but novel stimuli and actions were employed (see Table 8). This was the end of Experiment 5.

RESULTS AND DISCUSSION

The data from Experiment 5 are presented in Table 9. In brief, all four subjects passed the test for derived object-action relations only after explicit symmetry training. Subject 2 was the only subject who required two separate exposures to the explicit symmetry training (failing the first test by only 1 incorrect response). Follow-up data taken from three subjects (1, 2 & 4) demonstrated that these performances remained in the children's repertoires. For illustrative purposes, the results obtained from Subject 2 will be considered in detail.

Table 9
Number of training trials and number of correct responses during the test trials for each subject in Experiment 5

Subjects:	1	2	3	4
Session I				
Ph. 1 - Action-object training:	22	18	14	23
Ph. 2 - Test derived object-action:	2/8	6/8	1/8	4/8
Ph. 3 - Object-action training:	10	--*	-- *	--*
Session II				
Ph. 1 - Action-object training:	12	14	15	18
Ph. 2 - Test derived object-action:	8/8	3/8	5/8	4/8
Ph. 3 - Object-action training:	--	10	--*	--*
Session III				
Ph. 1 - Action-object training:	--	12	13	9
Ph. 2 - Test derived object-action:	--	7/8	5/8	2/8
Ph. 3 - Object-action training:	--	8	9	--*
Session IV				
Ph. 1 - Action-object training:	--	11	9	10
Ph. 2 - Test derived object-action:	--	8/8	8/8	1/8
Ph. 3 - Object-action training:	--	--	--	11
Session V				
Ph. 1 - Action-object training:	--	--	--	12
Ph. 2 - Test derived object-action:	--	--	--	8/8
Session VI (Two Month Follow-Up)				
Ph. 1 - Action-object training:	13	14	--	10
Ph. 2 - Test derived object-action:	8/8	8/8	--	8/8

* Indicates that the subject was re-exposed to action-object training.
In all cases, subjects completed the training in 8 trials (i.e., the minimum number required).

Subject 2 completed the conditional discrimination training of the action-object relations in 18 trials. Subsequently, he was tested for the derivation of object-action relations, but failed to pass, producing 6 correct responses. He was then re-exposed to the conditional discrimination (action-object) training with the stimuli employed in Session I. In Session II, Subject 2 successfully completed the conditional discrimination training, with novel actions and objects, in a total of 14 trials, but again failed to pass the test for the derivation of object-action relations (3 correct responses). This subject was then immediately exposed to the explicit symmetry (i.e., object-action) training, using the stimuli employed in Session II, which he completed in 10 trials. Subject 2 began Session III using another novel set of actions and objects. He required 12 trials of conditional discrimination training, but failed the symmetry test by only one response (7 correct). He was again exposed to explicit symmetry training using the stimuli from Session III, which he completed in 8 trials. In Session IV he was successfully trained in 11 trials using a novel set of actions and objects, and immediately passed the symmetry test without error. Two months later, he was exposed to the Follow-Up Session involving a new set of actions and objects. He required 14 trials to complete the conditional discrimination training, and then immediately passed the test for the transformation of function in accordance with symmetry without error.

EXPERIMENT 6

Procedure

Experiment 6 replicated Experiment 5, except that the trained and tested relations were reversed. This experiment was similar to Experiment 4 in the previous study. In effect, object-action relations were now trained and action-object relations were tested.

RESULTS AND DISCUSSION

The data from Experiment 6 are presented in Table 10. The patterns of test performance emitted by all four subjects were similar to those produced by subjects in Experiment 5. That is, action-object tests were only passed after subjects received explicit symmetry training (only one such exemplar was required by each subject). Follow-up data taken from two subjects (7 & 8) demonstrated that their performances remained stable. These data provide clear evidence that reversing the trained and tested relations does not reduce the facilitative effect of explicit symmetry training on derived symmetry responding.

Table 10

Number of training trials and number of correct responses during the test trials for each subject in Experiment 6

Subjects:	5	6	7	8
Session I				
Ph. 1 - Object-action training:	14	20	12	21
Ph. 2 - Test derived action-object:	5/8	7/8	6/8	2/8
Ph. 3 - Action-object training:	9	--*	--*	--*
Session II				
Ph. 1 - Object-action training:	11	13	11	10
Ph. 2 - Test derived action-object:	8/8	3/8	5/8	6/8
Ph. 3 - Action-object training:	--	10	--*	--*
Session III				
Ph. 1 - Object-action training:	--	9	11	8
Ph. 2 - Test derived action-object:	--	8/8	5/8	3/8
Ph. 3 - Action-action training:	--	--	9	--*
Session IV				
Ph. 1 - Object-action training:	--	--	8	12
Ph. 2 - Test derived action-object:	--	--	8/8	4/8
Ph. 3 - Action-object training:	--	--	--	10
Session V				
Ph. 1 - Object-action training:	--	--	--	9
Ph. 2 - Test derived action-object:	--	--	--	8/8
Session VI (Two Month Follow-Up)				
Ph. 1 - Action-object training:	--	--	16	11
Ph. 2 - Test derived object-action:	--	--	8/8	8/8

* Indicates that the subject was re-exposed to object-action training.
In all cases, subjects completed the training in 8 trials (i.e., the minimum number required).

EXPERIMENT 7

Procedure

Experiment 7 was similar to Experiment 5 in that training and testing involved action-object and object-action relations, respectively (see Table 11). Eight subjects (9-16) were first exposed to pretraining of object-action relations using set 1 (i.e., A1 & A2, car & doll). This pretraining was identical to the explicit symmetry training in object-action relations that had been used previously. Subjects were trained on these relations until eight consecutively correct responses were emitted. They were subsequently exposed to action-object training with a novel set of actions and objects, followed immediately by a test of the object-action relations (i.e., training and testing with set 2). Because subjects had been pretrained in object-action relations, without explicit symmetry training, it might be expected that some, but not all subjects would pass on the first symmetry test. If sufficient subjects indeed failed this test, it was planned that they be exposed to one of two experimental sequences. Some subjects would receive explicit symmetry training (on set 2), and would then be trained and tested on a new set (set 3) of action-object relations. The remaining subjects, who had also failed the symmetry test, would be re-exposed to the pretraining (using set 1). Once they reached the mastery criterion again, they would then be exposed to training and testing on a novel set of actions and objects (i.e., set 3). If the subjects again failed the symmetry test, they would receive explicit symmetry training. Following this, they would be re-exposed to action-object training and object-action testing involving another novel set of actions and objects (i.e., set 4). If subjects were available, they would be exposed to a one-month follow up using a novel set of actions and objects.

Table 11

Trained and tested relations employed in each session of Experiment 7

Session No.	Trained Action-Object Relations	Tested Object-Action Relations
I (Pretraining)	Wave-A1 & Clap-A2	A1-Wave & A2-Clap
I	Arms Out-B1 & Arms In-B2	B1-Arms Out & B2-Arms In
II	Pulling Ear-C1 & Pulling Nose-C2	C1-Pulling Ear & C2-Pulling Nose
III	Rubbing Head-D1 & Scratching Tummy-D2	D1-Rubbing Head & D2-Scratching Tummy
IV (Follow-Up)	Touching Feet-E1 & Flapping Arms-E2	E1-Touching Feet & E2-Flapping Arms

RESULTS AND DISCUSSION

The data from Experiment 7 are presented in Table 12. As expected, a greater proportion of subjects who received object-action pretraining passed the first symmetry test with a new set of actions and objects than had been observed in the previous experiments (i.e., four out of eight versus none out of eight subjects). The remaining four subjects (10, 12, 13 & 15) who failed the symmetry test were divided into two pairs. Two subjects (10 & 15) were immediately exposed to explicit symmetry training using the same set of actions and objects (Phase 3). The other two subjects (12 & 13) were re-exposed to object-action pretraining using set 1. Both subjects who received the explicit symmetry training on the same set, were then trained on a novel set and immediately passed the symmetry test (in Session II). However, both of the subjects who were re-exposed to the object-action pretraining, and were trained on a novel set, then failed the symmetry test for the second time. These subjects were then immediately exposed to explicit symmetry training using the same set of actions and objects as used in Phases 1 and 2. After training on a new set, they immediately passed the symmetry test (in Session III). Four subjects (9, 12, 15 & 16) were available for a one-month Follow-Up Session, and all demonstrated that the derived symmetry performances remained stable.

Table 12
Number of training trials and number of correct responses during the test trials for each subject in Experiment 7

Subjects:	9	10	11	12	13	14	15	16
Session I								
Object-action pretraining:	16	24	14	18	22	22	21	26
Ph. 1 - Action-object training:	12	16	16	20	15	19	24	29
Ph. 2 - Test derived object-action:	8/8	2/8	8/8	5/8	3/8	8/8	2/8	8/8
Ph. 3 - Object-action training:	--	12	--	--*	--*	--	14	--
Session II								
Ph. 1 - Action-object training:	--	12	--	10	18	--	10	--
Ph. 2 - Test derived object-action:	--	8/8	--	1/8	3/8	--	8/8	--
Ph. 3 - Object-action training:	--	--	--	10	14	--	--	--
Session III								
Ph. 1 - Action-object training:	--	--	--	12	16	--	--	--
Ph. 2 - Test derived object-action:	--	--	--	8/8	8/8	--	--	--
Session IV (One Month Follow-Up)								
Ph. 1 - Action-object training:	24	--	--	15	--	--	11	21
Ph. 2 - Test derived object-action:	8/8	--	--	8/8	--	--	8/8	8/8

* Indicates that the subject was re-exposed to object-action pretraining.
In all cases, subjects completed the training in 8 trials (i.e., the minimum number required.)
Objects and actions used in pretraining were never used in phases 1, 2, or 3, across any of the sessions.

The results from this experiment showed that it was possible to establish symmetry responding in some children by pretraining object-action relations alone (i.e., not symmetry relations) before exposure to the experimental procedures using novel actions and objects. However, for four of the children this pretraining was not effective. Even after two exposures to object-action pretraining, two of these subjects continued to fail the symmetry test. After receiving explicit symmetry training with the same set, however, they immediately produced derived symmetry responding. These results indicate that when object-action pretraining fails to generate derived symmetry, explicit symmetry training may prove to be more effective in this regard than simply repeating the pretraining procedure.

GENERAL DISCUSSION

The current study addressed two questions that arose from Experiments 1-4 described in the previous chapter. The first question concerned the role of the name training employed throughout those experiments. Although a clear facilitative effect for exemplar training on the transformation of function in accordance with symmetry had been demonstrated, all of the subjects were first trained to name all of the actions and objects. Consequently, this experimental naming history may have played an important role in generating the facilitative effect of the exemplar training. The current study removed the name training from the experimental procedures, and yet produced similar results. The present work, therefore, clearly answers the first question raised in the previous experiments -- the experimental name training was *not* needed for exemplar training to have its facilitative effect.

The second question concerned whether it would be possible to facilitate symmetry, in the current context, with means other than explicit symmetry training. To address this question, subjects in Experiment 7 of the current study were exposed to object-action pretraining which was designed to provide a history of reinforcement for responding on a task that was formally similar to one that was used during testing, but without explicitly training a symmetry relation. Although a greater proportion of subjects (50%) in this experiment passed the first symmetry test, in comparison to the previous six experiments across the two chapters (12.5%), the exemplar training still proved to be highly effective for those subjects who failed. Once again, therefore, exemplar training appears to be the most effective method for establishing a transformation of functions in accordance with symmetry using these experimental procedures.

A final issue arising from the current study concerns the fact that, like the research reported in the previous chapter, only one or two exemplars of explicit symmetry training were required before subjects showed symmetry on a subsequent set of actions and objects. The limited number of exemplars needed in both studies could be taken to indicate that the exemplar training was in some way discriminative for an already established behavioural repertoire. Future RFT research might focus, therefore, on establishing relational responding that is completely absent in the behavioural repertoires of young children. This was the focus of the subsequent two chapters outlined in the current thesis.

Chapter Four

Chapter 4

Testing and Training Relational Responding in Accordance with More-than and Less-than

Experiment 8

INTRODUCTION

According to RFT, relational frames are defined as generalised operant response classes that are established through appropriate histories of reinforcement. Once established, any stimulus event (regardless of form) may participate in a relational frame, given the relevant contextual cues. The RFT view of derived relational responding as a form of generalised operant behaviour may be difficult to appreciate if one typically conceptualises operants in structuralistic terms (see Barnes-Holmes & Barnes-Holmes, 2000). It is important to remember, however, that the concept of a response class with an infinite range of topographies is a *defining property* of operant behaviour (Catania, 1996). Nonetheless, topographical and functional classes of behaviour-environment interactions quite often overlap, and thus the two may become confused. Lever pressing, for instance, may be defined by the effect of activity upon the lever, but almost all lever presses involve "pressing" movements. A sensitive lever may be activated by coughing, but for most purposes such instances can normally be ignored. Sometimes, however, the independence between topographical and functional classes is made very clear. The concept of generalised imitation (e.g., Baer, Peterson & Sherman, 1967; Gewirtz & Stengle, 1968; Poulson, Kymissis, Reeve, Andreatos & Reeve, 1991) provides one excellent example. After a generalised imitative repertoire is established, an almost infinite variety of response topographies may be substituted for the forms used in the earlier training. The behaviour of imitating is *generalised* because it is not limited to any particular response topography. In a similar vein, some behaviour analysts have argued that it is possible to reinforce "generalised attending" (McIlvane, Dube & Callahan, 1995; McIlvane, Dube, Kledaras, Iennaco & Stoddard, 1990), although *what* is being attended to will change. Broadly similar arguments have also been made with respect to many other phenomena, such as generalised identity matching and mismatching (e.g., Cumming & Berryman, 1965; Dube, McIlvane & Green, 1992; Saunders & Sherman, 1986), exclusion (e.g., Lipkens et al., 1993; McIlvane, Kledaras, Munson, King, deRose & Stoddard, 1987), arbitrary assignment (e.g., Saunders, Saunders, Kirby & Spradlin, 1988), and one-trial learning (e.g., Catania, 1996; Dube, et al., 1992). Although these and yet other examples (see Neuringer, 1986; Pryor, Haag & O'Reilly, 1969; Stokes & Baer, 1977) constitute a simple extension of the three-term contingency as an analytic unit, specific qualifiers are often included when operant classes are not readily defined topographically. Such classes are referred to as "generalised," "higher order," or "overarching". As noted in Chapter 1, these qualifiers are not used as technical terms, and they do not imply the existence of mediational processes leading to the formation of operants of this type. They simply emphasise that a specific functional class cannot be defined by its response forms and/or stimulus forms, a fact that is true in principle for all functional classes (Barnes-Holmes & Barnes-Holmes, 2000).

Some of the concepts and terms presented in the Introduction are directly relevant to the research reported in this and the subsequent chapter, consequently some of the material from Chapter 1 will be repeated here to prevent the reader prevent the reader from having to return to earlier sections of the thesis. In applying the concept of the generalised operant to the phenomenon of derived relational responding, a new nomenclature has evolved. As described in Chapter 1, a relational frame is said to possess three properties: mutual entailment, combinatorial entailment, and transformation of stimulus function. Mutual entailment involves two events; an explicitly trained relation between A and B, in a specific context, derives a relation between B and A. For example, if A and B participate in a frame of comparison, such that 'A is *less than* B', it follows, in this instance, that 'B is more than A'. Combinatorial entailment occurs among three or more events and also differs from mutual entailment in the specificity of the relations. For example, explicitly trained relations between A and B and between B and C, in a specific context, derive relations between A and C and C and A. In some instances, all of the relations between the events can be specified. For example, 'A more than B and B more than C' derives 'A more than C and C less than A'. However, if 'A is more than B and C is more than B' the entailed relation between A and C is unspecified. Some combinatorially entailed relations, however, are always specified. The frame of opposite, for instance, has the property of "flipping" between "same" and "opposite" across the relata within a relational network. For example, if A is the opposite of B, and B is the opposite of C, then A and C are the same not opposite. If D is added to this network as opposite to C, D is now the same as B but opposite to A. Transformation of function refers to the changes that occur to stimulus functions by virtue of their participation in relational frames. For illustrative purposes, recall the example provided in Chapter 1. In the verbal community, a child learns that a ten pound note is worth "more than" a five pound note. As a result of this, the child is likely to be more excited at the prospect of receiving a ten pound note than receiving a five pound note, despite having no direct experience of the former. In this case, the increased excitement displayed with the ten pound note is a direct result of its participation in the "more-than" relation with the five pound note (i.e., the functions of the novel ten pound note have been transformed in accordance with the more-than relation).

In addition to these technical terms RFT explicitly specifies two forms of contextual control, Crels and Cfuncs, that operate within any instance of relational framing. These are referred to as Crel and Cfunc. Crels determine the relation that obtains among two or more events. The phrases, "more than", "same as", and "comes before", for example, may function as Crels that determine the relational response to two or more stimuli (e.g., if you are told that A comes before B, then you may derive that B comes after A). Cfunc stimuli determine the psychological functions that transform in accordance with derived stimulus relations. The phrases, or Cfuncs, "look at", "pick up", and "let go", for example, may determine specific transformations of function. Imagine once again that you are told that "cupan means cup in Irish". In this case, the word "means" functions as a Crel that establishes an equivalence relation (i.e., an example of the frame of coordination) between cupan, cup, and actual cups. Various Cfuncs may now be used to transform a wide variety of behavioural functions in accordance with this new equivalence relation. For example, the mands, "pick up the cupan", and "let go of the cupan" each contain a different Cfunc that transforms the function of an actual cup, based on an equivalence relation between the cup and the Irish word "cupan". In the presence of either of the foregoing mands, the function of a cup may be transformed such that it controls a "picking up" or "letting go" response function. In effect, Crels and Cfuncs control synergistically the behavioural patterns that define any particular instance of relational framing.

Relational Frame Theory has at its core the assumption that relational responding is a form of generalised operant behaviour. As described previously, a number of RFT studies have developed experimental procedures for demonstrating complex patterns of derived relational responding (e.g., Dymond & Barnes, 1995, 1996; Roche & Barnes, 1996, 1997; Roche, Barnes-Holmes, Smeets, Barnes-Holmes & McGeady, 2000; Steele & Hayes, 1991; Wulfert & Hayes, 1988). It is critically important to the RFT research agenda, however, that patterns of derived relational responding are brought under generalised operant control. The two studies reported in the previous chapters provided some evidence that transformations of function in accordance with symmetry constitute generalised operant response classes, because all subjects who received explicit symmetry training demonstrated the transformation of functions with novel stimulus sets.

A recent study reported by Healy, Barnes-Holmes and Smeets (2000) is the first published study to focus specifically on the generalised operant nature of relational responding. In the first experiment reported by Healy et al., for example, subjects were first exposed to conditional discrimination training on four matching-to-sample trial-types (A1-B1, B1-C1, A2-B2, B2-C2). The subjects were then tested for the formation of four combinatorially entailed derived relations (A1-C1, C1-A1, A2-C2, C2-A2). Following exposure to this first cycle of training and testing, accurate or inaccurate feedback was delivered for the test performances. The next cycle of training and testing then began, but with a novel set of stimuli. This cycle of training and testing, using novel sets of stimuli for each cycle, continued until a subject responded in accordance with the feedback across three consecutive stimulus sets. Once this stability criterion was reached, the type of feedback switched (accurate to inaccurate or vice versa) and the training and testing continued, using novel stimulus sets, until the performance again reached the stability criterion. In short, the feedback delivered for relational responding with earlier stimulus sets generalised to subsequent novel sets. This type of generalised consequential control across stimulus sets allowed the researchers to conclude that they had clearly demonstrated that derived relational responding can show one of the key properties of generalised operant behaviour.

Nevertheless, Healy et al. acknowledged that the relational repertoires that were targeted in the research were almost certainly established prior to the experiment (i.e., one would assume that undergraduates were capable of equivalence responding before entering the study). Consequently, the experimental procedures clearly influenced the subjects' existing relational repertoires, but no evidence was provided that these repertoires were actually established during the experiment. In the words of Healy et al. (2000), ". . . the feedback influenced pre-existing repertoires of generalised operant behaviour, and did not establish those repertoires ab initio. Consequently, the current data do not provide strong evidence for the RFT view that derived relational responding is established, in the first instance, as generalised operant behaviour" (pp. 224-225). Similar conclusions might also be drawn on the derived symmetry performances with the young children in the two previous chapters.

Based on this reasoning, in this and the next chapter particular patterns of relational framing were selected that appeared to be absent for a number of young subjects. In each study an attempt was made to establish and manipulate those patterns as generalised operant behaviour. In the current chapter, relational responding in accordance with more-than and less-than was targeted for investigation (relational responding in accordance with the frame of opposite was the focus of the study reported in the next chapter).

A basic problem-solving task was employed to test and train specific patterns of responding in accordance with more-than and less-than. To test and train responding in accordance with more-than and less-than, a problem-solving task was designed that involved presenting a child with two or three identically sized paper coins. On each trial, the experimenter described how the coins compared to one another in terms of their value, and the child was then asked to pick the coin that would buy as many sweets as possible. On some trials involving two coins, for example, the child was told that one coin (coin A) would buy more sweets than another coin (coin B) (i.e., A>B). On other trials involving three coins, for instance, the child was told that one coin would buy less sweets than a second coin, and that the second coin would buy less sweets than a third coin (i.e., A<B<C). Numerous sets of coins were used to test and train these types of relational performances. Each trial-type was designed to examine a particular pattern of a transformation of function in accordance with combinatorially entailed more-than or less-than relations. Imagine, for example, that on a particular trial, more-than relations (Crels) were established from coin A to coin B, and from coin B to coin C (i.e., A>B>C). If a subject then chooses coin A in the context of greatest value (Cfunc), according to RFT the function of coin A has been transformed in accordance with the combinatorially entailed more-than relations. In other words, the Crels and Cfunc transform the functions of coin A such that it is chosen over coin B and coin C. Four trial types were constructed using this general approach, two that specified more-than relations (i.e., A>B>C; C>B>A), and two that specified less-than relations (A<B<C; C<B<A). Of course, a total of 12 trial-types could be constructed using combinations of more-than and less-than relations among three coins presented in a linear sequence (e.g., B>A>C; C>A>B; A<C<B; etc.). Furthermore, a total of 24 trial-types could be constructed if non-linear sequences are employed (e.g., A>B<C). The purpose of the current study, however, was not to conduct an exhaustive examination of the relational frame of comparison, but rather to establish and manipulate specific patterns of relational responding that appear to be important constituent elements of this relational frame. The ultimate aim of the current experiment was to establish for each child specific patterns of contextually controlled relational responding that would generalise to increasingly novel contexts (e.g., novel objects, settings, and experimenters). The current study was not directly concerned with the analysis of sequence classes, order relations, or transitive inference (see Green, Stromer & Mackay, 1993), although there may be functional overlap between these phenomena and the performances reported herein (see General Discussion Chapter).

METHOD

Subjects

Three subjects (1, 2 & 3) participated in this experiment. At the beginning of the experiment, Subject 1, female, was 5 years and 5 months old; Subject 2, male, was 5 years and 10 months old; and Subject 3, male, was 4 years and 2 months old. At the end of the experiment, Subject 1 was 5 years and 8 months old; Subject 2 was 6 years and 1 month old; and Subject 3, was 4 years and 7 months old. The first two subjects were enrolled in a crèche in Cork, and the third subject was enrolled in a crèche in Dublin. They were chosen on the basis of parental consent, and that neither their parents nor their crèche supervisor had identified them as presenting a learning difficulty.

Setting and Apparatus

Each session was conducted in a quiet room free from distractions. Subjects participated individually. The experimenter and child sat side-by-side at a small wooden table during most of the sessions. During generalisation tests (described later) a novel experimenter and the child sat together on the floor. Forty five identically sized colored paper coins were used in this experiment. These were described to the subjects as "coins" and this label will be used throughout this and the subsequent chapter. There were fifteen blue coins, fifteen red coins, and fifteen green coins, and each coin was marked with a different pattern. The coins were divided into fifteen sets, each containing three coins, one blue, one red, and one green. The three coins contained in each set were designated as A, B, and C (subjects never saw these labels). Only one set of coins was used at any one time. Each set was placed on a background of white A4 paper (referred to as the stimulus sheet), containing one or two black printed arrows, with each arrow positioned between each pair of coins arranged horizontally. Each arrow pointed either to the right or to the left. When three coins were presented simultaneously, the stimulus sheet contained two identical arrows, both pointing in the same direction. For example, when coins A, B, and C were presented, one arrow was presented between coins A and B, and another arrow between coins B and C. The words "BUY MORE" or "BUY LESS" were printed above each arrow, and in cases of two arrows, both were accompanied by the same words, (i.e., both had "BUY MORE" or "BUY LESS" above the arrow). In subsequent phases of the study, the arrows and the text were systematically removed (because none of the children could read these words). Stimulus sheets containing only the text (i.e., with arrows removed), and blank stimulus sheets containing neither arrows nor text, were subsequently used for this purpose. A number of additional sets of stimuli were employed throughout the study as a test for generalisation. These included: books, compact disc (CD) covers, drinking glasses, cups, pencils, and spoons. All of the generalisation objects in each category (e.g., books) were identical in size. Other materials were employed as reinforcers including coloured beads, commercially available children's stickers and sweets. The reinforcers and an upright glass jar were placed on a wooden tray. The tray was placed to the left, and slightly in front of the experimenter throughout each session.

<u>Programmed Consequences</u>

A correct response consisted of the child pointing to the correct coin, and was followed by the words "Yes, you are correct. Good girl/boy. Take a bead." An incorrect response was defined as making an incorrect choice or emitting no response within 10s of the instruction. After collecting eight beads in the glass jar, the child was allowed to select a sticker/sweet from the wooden tray. Punishment during training trials consisted of the experimenter saying: "No, this is not correct. You loose a bead." The experimenter removed a bead from the jar and placed it back in the tray, and the next training trial began. No programmed consequences followed any test trial.

General Procedure

Testing and training each involved blocks of eight trials. Subjects were first exposed to a baseline test to determine whether they could respond in accordance with more-than and less-than in the context of the experimental task. There were twelve trial-types in total, and these are depicted in Figure 4. In each test or training trial the child was required to point to a particular coin. If a child made any comment during a trial, the experimenter simply replied "We can talk after we have finished our work." Pointing to two or more coins, even if one of the choices was correct, was recorded as an incorrect response.

AB Relations	BC Relations	ABC Relations
LESS THAN	LESS THAN	LESS THAN LESS THAN
A --------> B*	B --------> C*	A --------> B --------> C*
LESS THAN	LESS THAN	LESS THAN LESS THAN
A* <-------- B	B* <-------- C	A* <-------- B <-------- C
MORE THAN	MORE THAN	MORE THAN MORE THAN
A* --------> B	B* --------> C	A* --------> B --------> C
MORE THAN	MORE THAN	MORE THAN MORE THAN
A <-------- B*	B <-------- C*	A <-------- B <-------- C*

Figure 4: Trial-types used for testing and training the relations of more-than and less-than. In trials involving the presentation of text only, the arrows were removed and the subject was exposed to text only above the coins. In trials involving the vertical presentation of coins, the subject saw neither arrows nor text, only the coins positioned on a blank sheet of A5 paper, and coin A was always positioned above coin B, which was always positioned above coin C. In the generalisation test, trial-types were identical to those presented in Figure 4 and used throughout the Experiment, but the stimuli were either CD covers, books, pencils, drinking glasses or spoons randomly presented on the floor of the experimental room.

In general, sessions lasted no more than 20 mins. per day, and the children were exposed to a maximum of four sessions per week. When sessions lasted more than 10 mins., a break of 5 mins. was provided mid-way through the session. At the beginning of each block of training or testing trials, the experimenter always asked the child "Do you want to do some more work?" If the child indicated that s/he did want to do more, the experimenter continued as planned. If, however, the child responded negatively (or indicated during a training or test block that s/he wished to stop), the experiment was terminated for that day. If the child had reached a training criterion or passed a test during the previous block, in the next session the experimenter continued with the next planned stage of the experiment. If, however, the subject had failed to reach a training criterion or pass a test during the previous block (or asked to stop at any point during a block) the next planned stage was not presented. Instead, the next training or test block normally involved some form of reduction in the complexity of the previously presented stage (e.g., presenting two coins rather than three coins).

Training A-B relations. Training the A-B relations normally commenced with a block of eight trials, involving only coins A and B. Coin A was consistently placed on the left-hand side of the stimulus sheet, with Coin B on the right. On the first trial of each session, the experimenter placed the bead container on the table and positioned the coins according to the appropriate trial-type. The subject was first told; "We are going to play a birthday game." The following instructions were then given: "I want you to imagine that it is your birthday today and you have to go to the shops to get sweets for your birthday party. If I tell you that this coin (e.g., experimenter pointed to coin A) buys less (or more) sweets than this coin (experimenter pointed to coin B), which coin would you take to buy as many sweets as possible?" On subsequent trials, shorter instructions were provided as follows "If this coin (e.g., experimenter pointed to coin A) buys more (or less) sweets than this coin (experimenter pointed to coin B), which coin would you take to buy as many sweets as possible?"

There were four trial-types in each block of A-B relations (two less-than trial-types, and two more-than trial types), each type presented twice in a random order without replacement (see Figure 4). Each of these trial-types may be described as follows: A buys less (sweets) than B; B buys less than A; A buys more than B; and B buys more than A. Two of the trial-types involved the experimenter pointing to the A coin first (e.g., A buys less than B), whereas the other two trial-types involved the experimenter pointing to the B coin first (e.g., B buys more than A), depending on the relation being stipulated. Subjects were required to reach a mastery criterion of eight consecutively correct responses on the A-B training trials before proceeding to training on the B-C relations.

Training B-C relations. The procedure for training the B-C trial-types (see Figure 4) was identical to that employed with the A-B trial-types, except that coins B and C were used, and when subjects reached the mastery criterion they proceeded to training on the A-B-C relations.

Training A-B-C relations. The four A-B-C trial-types involved the use of all three coins, A, B, and C. The coins were positioned from left to right in the order A, B, and C, respectively (the coins remained in these positions throughout each block of trials). An example of the instructions provided during A-B-C training is as follows: "If this coin (e.g., experimenter pointed to coin A) buys less sweets than this coin (experimenter pointed to coin B), and if this coin (experimenter pointed again to coin B) buys less sweets than this coin (experimenter pointed to coin C), which coin would you take to buy as many sweets as possible?" Across trials, the experimenter pointed to the A coin first or to the C coin first, depending on the trial-type. The four trial-types were as follows: A buys less than B which buys less than C; C buys less than B which buys less than A; A buys *more* than B, which buys more than C; and C buys more than B which buys more than A (see Figure 4). Each trial-type was presented twice in a random order without replacement in a block of eight training trials.

Testing A-B, B-C, and A-B-C relations. This test consisted of 24 test trials, one block of eight test trials for each of the A-B, B-C, and A-B-C relations, respectively. In order to pass a test, subjects were required to achieve a minimum of 21 correct responses out of 24, without producing two or more incorrect responses on any one relation (e.g., if they responded incorrectly more than once to the 'A is worth more than B' relation, the test performance was recorded as a fail). Successful training on A-B, B-C, and A-B-C relations was always followed by a test of all three relations using a new set of coins. That is, subjects were exposed to the same procedure as used in training, but with a new set of coins and without programmed consequences. At the beginning of each test, and all subsequent tests throughout this experiment, subjects were given the instructions as normal, and were also informed "This time I can't tell you whether you are right or wrong."

Responding in accordance with 'would' and 'would-not'. When subjects successfully passed a test of all three relations, they were exposed to 'would' and 'would-not' trial-types. Subjects were instructed as follows: "This time, I will sometimes ask which coin *would* you take to buy as many sweets as possible, and other times I will ask which coin would you *not* take to buy as many sweets as possible?" During these trials subjects were required across blocks of training and/or testing to indicate which coin they *would* and *would not* select (referred to as 'would/would-not' training and testing) in order to buy as many sweets as possible. From an RFT perspective, the phrases "more-than" and "less-than" functioned as Crels, whereas "would" and "would-not" functioned as Cfuncs. The procedures used to train and test 'would' and 'would-not' responding were identical. For example, in a block of eight A-B trials, two of the trial-types may be summarised as follows: (i) A buys more sweets than B: Which coin *would* you choose? and (ii) A buys more sweets than B: Which coin *would you not* choose? The same format was applied to the blocks of B-C and A-B-C trial-types. Thus each block (A-B, B-C, or A-B-C) contained eight trial-types, four "would" trials and four "would-not" trials.

<u>Removing the arrows and text</u>. After subjects had demonstrated 'would' and 'would-not' responding, specific features of the stimulus presentation were systematically altered, in order to eliminate the arrows and/or text as possible sources of stimulus control. First, all arrows were removed and the text that had been positioned above the arrows was retained. Second, when subjects had passed a test involving this stimulus presentation, the text was removed. In other words, only the coins were now presented on the stimulus sheets with both arrows and text removed. In all subsequent trials for each subject throughout the experiment, the arrows and text were never reintroduced.

Vertical stimulus presentations. All of the previously described trial-types involved the horizontal presentation of coins placed adjacent to one another (i.e., A beside B, B beside C, or A beside B beside C). After subjects had successfully completed all of the training and testing outlined above with stimuli presented in this manner, they were exposed to a test in which the orientation of the stimuli was changed from horizontal to vertical. This alteration in the stimulus presentation permitted the elimination of the horizontal presentation as a possible source of stimulus control. For example, instead of stimuli being placed with A, B, and C from left to right, respectively, the coins were now positioned A, B, and C vertically, with A at the top, B in the middle, and C at the bottom. Once a subject had passed the test involving the vertical presentation of coins, this type of presentation was never used again with that subject.

Generalisation test. When subjects had completed all of the training and test procedures outlined above, they were exposed to a generalisation test (with no feedback). This test involved two or three identically sized objects that were randomly positioned on each trial around the floor of the experimental room. This generalisation test contained identical trial-types to the would/would-not test, except that they involved other objects instead of coins. Two further generalisation tests were conducted, each with novel objects, following two contingency reversals (see below). Novel experimenters who were unfamiliar with the general purpose of the study, and who had no knowledge of behavioural psychology, conducted all generalisation tests (the original experimenter was not present in the room during these tests). Each of the novel experimenters was provided with an appropriate script of the relevant question to be asked on each trial at the beginning of each session. Novel experimenters were not required to record responses (this was done by two independent observers). The novel experimenters were also explicitly instructed not to work out the correct answer to each trial because doing so might interfere with the experiment.

Follow-up tests. Follow-up tests, where possible, were conducted one month after the completion of testing and training to determine if the relational performances remained intact across extended periods of time (see Rehfeldt & Hayes, 2000; Saunders, Wachter & Spradlin, 1988). These tests involved; a novel set of coins; the horizontal presentation of stimuli, with no arrows or text; and would and would-not trial-types.

Contingency reversals. When subjects had passed all of the tests outlined above, the reinforcement contingencies were reversed (i.e., Reversal 1) in order to determine the operant nature of the performances that had been demonstrated. In effect, subjects were now required to respond *away* from the coin, the choice of which would have been reinforced previously. For example, given the relation 'A worth more than B', selecting B was now reinforced, whereas selecting A was reinforced previously. After subjects had passed all of the tests contained in Reversal 1, including the generalisation test, a second reversal (i.e., Reversal 2) was introduced in order to complete an A-B-A reversal design for each subject. In Reversal 2, the contingencies were reversed a second time, and the original reinforcement contingencies were reinstated. That is, given the relation 'A worth more than B', for example, selecting coin A was reinforced as before. At this point the experiment concluded with a generalisation test.

Inter-observer reliability. Approximately twenty five percent of training and testing trials were observed by an independent observer (or two observers during the generalisation tests), who had no knowledge of experimental psychology. The observer could not see the experimenter`s data sheet during the experimental sessions. The observer and experimenter disagreed on four training trials and two test trials.

PROCEDURE AND RESULTS

Given the nature of the study, the procedural details pertaining to each subject will be described in the context of the results. The complete procedure and results for Subject 1 will be presented, but for Subjects 2 and 3, only those features of the experiment that differed from Subject 1 will be described.

Subject 1

The data for Subject 1 are outlined in Table 13. The raw data from this subject are also presented in Appendix 1. Subject 1 was first exposed to six consecutive "baseline" tests of the A-B, B-C, and A-B-C relations using three sets of coins (i.e., sets 1-3). Set 1 was employed in Sessions 1 and 2, set 2 was employed in Sessions 3 and 4, and set 3 was employed in Sessions 5 and 6. Subject 1 failed to pass any of the six tests, and produced a highest score of 13 out of 24, or 54% correct. Given the lack of improvement across testing, explicit training of the relations was introduced, beginning in Session 7 with the A-B relations, and stimulus set 3.

Table 13
Sequence of training and testing, number of training trials, and test outcomes for Subject 1 on the relations of more-than and less-than

Condition	Training/Test Exposures	Session	Stimulus Set	Training/Test Type	No. of Training Trials/ Test Outcomes
Baseline	6 Tests	1-6	1-3	Would	FFFFFF
Intervention	Training	7-11	3	Would	136
	1 Test	11	4	Would	F
	Training	12	4	Would (A-B-C only)	14
	2 Tests	12-13	5	Would; Would/Not	P;F
	Training	14	5	Would/Not	28
	1 Test	14	6	Would/Not	F
	Training	15-16	6	Would/Not	64
	7 Tests	16-22	7-8	Would/Not; Text Only;	FP;FP
				Vertical; Gen. (CD's)	PP;P
Follow-Up	2 Tests	23-24	9	Would/Not	FP
Reversal 1	Training	25-26	9	Would	52
	1 Test	27	10	Would	F
	Training	28	10	Would	24
	1 Test	28	11	Would	F
	Training	29-30	11	Would	69
	3 Tests	30-32	12	Would; Would/Not;	P;P
				Gen. (Books)	P
Reversal 2	Training	33	12	Would	28
	1 Test	33	13	Would	F
	Training	34	13	Would	25
	1 Test	34	14	Would	F
	Training	35	14	Would	25
	4 Tests	35	15	Would; Would/Not;	FP; P
				Gen. (Pencils)	P

P = Pass; F = Fail: Reading from left to right.
FP indicates that the subject failed the first exposure to a test, and passed the second exposure to the same test.
Gen. = Generalisation test.

After 40 exposures to the training trials (i.e., 5 blocks of 8 trials), Subject 1 was still failing to produce eight consecutively correct responses on the A-B relations. At this point, therefore, a response-cost procedure was introduced in which every incorrect response was followed by the removal of one of the existing beads from the jar, and the subject was instructed to try again on the same trial. If a correct response was then emitted, the subject received verbal praise but was not allowed to select a bead (this modification was based on the concept of the *learn unit* described in Greer, Phelan & Sales, 1993). This modification was employed on all subsequent training sessions involving this subject and the two other subjects in all subsequent training trials. After a further 37 training trials, Subject 1 produced eight consecutively correct responses on the A-B relations (i.e., 77 A-B training trials in total). As indicated in Table 13, Subject 1 required a total of 136 training trials in order to complete training on the A-B, B-C, and A-B-C relations across Sessions 7-11 (i.e., she required 25 and 34 training trials on the B-C, and A-B-C relations, respectively). This training was followed by a test of all three relations using a new set of coins (i.e., Set 4). Subject 1 now produced 21 out of 24 correct responses, a dramatic improvement from baseline test performances. Although this test performance constituted a substantive improvement, all three errors produced by the subject occurred on the A-B-C less-than relations, and so the subject was retrained on the A-B-C relations only. When she reached eight consecutively correct responses on the A-B-C relations in 14 training trials, Subject 1 was re-exposed to a complete test of all relations using a new set (i.e., set 5). In Session 12, she produced 23 out of 24 correct responses, which constituted the first successful test performance.

Having now passed the initial test of A-B, B-C, and A-B-C relations, the would/would-not test was introduced. Subject 1 produced 20 out of 24 correct responses on this test (Session 13), and although this performance was high, it did not constitute a pass. She was subsequently trained explicitly to respond appropriately to the would and would-not trial-types. Twenty-eight training trials were required for her to reach the mastery criterion on all three relations. Following this training, she was retested (in Session 14) on the would/would-not trial-types using a new set of coins (i.e., set 6). Subject 1 produced 21 correct responses, with two errors occurring on the same relation, and so she was retrained on all relations using the same set of coins. This time she required 64 training trials to achieve the mastery criterion, and she was then (in Session 16) re-exposed to the would/would-not test using a new set of coins (set 7). She again produced 21 correct responses out of 24, with two errors on the same relation. Because improvement across blocks of test trials is a relatively common finding in the derived stimulus relations literature (e.g., Devany, Hayes & Nelson, 1986), Subject 1 was reexposed to the same test in the subsequent session without further training. In Session 17, she passed the would/would-not test with 23 correct responses.

Having now passed the initial test of all relations involving both would and would-not responding, features of the stimulus presentation were altered. (Until specified otherwise, all subsequent training and testing sequences incorporated would and would-not trial-types). In Session 18, the 'text only' test was introduced, in which all arrows on the stimulus sheet were removed and only the text that had been positioned above the arrows was retained. Subject 1 produced 21 correct responses out of 24 and again, although this constituted a fail, she was retested without further training. She then produced perfect responding (i.e., 24 out of 24) on this test. In the following session, the text was removed and the orientation of the stimuli was altered from horizontal to vertical. In the first test involving a vertical presentation (in session 20), Subject 1 passed with 23 correct responses. Because the same stimulus set had now been used for a number of tests, the subject was retested immediately using a novel set (i.e., set 8) and she passed again.

Following this successful performance of would and would-not responding using the vertical presentation of stimuli, a generalisation test was conducted using two and three identically sized CD covers, randomly positioned around the floor of the experimental room. As indicated previously, novel experimenters were employed for this and all subsequent generalisation tests. During this test, Subject 1 immediately produced perfect responding.

Approximately one month later (in Session 23), a follow-up test was conducted (with the original experimenter) involving a new set of coins, in order to determine whether the relational performances were retained in the child's repertoire. This test involved would and would-not responding, and the coins were presented in horizontal positions. All subsequent stimulus presentations were horizontal. Subject 1 produced 20 correct responses (i.e., failing by one response). The child was then retested without further training and she produced a perfect test performance. From these data, it appeared that the arbitrary relations of more-than and less-than, involving responding in accordance with would and would-not, and incorporating some degree of generalisation, had been established in the repertoire of the subject.

In the next part of the study, Subject 1 was exposed to Reversal 1 (see Figure 5), in which the baseline contingency was reversed. The subject was now required to respond *away* from the coin, the choice of which would have been reinforced during baseline trials. Because it seemed uncertain whether this task would prove difficult for her, the training began with would-only trials. In Sessions 25-26, Subject 1 required 52 training trials in order to reach the mastery criterion on all three reversed relations. On a subsequent test (in Session 27) of these relations, involving a new set of coins (i.e., set 10), she failed to pass the reversal test, producing 11 reversal responses out of 24 (i.e., 13 "correct" responses based on the pre-reversal contingencies). The subject was subsequently given further explicit training on the reversed relations and reached the mastery criterion in 24 training trials. On a subsequent test, the performance of the subject deteriorated and she now produced only 6 reversed responses out of 24 (i.e., 18 previously "correct" responses). She was then (in Sessions 29-30) exposed to further explicit training on the reversed relations, and required a total of 61 training trials in order to reach the mastery criterion. Immediately after this training, she passed a test of the reversed relations by producing 22 out of 24 reversed responses (i.e., only 2 previously "correct" responses). Furthermore, in subsequent sessions (31-32), Subject 1 passed, without further training, both a would/would-not test and a generalisation test of the reversed relations (i.e., with books randomly positioned on the floor). From these data, as depicted in Figure 5, it is apparent that the original pattern of responding, observed before the introduction of the contingency reversal, had now been successfully modified.

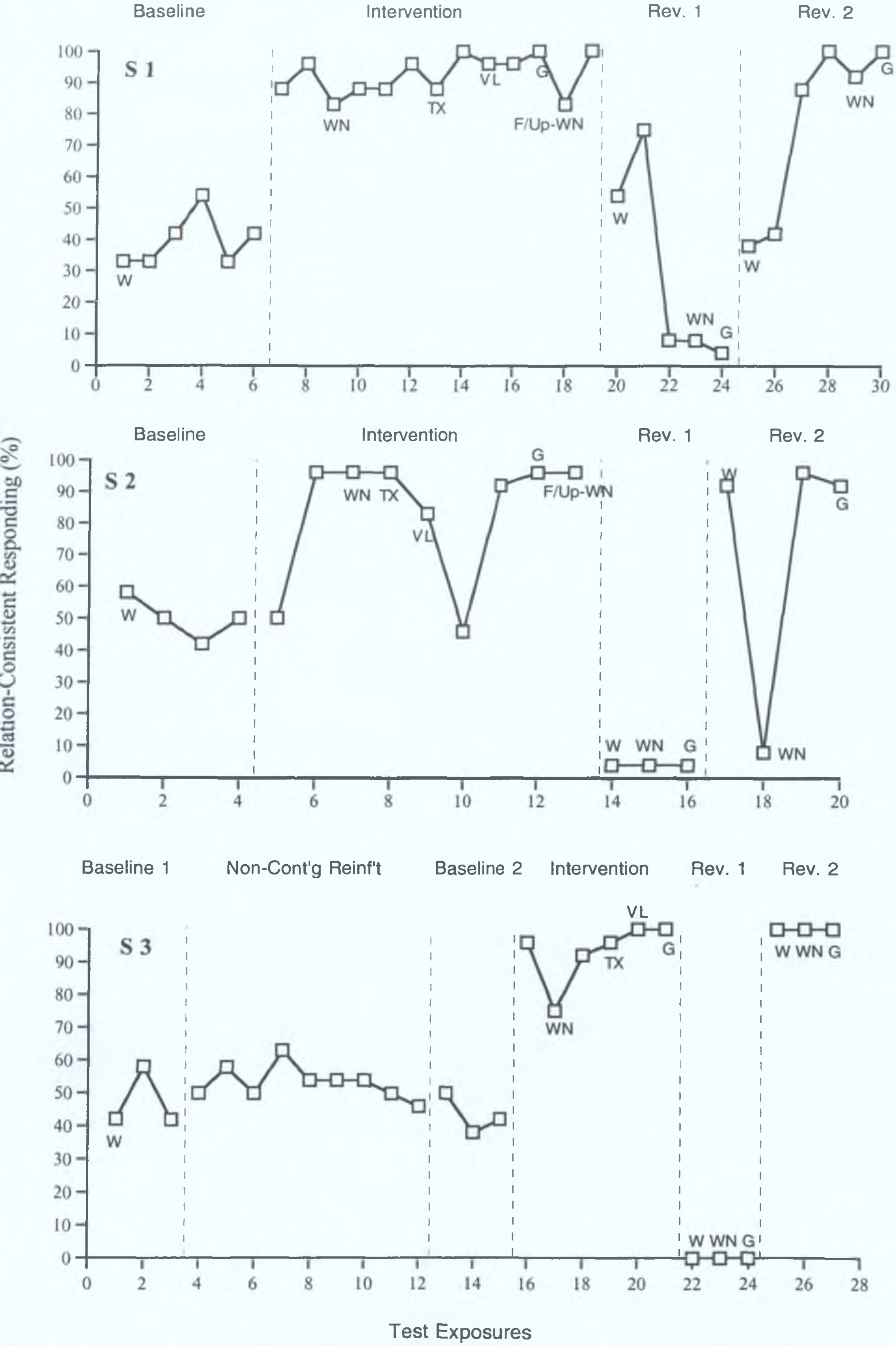
Baseline
Intervention
Rev. 1
Rev. 2
S 1
WN
TX
VL
G
F/Up-WN
W
S 2
Baseline 1
Non-Cont'g Reinf't
Baseline 2
S 3
W WN G
Relation-Consistent Responding (%)
Test Exposures

Figure 5. Percentage of relation-consistent responses for Subjects 1, 2, and 3 on tests of the relations of more-than and less-than. Letters adjacent to data points indicate the type of stimulus presentation or condition in operation. Data points that are not accompanied by letters involve the stimulus presentation or condition indicated by the previously marked data point. (W = would responding; WN = would and would-not responding; TX = text-only stimulus presentation; VL = vertical stimulus presentation; G = generalisation test; F/Up = follow-up).

Having passed all of the tests contained in the first reversal, Subject 1 was now exposed to Reversal 2 (see Figure 5), in which the original reinforcement contingencies were reinstated. The training began with would-only trial-types, as had been done previously. In Session 33, she reached the mastery criterion on all of the relations in only 28 training trials. In a subsequent test of these relations involving a new set of coins (i.e., set 13), she failed the would-only test by producing only 9 correct responses out of 24 (i.e., 15 responses in accordance with the previously reversed reinforcement contingency). She was again explicitly trained on these relations and reached the mastery criterion in only 25 training trials. Subject 1 was subsequently retested using a new set of coins (set 14), but again failed the test by producing only 10 correct responses. In the subsequent session (35), she was retrained again, and reached the mastery criterion in 25 training trials. The subject was then immediately retested on a new set of coins (set 15) and the test performance improved dramatically to 21 correct responses, but with two errors occurring on the same relation. She was immediately retested, and she produced a perfect test performance. In the same session, she was then tested on would and would-not trial-types using the same set of coins. In this test, Subject 1 immediately passed with 22 correct responses. The final test was a generalisation test using pencils randomly positioned on the floor of the experimental room. On this final test, Subject 1 immediately produced a perfect test performance.

Subject 2

The data for Subject 2 are outlined in Table 14. The raw data for this subject is also presented in Appendix 2. The testing and training procedures employed with this subject were very similar to those employed with Subject 1, except that a number of minor alterations were required, especially in establishing initial responding to the A-B, B-C, and A-B-C relations.

Table 14
Sequence of training and testing, number of training trials, and test outcomes for Subject 2 on the relations of more-than and less-than

Condition	Training/Test Exposures	Session	Stimulus Set	Training/Test Type	No. of Training Trials/ Test Outcomes
Baseline	4 Tests	1-2	1-2	Would	FFFF
Intervention	Training	3-5	2	Would (A-B only)	104*
	2 Tests	6	3	Would Non-arbitrary; Arbitrary	P;F
	Training	7-9	3	Would Interpolated (A-B only)	91
	1 Test	9	4	Would (A-B only)	F
	Training	10	4	Would	24
	5 Tests	11-12	5	Would; Would/Not; Text Only;	P;P;P
				Vertical	FF
	Training	13	5	Vertical	42
	2 Tests	13-14	6	Vertical; Gen. (Glasses)	P;P
Follow-Up	1 Test	15	7	Would/Not	P
Reversal 1	Training	15-16	7	Would	26
	3 Tests	16-17	8	Would; Would/Not;	P;P
				Gen. (Books)	P
Reversal 2	Training	18	8	Would	29
	2 Tests	18	9	Would; Would/Not	P;F
	Training	19	9	Would/Not	34
	2 Tests	19	10	Would/Not; Gen. (Pencils)	P;P

P = Pass; F = Fail: Reading from left to right.
* Indicates that the subject failed to reach the mastery criterion during training.
Gen. = Generalisation test.

Subject 1 required a total of 150 training trials on the initial A-B, B-C and A-B-C relations before passing the first baseline test. However, after 104 exposures to only the A-B training trials (in Sessions 3-5), Subject 2 failed to reach the mastery criterion. At this point in Subject 2's training, it seemed appropriate to turn my attention to non-arbitrary stimulus relations.

According to RFT, a history of reinforcement for responding in accordance with non-arbitrary relations provides an important historical context for the establishment of their arbitrary counterparts in a child's behavioural repertoire. For example, only in the most artificial learning environment could one imagine a child responding in accordance with the arbitrary relations of more-than and less-than before first demonstrating the non-arbitrary class of this relational responding (Hayes, Barnes-Holmes & Roche, 2001). In Session 6, therefore, a test of the non-arbitrary more-than and less-than relations that involved placing sweets on top of two coins was introduced. This test consisted of four trial-types that matched the arbitrary trial-types used previously (see Figure 4). Two trial-types consisted of two sweets placed on top of Coin A, and one sweet placed on top of coin B (i.e., A was physically more than B, and B less than A). The two other trial-types consisted of the reverse arrangement with two sweets placed on top of coin B and one sweet on top of coin A (i.e., B was physically more than A, and A less than B). The location of the coins was also alternated randomly, such that on half of the test trials coin A was positioned on the left with coin B on the right, and on the other half of the trials coin B was positioned on the left with coin A on the right. The test, therefore, consisted of one block of eight trials, with each trial-type randomly presented twice, once in each location, without replacement. At the beginning of each trial the subject was simply asked "Which coin has more?" No feedback was provided during this test. Subject 2 produced perfect responding on this non-arbitrary test.

After passing the non-arbitrary test, the subject failed a subsequent exposure to a baseline arbitrary test. Because this subject had passed the non-arbitrary test, but failed the arbitrary tests, an intervention involving interpolating arbitrary and non-arbitrary training trials (see Barnes et al., 1995) was introduced in an attempt to establish the mutually entailed arbitrary more-than and less-than relations. During Sessions 7 and 8, seven blocks of eight training trials of A-B relations only were presented, with each block containing four arbitrary and four non-arbitrary trial-types, as described above. The first training trial was a non-arbitrary trial-type, and this was always followed by an arbitrary trial-type. All trial-types during this part of the training were presented in that order. After 56 training trials, Subject 2 had still failed to produce eight consecutively correct responses on the interpolated arbitrary training trials (and showed no sign of improvement), but produced no errors on the non-arbitrary trials. At this point, simply interpolating non-arbitrary/arbitrary training trials was discontinued, and an alternative procedure was introduced to train the arbitrary relations between two coins.

In Session 9 non-arbitrary trials were used to correct errors conducted on arbitrary trials, without presenting any non-arbitrary trials independently. On an arbitrary training trial, for example, the subject was presented with two coins, with no sweets placed on top, and asked "If this coin (e.g., experimenter pointed to coin A) has more sweets than this coin (experimenter pointed to coin B), which coin would you take to buy as many sweets as possible?" If he produced an incorrect response, the experimenter transformed the trial into a non-arbitrary trial-type by placing two sweets on top of the coin which was worth "more" and one sweet on top of the coin which was worth "less", according to the arbitrary relation specified. The subject was then asked "Now which has more?" The subject produced no errors on the non-arbitrary correction trials. A correct non-arbitrary (corrective) response was followed by verbal praise, but no bead could be selected. A new arbitrary training trial was then presented. After 35 training trials conducted in this way, Subject 2 finally produced eight consecutively correct responses on the arbitrary A-B relations. As indicated in Table 14, he required 91 training trials in total with non-arbitrary interventions to reach the mastery criterion on the A-B relations only. He was then immediately exposed to a block of eight test trials of arbitrary relations involving only two coins (A and B) from a novel set (i.e., set 4), but failed. In Session 10, the subject was introduced once again to a block of eight arbitrary training trials of A-B relations (i.e., without non-arbitrary interventions), and he produced eight consecutively correct responses immediately. In an effort to maintain a relatively high level of reinforcement for on-task behaviour, training on the B-C and A-B-C relations immediately followed. He completed this training without error (i.e., a total of 24 training trials were required to complete all three relations in Session 10). At this point, Subject 2 had now successfully completed initial training of all three arbitrary relations for the first time, and had required a total of 219 training trials to reach the mastery criterion on all three baseline arbitrary relations. He passed the baseline arbitrary test for the first time in Session 11.

Unlike Subject 1, Subject 2 passed the would/would-not test without training, but after an absence of three weeks, he failed two exposures to the vertical test, and required explicit training of the relations presented vertically. He immediately passed a subsequent vertical test. In Reversals 1 and 2, he adjusted quickly to the altered contingency arrangements, and generally required very little explicit training. Unlike Subject 1, he did not require repeated training exposures to the initial reversed relations involving would-only questions, although in Reversal 2, he did require some explicit training on the would and would-not questions (see Figure 5).

Subject 3

The data for Subject 3 are outlined in Table 15. The raw data for this subject is also presented in Appendix 3. The testing and training procedures employed with this subject were again similar to those employed previously. However, this subject was exposed to a long baseline of non-contingent reinforcement, in order to determine whether extended exposure to the experimental tasks might establish the performance in the absence of contingent reinforcement. A non-contingent reinforcement condition was employed because pilot work had demonstrated that subjects invariably found the tasks aversive and were less willing to co-operate during extended periods without any reinforcement.

Table 15
Sequence of training and testing, number of training trials, and test outcomes for Subject 3 on the relations of more-than and less-than

Condition	Training/Test Exposures	Session	Stimulus Set	Training/Test Type	No. of Training Trials/ Test Outcomes
Baseline 1	3 Tests	1-2	1-2	Would	FFF
Non-Cont'g Reinforcement	Training	3-7	2	Would (A-B only)	224*
Baseline 2	3 Tests	8-10	2-3	Would	FFF
Intervention	Training	11-17	3	Would (A-B only)	121
	Training	18-20	3	Would (B-C only)	75
	Training	21-23	3	Would (A-B-C only)	40*
	Training	24	3	Would (A-B only)	18
	Training	25	3	Would (B-C only)	8
	Training	25	3	Would (A-B-C only)	8*
	Training	26-27	3	Would (A-B-C only) Placing 2 coins first	33
	Training	28	3	Would (A-B-C only)	9
	2 Tests	29-30	4	Would; Would/Not	P;F
	Training	31-32	4	Would/Not	29
	4 Tests	33-35	5-6	Would/Not; Text Only; Vertical; Gen. (CD's)	P;P;P P
Reversal 1	Training	36-37	6	Would	83
	3 Tests	37	7	Would; Would/Not; Gen. (Spoons)	P;P;P
Reversal 2	Training	38	7	Would	29
	3 Tests	38	8	Would; Would/Not; Gen. (Books)	P;P;P

P = Pass; F = Fail: Reading from left to right.
* Indicates that the subject failed to reach the mastery criterion during training.
Gen. = Generalisation test.

After failing three baseline tests, Subject 3 was introduced immediately to the extended non-contingent reinforcement training. The number of non-contingent reinforcement trials was based on the number of training and test trials required by Subject 2 to pass the baseline test. Subject 1 required fewer trials than Subject 2, and so using the latter subject as the basis for determining the minimum number of non-contingent reinforcement trials constituted a stronger test of whether mere exposure to the experimental tasks would generate the performance. Subject 2 required 219 training trials to pass the baseline test. In order to present the training trials in blocks of eight as had been done previously, Subject 3 was exposed to 224 non-contingent reinforcement trials (i.e., 28 blocks of 8). To make this form of training closely resemble the explicit training given to previous subjects, similar quantities of reinforcement, trial repetitions, and bead withdrawals to those used previously were employed. For example, in each block of eight trials, reinforcement was provided on four trials, two trials were repeated, and a bead was withdrawn after one trial (the sequence of these manipulations was randomised across blocks). The feedback that was provided was *entirely* random, and may or may not have been correct in terms of the specified relation.

In Sessions 3-7, Subject 3 was exposed to 224 non-contingent reinforcement training trials presented in the manner described above. This training involved only the A-B relations because all subjects were required to master the A-B relations before proceeding to the B-C relations. At no point during this training did the subject produce eight consecutively correct responses on the A-B relations. On the completion of the 224 trials, he was re-exposed to three baseline tests, all of which he failed. Subject 3 was subsequently exposed to the explicit training intervention employed with the previous subjects. Similar to Subject 2, he had great difficulty during training of the initial relations. Specifically, he required 121 training trials to reach criterion on the initial A-B relations, and 75 training trials to reach criterion on the B-C relations. Unlike Subject 2, however, he did eventually reach criterion on both of these relations without the use of non-arbitrary interventions. Similar to Subject 1, Subject 3 had particular difficulty during training of the combinatorially entailed A-B-C relations. After failing to reach criterion on the A-B-C relations in 40 trials (Sessions 21-23), he was re-exposed to training on the A-B and B-C relations, and reached the mastery criterion quickly. On the second exposure to A-B-C training, he once again failed to reach the mastery criterion, and an alternative intervention for training these relations was employed.

In Session 26, an intervention in which two coins were placed down first was introduced and part of the A-B-C relation was specified. The third coin was then placed down and the complete relation was specified. For example, on one trial, coins A and B were positioned, and the subject was told: "If this coin (A) buys more sweets than this coin (B), which coin would you choose?" Corrective feedback (but no bead) was provided for a correct response. The third coin was then positioned and the trial was continued with the instructions "If this coin (A) buys more sweets than this coin (B), and this coin (B) buys more sweets than this coin (C), which coin would you choose?" A bead followed each correct response at this point in the trial; incorrect responses produced no beads. If the child emitted one or two incorrect responses during the trial, the trial-type was repeated, without beads for correct responses. After 33 of these training trials, Subject 3 finally reached criterion on the A-B-C relations. He was subsequently exposed to training on A-B-C relations without this intervention and reached criterion in only 9 trials. Subject 3 had required a total of 293 training trials to reach the mastery criterion after the non-contingent reinforcement condition. He then passed an arbitrary baseline test for the first time (Session 29). Similar to Subject 1, he also required explicit training on the would/would-not relations, and subsequently passed the would/would-not test immediately. He passed all subsequent tests without training. Prior training had taken so long that this subject was not exposed to a follow-up test. He required only minimal training during both reversals (see Figure 5).

DISCUSSION

These data clearly demonstrate that relational responding in accordance with the frame of comparison (i.e., more-than and less-than) was established in the behavioural repertoires of four and five year old children. Furthermore, the ABA reversal design showed that this form of responding could be brought under operant control. Performance on the generalisation tests provided additional evidence of the frame-like qualities of these observed response patterns, in that the subjects responded relationally to novel stimulus sets (books, CD covers, pencils, spoons, and drinking glasses) and in the context of novel experimenters. Further evidence of the effectiveness of the current training interventions was demonstrated by the performance of Subject 3, who made no progress with an extended baseline of non-contingent reinforcement, and yet progressed with the subsequent introduction of the explicit training intervention. Overall, these data provide evidence that responding in accordance with the relational frame of comparison may be established and manipulated as a type of generalised operant behaviour. Other issues pertaining to this study are discussed at the end of Chapter 5.

Chapter Five

Chapter 5

Testing and Training Relational Responding in Accordance with Opposite

Experiment 9

INTRODUCTION

The experiment described in the previous chapter focused on four specific patterns of relational responding in accordance with the relational frame of comparison involving only three elements (A, B, and C). Although there are clearly a large number of trial-types that could be constructed to further examine this frame, in the interests of extending the current analysis, the present study focused on another relational frame. The current study was concerned with establishing and manipulating patterns of relational responding in accordance with opposite, while also increasing the number of elements. In order to achieve this goal, a similar problem-solving task to that reported in the previous study was employed. For example, subjects were presented with two coins and instructed: "If this coin buys many (or few) sweets, and is opposite to this coin (i.e., A=MANY: A opp. B) which would you take to buy as many sweets as possible?" Once again, numerous sets of coins and objects were used to test and train the relational performances in order to establish specific patterns of opposite responding. One of the key differences between this and the previous experiment is that for all trial-types involving four or more coins, a correct response in the current study required choosing at least two coins. As will become clear, this feature of the opposite task allowed examination of the generalisation of opposite responding to a number of elements that had not been trained using a previous stimulus set.

METHOD

Subjects

Three children (Subjects 1, 2 & 3) participated in this experiment. At the beginning of the experiment, Subject 1, male, was 4 years and 8 months old; Subject 2, female, was 6 years and 2 months old; and Subject 3, male, was 4 years old. At the end of the experiment, Subject 1 was 5 years and 2 months old; Subject 2 was 6 years and 5 months old; and Subject 3 was 4 years and 5 months old. The first two subjects were enrolled in a crèche in Cork, and the third subject was enrolled in a crèche in Dublin.

Apparatus

The 45 coins used in the previous experiment were employed and an additional 125 coins were constructed, totalling 170 coins. There were 57 blue coins, 57 red coins and 56 green coins and each coin was marked with a different pattern. These coins were used to construct seventeen sets of coins with ten coins in each set. In each set of coins, there were three blue coins, three red coins and three green coins, and another coin of one of the three colours. Sets of coins were constructed anew for each subject. Only one subject was exposed to all seventeen sets, and the full ten coins from any set were never actually used with any of the subjects. Coins were presented on a white A3 stimulus sheet (i.e., no arrows or text) in either a horizontal or random presentation. The additional materials used in the previous experiment were also employed.

Programmed Consequences

Programmed consequences were identical to those employed in the previous experiment. The modification involving removing a bead for an incorrect response and then repeating the trial was also used with these three subjects.

General Procedure

Once again, procedural details specific to each subject will be described in a combined Procedure and Results section. Unlike the previous experiment, in each test or training trial the child was required to point to one or more coins, depending on the particular trial-type. When there was more than one correct coin, subjects were not required to point to the coins in any particular sequence. For a trial to be recorded as correct, the child was required to point only to the correct coin or coins. Subjects were never instructed as to the correct number of coins to choose in any given trial. Pointing to any incorrect coin, even if a correct coin was also chosen, was recorded as an incorrect response. As before, if a child made any comment during a trial, the experimenter simply replied "We can talk after we have finished our work." All other aspects of the General Procedure were similar to those outlined in the previous experiment (e.g., sessions lasted no more than 20 mins. per day, and the children were asked at the beginning of each block if they wished to continue).

Testing opposite relations among four coins. Subjects were first exposed to a "baseline" test of opposite relations among four coins. This test consisted of a single block of eight test trials using four coins (A, B, C, and D) from set 1, positioned horizontally left-to-right from A to D (i.e., A then B, then C, then D). On the first trial of each session, the experimenter placed the bead container on the table and positioned the coins according to the appropriate trial-type. The instructions were similar to those given in the previous experiment. That is, the subject was told that s/he was going to play a 'birthday game'. The following instructions were then given. "I want you to imagine that it is your birthday today and you have to go to the shops to get sweets for your birthday party. If I tell you that this coin (e.g., experimenter pointed to coin A) buys many (or few) sweets, and this coin (experimenter still pointing to coin A) is opposite to this coin (experimenter pointed to coin B), and this coin (experimenter still pointing to coin B) is opposite to this coin (experimenter pointed to coin C), and this coin (experimenter still pointing to coin C) is opposite to this coin (experimenter pointed to coin D), which would you take to buy as many sweets as possible?" On subsequent trials, shorter instructions were provided (i.e., only the second sentence of the instructions was presented).

There were four trial-types in each block of eight test trials, with each trial-type presented twice in a random order without replacement. These trial-types are depicted in Figure 6 (third panel). Each of these trial-types may be described as follows: A buys many: and A is opposite to B, which is opposite to C, which is opposite to D; D buys many: and D is opposite to C, which is opposite to B, which is opposite to A; A buys few: and A is opposite to B, which is opposite to C, which is opposite to D; and D buys few: and D is opposite to C, which is opposite to B, which is opposite to A. When the experimenter specified that a particular coin bought many or few sweets, that coin was always identified first. For example, for the trial-type A-Many: A opp. B opp. C opp. D, the experimenter pointed to the A coin first, whereas for the trial-type D-Few: D opp. C opp. B opp. A, the experimenter pointed to the D coin first.

AB Relations- Two Coins

```
MANY:   A*  --------> B          MANY:   B*  -------->  C
        A   <-------- B*                 B   <--------  C*
FEW:    A   --------> B*         FEW:    B   -------->  C*
        A*  <-------- B                  B*  <--------  C
```

ABC Relations-Three Coins

```
MANY:   A*   -------->  B   -------->  C*
        A*   <--------  B   <--------  C*
FEW:    A    -------->  B*  -------->  C
        A    <--------  B*  <--------  C
```

ABCD Relations- Four Coins

```
MANY:   A*   -------->  B   -------->  C*  -------->  D
        A    <--------  B*  <--------  C   <--------  D*
FEW:    A    -------->  B*  -------->  C   -------->  D*
        A*   <--------  B   <--------  C*  <--------  D
```

ABCDE Relations- Five Coins

```
MANY:   A*   --------> B   --------> C*  -------->  D   -------->  E*
        A*   <-------- B   <-------- C*  <--------  D   <--------  E*
FEW:    A    --------> B*  --------> C   -------->  D*  -------->  E
        A    <-------- B*  <-------- C   <--------  D*  <--------  E
```

ABCDEF Relations-Six Coins

```
MANY:   A*  -------->  B   -------->  C*  -------->  D   -------->  E*  -------->  F
        A   <--------  B*  <--------  C   <--------  D*  <--------  E   <--------  F*
FEW:    A   -------->  B*  -------->  C   -------->  D*  -------->  E   -------->  F*
        A*  <--------  B   <--------  C*  <--------  D   <--------  E*  <--------  F
```

ABCDEFG Relations-Seven Coins/Objects

```
MANY:   A*  -------->  B   -------->  C*  -------->  D   -------->  E*  -------->  F   -------->  G*
        A*  <--------  B   <--------  C*  <--------  D   <--------  E*  <--------  F   <--------  G*
FEW:    A   -------->  B*  -------->  C   -------->  D*  -------->  E   -------->  F*  -------->  G
        A   <--------  B*  <--------  C   <--------  D*  <--------  E   <--------  F*  <--------  G
```

ABCDEFGH Relations-Eight Objects

```
MANY:   A*  ------->  B   ------->  C*  ------->  D   ------->  E*  ------->  F   ------->  G*  ------->  H
        A   <-------  B*  <-------  C   <-------  D*  <-------  E   <-------  F*  <-------  G   <-------  H*
FEW:    A   ------->  B*  ------->  C   ------->  D*  ------->  E   ------->  F*  ------->  G   ------->  H*
        A*  <-------  B   <-------  C*  <-------  D   <-------  E*  <-------  F   <-------  G*  <-------  H
```

ABCDEFGHJ Relations-Nine Objects

```
MANY:   A*  ------->  B   ------->  C*  ------->  D   ------->  E*  ------->  F   ------->  G*  ------->  H   ------>  J*
        A*  <-------  B   <-------  C*  <-------  D   <-------  E*  <-------  F   <-------  G*  <-------  H   <------  J*
FEW:    A   ------->  B*  ------->  C   ------->  D*  ------->  E   ------->  F*  ------->  G   ------->  H*  ------>  J
        A   <-------  B*  <-------  C   <-------  D*  <-------  E   <-------  F*  <-------  G   <-------  H*  <------  J
```

ABCDEFGHJK Relations-Ten Objects

```
MANY:  A*  ------> B  -------> C*-------> D  ------->E* -------> F  -------> G*-------> H  ------> J* ------> K
       A   <------- B*<------- C  <------- D*<------- E <-------  F*<------- G  <------- H*<------- J  <------ K*
FEW:   A   -------> B*-------> C  -------> D*-------> E  -------> F* -------> G  ------->H* ------> J  ------> K*
       A*  <------- B  <------- C*<------- D <-------  E*<------- F <-------  G*<------- H <------  J*<------ K
```

* Indicates correct choices.

Figure 6. Trial-types used for testing and training the relation of opposite, involving two (first panel), three (second panel), four (third panel), five (fourth panel), six (fifth panel), seven (sixth panel), eight (seventh panel), nine (eighth panel), and ten coins (ninth panel). All trial-types with coins presented in random positions were identical to those outlined for horizontal presentations, but coins were randomly positioned on the white sheet of blank A3 paper, instead of being presented horizontally.

With trials involving relations between four coins, each trial-type consisted of two correct choices (A and C, or B and D). For example, given the relation D-Many: D opp. C opp. B opp. A, coins D and B were the correct choices. However, given the relation A-Many: A opp. B opp. C opp. D, coins A and C were the correct choices (see Figure 6). Failing to select *both* correct coins was defined as an incorrect response. To pass a block of test trials, subjects were required to produce at least seven out of eight correct responses.

Horizontal/random stimulus presentations. All of the trial-types used in the baseline test involved coins presented horizontally from A to D (i.e., A beside B beside C beside D). After subjects had successfully completed this test, they were exposed to the same coins presented in random positions (to eliminate stimulus control by location alone). During random presentations, coins could be placed in any location on the stimulus sheet. This horizontal-first, random-second sequence was adopted throughout the experiment. That is, once subjects had passed a test involving any given number of coins presented horizontally, they were then exposed to the same coins presented in random positions.

Training opposite relations among four coins. If subjects failed the baseline test, they were exposed to training of the same relations using the same four coins. In effect, subjects were exposed to the same procedure as used in testing, but with programmed consequences. Training trials were also presented in blocks of eight trials. The number of training trials depended on the subjects' performance, and they were required to achieve a mastery criterion of eight consecutively correct responses. Successful training with four coins was always followed by a test involving four coins from a new set presented horizontally. If subjects failed this test again, they were re-exposed to training with the same relations using the same set of coins presented horizontally. If subjects passed this test, the same coins were then presented randomly. If subjects passed the baseline test at this point with both horizontal and random positions, they were introduced to a test of opposite relations among five coins, using the same set (see below). If subjects failed the test, they were trained on the same set and tested on a new set. This pattern of recursive training and testing continued until a subject passed the test using a novel set of coins (in both horizontal and random positions).

Testing and training opposite relations among five coins. The trial-types involved in five-coin presentations were identical to those used with four coins, except that a fifth coin was added. Coins A and E now "bought many and few sweets", instead of coins A and D (as in four-coin presentations), and either A or E was pointed to first, depending on the relation specified. These trial-types are depicted in Figure 6 (fourth panel). With presentations involving five coins, a correct response was defined as selecting two or three coins, depending on whether the coin specified bought many or few sweets. For example, when coins A or E 'bought many' a correct response was defined as selecting three coins (A, C, and E). However, when coins A or E 'bought few' a correct response was defined as selecting two coins (B and D). If subjects passed the five-coin test in both horizontal and random positions, they were introduced to a test of the same relations involving six coins, using the same set (see below). If subjects failed the five-coin test, they commenced with the same pattern of recursive training and testing employed with four coins.

Testing and training opposite relations among six coins. The trial-types involved in six-coin presentations were identical to those used with five coins, except that a sixth coin was added. Coins A and F now "bought many and few sweets", instead of coins A and E, and either A or F was pointed to first, depending on the relation specified. These trial-types are depicted in Figure 6 (fifth panel). With presentations involving six coins, a correct response was always defined as selecting three coins, depending on which coin was specified, and whether this bought many or few sweets. For example, when coin A 'bought many' or coin F 'bought few' a correct response was defined as selecting coins A, C, and E. However, when coin A 'bought few' or coin F 'bought many' a correct response was defined as selecting coins B, D, and F. If subjects passed the six-coin test in both horizontal and random positions, they were introduced to a test involving would and would-not trial-types, using the same set (see below). If subjects failed the six-coin test, they commenced with the same pattern of recursive training and testing employed with four and five coins.

Responding in accordance with 'would' and 'would-not". When subjects had passed horizontal and random tests with six coins, a test block involving would and would-not trial-types was introduced. The subjects were required to indicate which coins they *would* and *would not* select in order to buy as many sweets as possible. The instructions were identical to those provided in the previous experiment. This test consisted of one block of eight test trials randomly presented. These eight trials consisted of the same four trial-types as in the six-coin presentation, except that each trial-type was presented once for 'would' responding and once for 'would-not' responding (i.e., each trial-type was presented with a 'would' and a 'would-not' question). Training and testing with would and would-not responding were identical, except for the provision of programmed consequences. If subjects failed the six-coin would/would-not test, they commenced with a similar pattern of recursive training and testing employed previously, except that the training and testing incorporated would and would-not trial-types.

Generalisation test. When subjects had completed all of the test and training procedures outlined above, they were exposed to a generalisation test with six identically sized objects (instead of coins), and the test was conducted by a novel experimenter, who was unfamiliar with the specific purposes of the study. The objects were randomly positioned around the floor of the experimental room. This generalisation test contained identical trial-types to the would/would-not test. As in the previous experiment, subjects were never trained on the stimulus sets used for generalisation tests.

Follow-up test. A follow-up test, where possible, was conducted one month after the completion of testing and training. This test involved a novel set of six coins presented randomly with would and would-not trial-types. Additional training proved not to be necessary during the follow-up test for any subject.

Contingency reversals. When subjects had passed all of the tests outlined above, the reinforcement contingencies were reversed in a procedure similar to that employed in the previous experiment (i.e., Reversals 1 and 2) in order to further test the generalised operant nature of the performances that had been demonstrated. In Reversal 1, the procedure outlined above was repeated with reversed reinforcement contingencies. In Reversal 2, the contingencies were reversed once again. The details of these reversals will be presented in the Procedure and Results section.

Testing opposite relations among seven coins/objects. When subjects had completed the two contingency reversal conditions, they were exposed to a test involving seven coins or seven generalisation objects randomly positioned on the floor of the experimental room. This test was identical to a generalisation test, except that on some occasions coins were used instead of generalisation objects. The trial-types involving seven coins/objects were identical to those used with six coins in random positions, except that a seventh coin/object (G) was added. Coins/objects A and G now "bought many or few sweets", and either A or G was pointed to first, depending on the relation specified. These trial-types are depicted in Figure 6 (sixth panel). With presentations involving seven coins/objects, a correct response was defined as selecting three or four coins/objects, depending on whether the specified item bought many or few sweets. For example, when coin A or G 'bought many' a correct response was defined as selecting four coins (A, C, E, and G), and when coin A or G 'bought few' a correct response was defined as selecting three coins (B, D, and F). This seven-item random presentation also involved would and would-not trial-types.

Testing opposite relations among eight, nine, and ten objects. When subjects had been exposed to the test involving seven coins/objects, they were subsequently exposed to tests involving eight, nine, and/or ten generalisation objects (i.e., coins were not used). These tests were identical to the generalisation test described above. The trial-types with eight objects were identical to those used with seven coins/objects, except that another object (H) was added, and this together with object A, was specified as buying many or few sweets (see Figure 6: seventh panel). With presentations involving eight objects, a correct response was always defined as selecting four objects, depending on which object was specified, and whether this bought many or few sweets. For example, when object A 'bought many' or object H 'bought few' a correct response was defined as selecting objects A, C, E, and G. However, when object A 'bought few' or object H 'bought many' a correct response was defined as selecting coins B, D, F and H.

The trial-types involving nine objects were identical to those employed with eight objects, except that in each case an extra object was added. Objects denoted as A and J were pointed to first and identified as those buying many or few sweets (see Figure 6: eighth panel). A correct response was defined as selecting four or five objects, depending on whether the specified object bought many or few sweets. For example, when object A or J 'bought many' a correct response was defined as selecting five objects (A, C, E, G, and J), and when objects A or J 'bought few' a correct response was defined as selecting four objets (B, D, F, and H).

With trial-types involving ten objects, A and K were specified as buying many or few sweets (see Figure 6: ninth panel). A correct response was always defined as selecting five objects, depending on which object was specified, and whether this bought many or few sweets. For example, when object A 'bought many' or object K 'bought few' a correct response was defined as selecting A, C, E, G, and J. However, when object A 'bought few' or object K 'bought many' a correct response was defined as selecting B, D, F, H, and K.

<u>Inter-observer reliability</u>. Approximately twenty five percent of training and testing trials were observed by an independent observer (or two observers during the generalisation tests), who had no knowledge of experimental psychology. The observer could not see the experimenter's data sheet during the

experimental sessions. The observer and experimenter disagreed on six training trials and three test trials.

PROCEDURE AND RESULTS

Subject 1

The data for Subject 1 are outlined in Table 16. The raw data for this subject is also presented in Appendix 4. During the baseline test involving four coins from set 1 presented horizontally, he failed to emit a correct response (i.e., he never chose the two correct coins on any trial). He was immediately exposed to blocks of training trials using four coins from set 1 (corrective feedback was provided). Across 16 training trials, he produced only three correct responses, and he indicated that he wished to stop.

Table 16
Sequence of training and testing, number of training trials, and test outcomes for Subject 1 on the relation of opposite

Condition	Training/Test Exposures	Session	Stimulus Set	Training/Test Type	No. of Training Trials/ Test Outcomes
Baseline	1 Test	1	1	Would 4Hz	F
Intervention	Training	1	1	Would 4Hz	16*
	Training	2	1	Would 2Rm	20
	1 Test	2	2	Would 2Rm	P
	Training	2-3	2	Would 3Hz	40*
	Training	4	2	Would 2Rm	18
	1 Test	4	3	Would 2Rm	P
	Training	4	3	Would 3Hz	16*
	Training	5	3	Would 3Hz (Same)	17
	2 Tests	5-6	4	Would 3Hz; 3Rm	P;F
	Training	6	4	Would 3Rm	25
	2 Tests	7	5	Would 3Rm; 4Hz	P;F
	Training	8	5	Would 4Hz (Same)	13
	3 Tests	8-9	6	Would 4Hz; 4Rm; 5Hz	P;P;F
	Training	10	6	Would 5Hz	9
	6 Tests	10-12	7	Would 5Hz; 5Rm; 6Hz; 6Rm; 6 Would/Not; 6 Gen. (Cups)	P;P;P;P P;P
Follow-Up	1 Test	13	8	6 Would/Not	P
Reversal 1	Training	13	8	Would 4Hz	9
	8 Tests	13	9	Would 4Hz; 4Rm; 5Hz; 5Rm; 6Hz; 6Rm; 6 Would/Not; 6 Gen. (Books)	P;P;P;P P;P;P P
Reversal 2	Training	14	10	6 Would/Not	8
	2 Tests	14	11	7Rm Would/Not; 8 Gen. (Pencils)	P P

P = Pass; F = Fail: Reading from left to right.
* Indicates that the subject failed to reach the mastery criterion during training.
Hz = Coins presented in horizontal positions.
Rm = Coins presented in random positions.
Same = Intervention involved the use of the "sameness" relation.
Gen. = Generalisation test.

In Session 2, the training trials were simplified by using only two coins from set 1. In *all* presentations involving only two coins, the coins were always presented in random positions. The subject was exposed to two blocks of these training trials. The first block of trials involved coins A and B from set 1, and the second block involved coins B and C from the same set. The number of training trials in each block to which the subject was exposed depended on his performance during training. He was required to reach the mastery criterion of eight consecutively correct responses with the A-B coins before training on the B-C coins. There were four trial-types in this two-coin presentation for each pair of coins. The A-B and B-C trial-types are depicted in Figure 6, (first panel). In one trial-type involving coins A and B, for example, the experimenter pointed to coin B first, and then said "This coin buys many sweets, and is opposite to this coin (experimenter pointed to coin A). Which would you choose to buy as many sweets as possible?" A correct response consisted of selecting one coin depending on the relation specified. Each trial-type was presented twice in a quasi-random order in a block of eight trials. In Session 2, Subject 1 reached the mastery criterion on the A-B relations in 12 training trials, and produced 8 consecutively correct responses on the B-C relations (making a total of 20 training trials). He was subsequently exposed to a test (i.e., no feedback) with two pairs of novel coins (i.e., A and B, and B and C from set 2). There were sixteen test trials in total, one block of eight trials involved the A-B relations and the other block involved the B-C relations. The subject passed this test when he produced 15 correct responses (a minimum of 14 correct was required: see Table 16).

Having passed the test with two coins presented horizontally, the subject was then (in Sessions 2 and 3) exposed to training involving three coins in horizontal positions. For this training the same coins used previously were now presented simultaneously (i.e., A, B, and C from set 2). There were four trial-types in the three-coin presentation. These are shown in Figure 6 (second panel). Each trial-type was presented twice in a quasi-random order without replacement in a block of eight trials. In one trial-type, for example, the experimenter pointed to the C coin first, and then said "This coin buys few sweets, and is the opposite to this coin (experimenter pointed to B), and this coin (still pointing to B) is the opposite to this coin (experimenter pointed to A). Which would you choose to buy as many sweets as possible?" Depending on whether the experimenter specified that a coin could buy many or few sweets, a correct response consisted of selecting one or two coins. If the specified coin (A or C) bought many sweets, a correct response was defined as choosing two coins (i.e., A and C). If the selected coin bought few sweets, a correct response was defined as choosing only one coin (i.e., coin B). Subject 1 failed to reach the mastery criterion after 40 training trials, and indicated that he wished to stop.

In the following session (Session 4), the child was re-exposed to training trials involving only two coins, using the same set of coins (i.e., A, B, and C from set 2). The subject reached the mastery criterion on the A-B relations in 10 training trials, and produced eight consecutively correct responses on the B-C relations. He was immediately re-exposed to a test involving two blocks of two-coin presentations, but with novel coins (i.e., A, B, and C from set 3). The subject passed this test when he produced 15 out of 16 correct responses (see Table 16). The child was then re-exposed to the same coins in a three-coin horizontal presentation for the second time. However, he once again failed to produce eight consecutively correct responses after 16 training trials, and indicated that he wished to stop. In summary, Subject 1 had, on two occasions, successfully trained in accordance with the mutually entailed opposite relations between two coins, and had twice passed a test that examined the derivation of these relations with a novel set. However, the child had failed to respond in accordance with the combinatorially entailed opposite relations among three and four coins presented in horizontal positions.

At this point, the relational frame of 'sameness' was employed in an attempt to establish the combinatorially entailed relation of opposite (casual observation indicated that responding in accordance with the frame of 'sameness' was already established in the child's behavioural repertoire). In Session 5, the child was exposed once again to the same three coins in horizontal positions. When the subject emitted an incorrect response he was given a set of novel instructions that provided a contextual cue for responding in accordance with 'sameness'. For example, on the first trial the experimenter pointed to the A coin, and said "This coin buys many sweets, and is opposite to this coin (B), and this coin (B) is opposite to this coin (C). Which would you choose to buy as many sweets as possible?" (coins A and C were the correct choices on this trial). At this point, the subject produced an incorrect response and was immediately given the following instruction: "No, that's not correct. If this coin (A) buys many sweets and is opposite to this coin (B), and this coin (B) is opposite to this coin (C), then these two coins (A and C) are the *same*." The subject was simply required to listen to the instruction and the next trial was presented immediately. During this training he emitted five incorrect responses, and each time he was presented with the 'sameness' instruction. With this intervention, he reached the mastery criterion on the opposite relations with three coins in horizontal positions in 17 training trials (see Table 16). The subject was then immediately (in Session 5) exposed to a test (i.e., no feedback or 'sameness' instructions) of these relations, using three novel coins (i.e., from set 4). This test consisted of four trial-types identical to those used in training, each of which was presented twice in a quasi-random order. He passed this test when he produced 7 correct responses out of 8 (a minimum of 7 correct was required: see Table 16).

In the following Session (6) the subject was exposed to another test involving the same coins used previously, but this time they were presented in random positions (i.e., on each trial the coins were placed on the stimulus sheet in a completely random manner). He failed to pass this test when he produced only 5 out of 8 correct responses, and he was subsequently exposed to explicit training trials with the coins presented in random positions. He reached the mastery criterion in a total of 25 trials. In Session 7, the child was exposed to a test using a novel set of three coins (set 5) positioned randomly on each trial. He passed this test without error. Following this successful test performance with a three-coin random presentation, he was immediately re-exposed to the baseline test involving four coins positioned horizontally. He failed this test, producing only 3 out of 8 correct responses.

In earlier sessions with this subject, attempts to train the combinatorially entailed relations of opposite among four coins (Session 1) had failed, but the relational frame of 'sameness' had been successfully used to establish these relations with three coins. In the next session (8), therefore, the frame of 'sameness' was employed once again to establish these relations with four coins. In this session the subject emitted two incorrect responses, and each time he was presented with the 'sameness' instruction, as outlined above. With this intervention, he reached the mastery criterion on the opposite relations with four coins in 13 training trials (see Table 16). He was then immediately exposed to a test of these relations using four coins from a novel set (set 6) positioned horizontally. He passed this test without error. In the subsequent session

(Session 9) the child was tested on the same set of coins presented randomly. Again he passed this test without error.

Having now passed tests involving two, three, and four coins presented in horizontal and random positions, the child was introduced to a test involving the opposite relations among five coins positioned horizontally (see Figure 6). On one trial-type, for example, the experimenter pointed to the A coin, and said, "This coin buys many sweets, and is opposite to this coin (B), and this coin (B) is opposite to this coin (C), and this coin (C) is opposite to this coin (D), and this coin (D) is opposite to this coin (E). Which would you choose to buy as many sweets as possible?" (coins A, C, and E were the correct choices on this trial). Each trial-type was presented twice in a quasi-random order in a block of eight trials. The subject failed this five-coin test when he produced only 4 correct responses (a minimum of 7 correct was required: see Table 16). Following this failure, the subject was exposed (in Session 10) to explicit training involving the same five coins presented horizontally. Feedback was provided on all trials, but no 'sameness' instructions were employed. This training consisted of four trial-types identical to those used in the previous test, each of which was presented twice in a quasi-random order in a block of eight trials. He reached the mastery criterion of eight consecutively correct responses in only 9 trials. The subject was then immediately exposed to another test involving five coins from a novel set (7). He passed this test without error. This was immediately followed by another test with the same coins presented in random positions, and again he passed without error.

In Session 11, the subject was introduced for the first time to the test involving six coins presented horizontally (see Figure 6). On one trial-type, for example, the experimenter pointed to coin F first and said, "This coin buys few sweets, and is opposite to this coin (E), and this coin (E) is opposite to this coin (D), and this coin (D) is opposite to this coin (C), and this coin (C) is opposite to this coin (B), and this coin (B) is opposite to this coin (A). Which would you choose to buy as many sweets as possible?" (coins A, C, and E were the correct choices on this trial). Each trial-type was presented twice in a quasi-random order, in a block of eight test trials. Subject 3 passed this test without error, and immediately thereafter he passed a test in which the same set of coins was presented in random positions (see Table 16).

At this point (in Session 12), the would/would-not test was introduced, in which the subject was required on half of the eight trials to select the coin that would *not* buy as many sweets as possible. This test involved one 'would' and one 'would-not' choice for each of the trial-types in a six-coin presentation. An example of one of the 'would-not' trial-types was as follows. "This coin (F) buys few sweets, and is opposite to this coin (E), and this coin (E) is opposite to this coin (D), and this coin (D) is opposite to this coin (C), and this coin (C) is opposite to this coin (B), and this coin (B) is opposite to this coin (A). Which would you *not* choose in order to buy as many sweets as possible?" A correct response on this trial consisted of selecting the three coins B, D, and F. The subject passed this test without error.

Following this successful test performance, a novel experimenter (Session 12) conducted a generalisation test using six identically sized cups randomly positioned around the table in the experimental room. This generalisation test involved would and would-not trial-types identical to those used in the previous test. The subject immediately passed the generalisation test without error. One month later, (Session 13) Subject 1 passed without error a follow-up test involving six novel coins presented randomly, and including would and would-not trial-types.

At this point, reversed reinforcement contingencies were introduced, as had been done in Experiment 1, in order to establish the generalised operant nature of the opposite responding. The subject was now required to respond away from the coins, the choice of which had been reinforced previously (see Figure 7). During Reversal 1, the procedures employed in the original reinforcement contingency were replicated, commencing with training on four coins presented horizontally, and involving would-only trial-types (as had been done in Experiment 8). Subject 1 was immediately trained on this four-coin horizontal presentation and required only 9 trials to reach the mastery criterion (i.e., he made an error on the first trial only and then responded consistently to the new contingency arrangement). He was then tested on four novel coins in horizontal positions (set 9), and passed without error. He subsequently produced perfect responding on the following tests, respectively; four coins in random positions; five coins in horizontal then random positions; six coins in horizontal then random positions; six coins in random positions involving would and would-not trial-types, and a generalisation test involving six identically-sized books in random positions including would and would-not trial-types conducted by a novel experimenter. At this point, Subject 1 had clearly demonstrated that the original pattern of responding, observed before the introduction of the contingency reversal, had been modified.

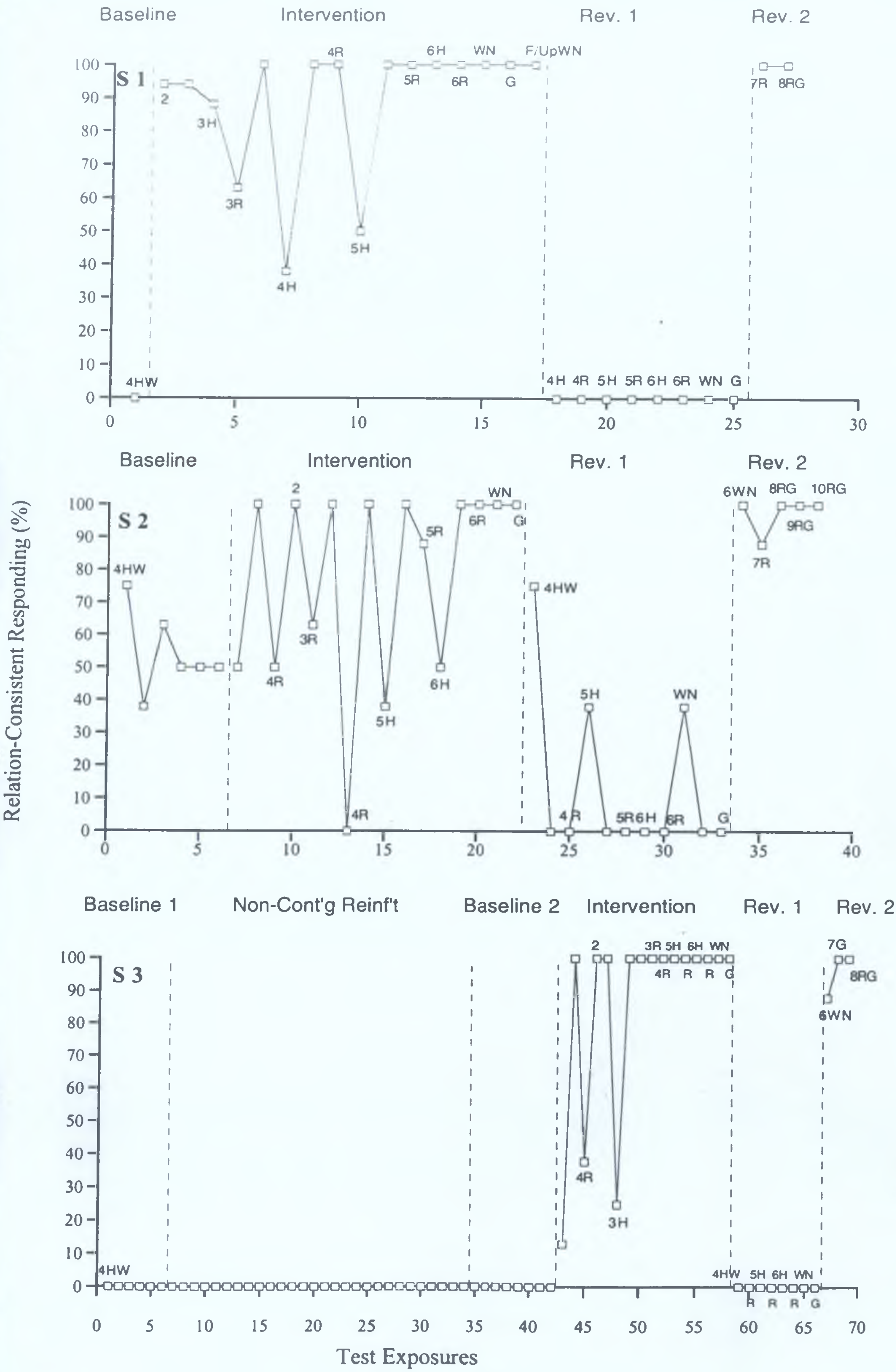
Baseline
Intervention
Rev. 1
Rev. 2
S 1
4HW
2
3H
3R
4H
4R
5H
5R
6H
6R
WN
G
F/UpWN
4H 4R 5H 5R 6H 6R WN G
7R 8RG
Baseline
Intervention
Rev. 1
Rev. 2
S 2
4HW
2
3R
4R
5H
5R
6H
6R
WN
G
4HW
5H
WN
4R
5R6H
6R
G
6WN
7R
8RG
9RG
10RG
Baseline 1
Non-Cont'g Reinf't
Baseline 2
Intervention
Rev. 1
Rev. 2
S 3
4HW
2
4R
3H
3R 5H 6H WN
4R R R G
4HW 5H 6H WN
R R R G
7G
8RG
6WN
Relation-Consistent Responding (%)
Test Exposures

Figure 7. Percentage of relation-consistent responses for Subjects 1, 2, and 3 on tests of the relation of opposite. The numbers adjacent to data points indicate the number of coins/objects used during that test. Letters adjacent to data points indicate the type of stimulus presentation or condition in operation. Data points that are not accompanied by numbers or letters involve the stimulus presentation or condition indicated by the previously marked data point.
(H = horizontal presentation of coins/objects; W = would responding; R = random presentation of coins/objects; WN = would and would-not responding; G = generalisation test; F/Up = follow-up).

In the following session (14) the subject was exposed to Reversal 2, which involved a return to the original reinforcement contingency (see Figure 7). Because the subject had proceeded so rapidly through Reversal 1, the second reversal was introduced with training on a six-coin random presentation with would and would-not trial-types. He reached the mastery criterion in the minimum number of training trials, although the reinforcement contingency was reversed. Without testing on six coins, he proceeded immediately to a test involving seven coins in random positions (see Figure 6). Subject 1 passed this test without error. Finally, he was exposed to a generalisation test involving eight identically sized pencils (see Figure 6) randomly positioned around the floor of the experimental room, conducted by a novel experimenter. He also passed this test without error.

Subject 2

The data for Subject 2 are presented in Table 17. The raw data for this subject is also presented in Appendix 5. The testing and training procedures employed with this subject were similar to those employed with the previous subject. However, there were two key differences between these subjects. Unlike Subject 1, this subject quickly reached the mastery criterion on the baseline relations involving four coins presented horizontally, requiring a total of only 51 training trials. However, once Subject 1 had passed the baseline test he immediately passed the subsequent test involving four coins in random positions. This was not the case with Subject 2, who required a very similar series of extended interventions to pass the first test involving the random presentation of coins as Subject 1 had required to pass the baseline test.

Table 17
Sequence of training and testing, number of training trials, and test outcomes for Subject 2 on the relation of opposite

Condition	Training/Test Exposures	Session	Stimulus Set	Training/Test Type	No. of Training Trials/ Test Outcomes
Baseline	6 Tests	1	1-3	Would 4Hz	FFFFFF
Intervention	Training	2	3	Would 4Hz	16
	1 Test	2	4	Would 4Hz	F
	Training	2-3	4	Would 4Hz	35
	2 Tests	3	5	Would 4Hz; 4Rm	P;F
	Training	4	5	Would 4Rm	16*
	Training	4-5	5	Would 4Rm (Same)	24*
	Training	6-7	5	Would 3Rm	72*
	Training	7	5	Would 2Rm	16
	1 Test	7	6	Would 2Rm	P
	Training	8-10	6	Would 3Rm	64*
	Training	11-13	6	Would 3Rm (Same)	115
	1 Test	13	7	Would 3Rm	F
	Training	14	7	Would 3Rm	8
	2 Tests	14	8	Would 3Rm; 4Rm	P;F
	Training	14-15	8	Would 4Rm	40
	2 Tests	15-16	9	Would 4Rm; 5Hz	P;F
	Training	16	9	Would 5Hz	15
	3 Tests	16-17	10	Would 5Hz; 5Rm; 6Hz	P;P;F
	Training	17-18	10	Would 6Hz	20
	4 Tests	18-19	11	Would 6Hz; 6Rm; 6 Would/Not;	P;P;P
				6 Gen (Pencils)	P
Reversal 1	Training	19	11	Would 4Hz	25
	1 Test	19	12	Would 4Hz	F
	Training	20	12	Would 4Hz	13
	3 Tests	20-21	13	Would 4Hz; 4Rm; 5Hz	P;P;F
	Training	22	13	Would 5Hz	8
	7 Tests	22-24	14	Would 5Hz; 5Rm; 6Hz; 6Rm	P;P;P;P
				6 Would/Not; 6 Gen. (Spoons)	FP;P
Reversal 2	Training	24	14	6 Would/Not	19
	5 Tests	24-25	15	6 Would/Not; 7Rm;	P;P
				8 Gen. (Beads); 9 Gen. (Cups);	P;P
				10 Gen. (Pasta)	P

P = Pass; F = Fail: Reading from left to right.
FP indicates that the subject failed the first exposure to a test, and passed the second exposure to the same test.
Hz = Coins presented in horizontal positions.
Rm = Coins presented in random positions.
Same = Intervention involved the use of the "sameness" relation.
Gen. = Generalisation test.

After failing the first test involving four coins in random positions, Subject 2 was exposed to 16 training trials, but failed to reach the mastery criterion. The relation of 'sameness' was then used to facilitate opposite training as had been done with the previous subject (although this intervention was employed at a much earlier point in Subject 2's experimental history than was the case for Subject 1). Once again, when the subject made an incorrect response she was simply required to listen to the 'sameness' instruction before the next trial was presented. On this occasion, the intervention was not successful and the subject failed to reach the mastery criterion. The training was then simplified to three coins in random positions but she also failed to reach criterion during this training. The procedure was then simplified further by presenting only two coins from the same set, as had been done with the previous subject. She reached the mastery criterion in the minimum number of trials and passed a subsequent test involving a novel set of coins. She subsequently failed to reach the mastery criterion on a three-coin random presentation for the second time.

At this point (Sessions 11-13) the relation of 'sameness' was employed once again, this time with a three-coin random presentation. During this training, the 'sameness' intervention proved more successful with three coins in random positions, and the subject reached the mastery criterion after 115 training trials. She was immediately exposed to a test involving three novel coins presented randomly (set 7), but failed once again. In the following Session (14) she was trained again on the three-coin random presentation using the same coins, *without* the 'sameness' instruction (because the subject had produced 5 out of 8 correct responses during the previous test). She reached the mastery criterion during this training in the minimum number of trials, and passed a subsequent test with three novel coins without error. Given that the subject had now passed a test involving three coins randomly presented, she was re-exposed to a test involving four coins. At this point in the experiment, it did not seem necessary to retest the four-coin horizontal presentation, because she had demonstrated little difficulty with the horizontal format. She failed a test of four coins in random positions without any correct responses. In Sessions 14 and 15, she was explicitly trained on this four-coin random presentation, and reached the mastery criterion after 40 training trials. She passed a subsequent test with four novel coins presented randomly without error.

The performances of Subject 2 during the rest of the experiment were very similar to those recorded for the previous subject, with a number of very minor differences. After passing the test involving five coins in random positions, this subject subsequently required explicit training with six coins in horizontal positions, and thereafter passed all subsequent tests (prior to the reversal conditions) without training. During Reversal 1, Subject 2 required a second exposure to training on the reversed relations among four coins in horizontal positions and also required limited training with five coins in horizontal positions, neither of which had been required by the previous subject. Some minor alterations to the procedure were also employed during Reversal 2. Specifically, after receiving training on would and would-not trial-types with six coins in random positions and passing a subsequent test of these relations, Subject 2 was exposed to the following tests; seven coins, and eight, nine, and ten generalisation objects (all of which involved would and would-not trial-types and the random presentation of the stimuli). Subject 2 passed all of these tests without error (see Figure 7).

Subject 3

The data for Subject 3 are presented in Table 18. The raw data for this subject is also presented in Appendix 6. In order to replicate the findings obtained from Subject 3 in Experiment 8, Subject 3 was also exposed to the non-contingent reinforcement condition. The same number of 224 non-contingent reinforcement trials was conducted as in Experiment 8. This greatly exceeded the maximum number of training trials required by either Subjects 1 or 2 of the current study in order to pass a test of the baseline relations. Subject 2 had required the greater number of training trials (i.e., 165).

Table 18
Sequence of training and testing, number of training trials, and test outcomes for Subject 3 on the relation of opposite

Condition	Training/Test Exposures	Stimulus Session	Set	Training/Test Type	No. of Training Trials/ Test Outcomes
Baseline 1	6 Tests	1-3	1-3	Would 4Hz	FFFFFF
Non-Cont'g Reinforcement	Training	4-9	3	Would 4Hz	224*
Baseline 2	8 Tests	10-11	3-6	Would 4Hz	FFFFFFFF
Intervention	Training	12-13	6	Would 4Hz	20
	1 Test	13	7	Would 4Hz	F
	Training	14-16	7	Would 4Hz	48
	2 Tests	16-17	8	Would 4Hz; 4Rm	P;F
	Training	17-25	8	Would 4Rm	84*
	Training	26	8	Would 3Rm	16*
	Training	26	8	Would 2Rm	18
	1 Test	27	9	Would 2Rm	P
	Training	28	9	Would 3Rm	16*
	Training	29-31	9	Would 3Rm (Same)	42*
	Training	31	9	Would 2Rm	16
	1 Test	31	10	Would 2Rm	P
	Training	32	10	Would 3Hz	18
	1 Test	33	11	Would 3Hz	F
	Training	33	11	Would 3Hz	10
	1 Test	33	12	Would 3Hz	P
	Training	34-35	12	Would 3Rm	32*
	Training	36	12	Would 3Hz	8
	1 Test	36	13	Would 3Hz	P
	Training	36-39	13	Would 3Rm (3 Hz trials before each block)	76
	8 Tests	40-41	14-15	Would 3Rm; 4Rm; 5Hz; 5Rm; 6 Hz; 6Rm; 6 Would/Not; 6 Gen. (Pencils)	P;P;P;P P;P;P P
Reversal 1	Training	41	15	Would 4Hz	17
	8 Tests	42	16	Would 4Hz; 4Rm; 5Hz; 5Rm; 6Hz; 6Rm; 6 Would/Not; 6 Gen. (Tapes)	P;P;P;P P;P;P P
Reversal 2	Training	42-43	16	6 Would/Not	20
	3 Tests	43	16-17	6 Would/Not; 7 Gen. (Spoons); 8 Gen. (Cups)	P;P P

P = Pass; F = Fail: Reading from left to right
* Indicates that the subject failed to reach the mastery criterion during training.
Hz = Coins presented in horizontal positions.
Rm = Coins presented in random positions.
Same = Intervention involved the use of the "sameness" relation.
Gen. = Generalisation test.

Subject 3 was first exposed to a total of six baseline tests, with two exposures to each of three sets of coins (i.e., sets 1-3), involving would-only responding. He failed all six tests, without a single correct response. After failing six baseline tests, the non-contingent reinforcement condition was introduced (as had been done with Subject 3 in Experiment 8). In this case, the condition involved 224 trials involving four-coin horizontal presentations. This was identical to the baseline test, except for the provision of non-contingent reinforcement. Once again, to make this form of training closely resemble the explicit training given to previous subjects, similar quantities of reinforcement, trial repetitions, and bead withdrawals were provided. The feedback that was provided was *entirely* random, and may or may not have been correct in terms of the specified relations. At no point during this training did this subject produce eight consecutively correct responses on these relations. In fact, throughout the non-contingent reinforcement condition, the subject continuously selected only one coin instead of two, and visual inspection of the raw data (not shown) also indicated that the coin that he selected was never correct on eight consecutive trials.

On the completion of the non-contingent reinforcement condition, Subject 3 was re-exposed to eight baseline tests, and once again failed all eight tests, without a single correct response. He was subsequently exposed to explicit training of the baseline relations using the same four coins presented horizontally. The performances of Subject 6 were more similar to those recorded for Subject 2 than for Subject 1 in that he showed little difficulty in passing the baseline relations (i.e., he required a total of only 68 training trials) but showed great difficulty in passing the test of four coins in random positions. During training with four coins in random positions it was necessary on two occasions to revert to presenting only two coins. Furthermore, the 'sameness' intervention was used when attempting to train three coins in random positions. Neither of these interventions was sufficient to establish correct responding. At this point, training with three coins in horizontal positions was introduced. In Session 33, the subject failed a test involving three coins in horizontal positions, although he had previously passed the baseline test involving four coins in horizontal positions. After further training, he passed two subsequent tests involving three coins in horizontal positions but repeatedly failed to reach the mastery criterion on three coins in random positions.

At this point, trials involving horizontal presentations were used to facilitate training with trials involving random presentations. In Sessions 36-39, each block of eight training trials with coins in random positions was preceded with a block of three training trials with coins in horizontal positions. In other words, in each 11-trial block, there were three training trials with coins in horizontal positions, to which the subject always responded correctly (these data are not shown), followed by eight training trials with coins in random positions. After 76 training trials with random presentations, where each block of eight was preceded by three correct horizontal trials, he finally reached the mastery criterion. On a subsequent test (Session 40) involving three novel coins in random positions, he passed without error. He passed all subsequent tests (prior to the reversal conditions) without further training. During Reversals 1 and 2, he required minimal training to pass the initial relations, and did not require additional training at any other point during either reversal condition (see Figure 7). At the end of Reversal 2, the subject received a sequence of testing similar to that employed with Subject 1. After training and testing on six coins in random positions with would and would-not trial-types, the subject was exposed to two generalisation tests involving seven and eight objects in random positions. He passed both of these tests without error.

Response Sequences

As indicated previously, when the correct response involved two or more coins/objects subjects were not required to choose the correct items in any particular sequence. The response sequences were, however, monitored throughout the experiment, and very consistent patterns emerged (these data are not shown). First, on all correct training trials, the subjects always chose the correct coins/objects in the same sequence in which they were specified in the experimenter's instruction (e.g., given "if C buys many, and C is the opposite to B and B is opposite to A. . ." all subjects consistently chose C and then A). During the test trials, however, an interesting pattern emerged, for all three subjects, but only after the introduction of the first generalisation test. Across approximately 20 percent of the post-generalisation test trials, the subjects spontaneously reversed the response sequences that were consistently observed during training and early testing (given the example presented above, subjects would sometimes choose A and then C). The emergence of this pattern was not accompanied by any increase in errors, and casual observation indicated that all three children considered these reversed response sequences to be correct (although these reversals were never reinforced at any point in the experiment).

DISCUSSION

These data clearly demonstrate that specific patterns of relational responding in accordance with opposite can be established in the behavioural repertoires of four, five and six year old children. Furthermore, there is evidence to suggest that using the relational frame of 'sameness' may facilitate the establishment of these relations for some subjects, when these relations cannot easily be trained explicitly. Performance on the generalisation tests provided additional evidence for the frame-like, or generalised operant qualities of these response patterns, in that these subjects (as well as subjects in Experiment 8) responded relationally to stimuli that differed along many physical dimensions from the coins used throughout most of the experiment.

GENERAL DISCUSSION: CHAPTERS 4 AND 5

The two studies reported in Chapters 4 and 5 provided evidence that responding in accordance with the relational frames of more-than, less-than and opposite is a form of generalised operant behaviour. In these studies, all six subjects failed to pass baseline tests for responding in accordance with the relations of more-than and less-than or opposite. Two subjects (Subject 3 in Experiment 8 and Subject 3 in Experiment 9) were also provided with extended baselines of non-contingent reinforcement, but still failed to demonstrate the appropriate relational responding before operant contingencies were introduced. These consistent failures indicated that the target relational performances were not present in the subjects' behavioural repertoires. Furthermore, the extensive training required by each of the six subjects to establish the patterns of relational responding provided even further evidence to support the conclusion that the target relational repertoires were absent prior to the commencement of the study.

In the current studies operant contingencies were applied across multiple sets of stimuli and these contingencies successfully established the target relational responses for all six subjects. Increasingly complex patterns of these relational responses were also established by the operant contingencies (e.g., contextual control by would/would-not), thereby demonstrating that specific patterns of relational responding had been established for each child. Data from the generalisation tests, the non-contingent reinforcement condition, and the two contingency reversals also indicated that these relational responses were a class of generalised operant behaviours. The current findings support and extend the data obtained in Chapters 2 and 3 of the current thesis, as well as those reported by Healy et al., (2000).

The experiment for each child may be considered in terms of two broad stages. The first stage consisted of establishing the basic relational repertoire, whereas the second stage was concerned with increasing the complexity and flexibility of that repertoire. The results obtained across each of the children during the second stage were relatively consistent. For example, for each child contextual control by would/would-not and control by the two contingency reversals required limited amounts of training. Furthermore, generalisation tests across all six children were highly consistent. The first stage of the experiment, however, may appear somewhat more disparate across subjects than the latter stage. More specifically, a number of interventions were employed in response to the idiosyncratic relational deficits that emerged for each child. For example, in Experiment 8 Subjects 1 and 3 trained with relative ease on the mutually entailed

A-B and B-C more-than and less-than relations, whereas Subject 2 displayed great difficulty with these relations. The former two subjects, however, demonstrated some difficulty with the combinatorially entailed relations, whereas Subject 2 did not -- once the mutually entailed relations had been established. (Parenthetically, the functional separation of mutual and combinatorial entailment has been reported in a number of previous studies with both children and adults [e.g., Healy, et al., 2000; Lipkens, Hayes & Hayes, 1993; Pilgrim & Galizio, 1990, 1995; Pilgrim, Chambers & Galizio, 1995]. The Lipkens et al. study in particular demonstrated, not unlike the current study, that mutual entailment appears to develop before combinatorial entailment). In Experiment 9, Subject 1 displayed considerable difficulty in training on the opposite relations among four coins in horizontal positions, whereas Subjects 2 and 3 did not. Nevertheless, the latter subjects showed great difficulty in training on four coins in random positions, whereas Subject 1 did not -- once responding to four coins in horizontal positions had been established.

In response to these and other individual differences across subjects, four key training interventions were employed (two in each experiment). For Subject 2, in Experiment 8, non-arbitrary stimuli (i.e., different numbers of sweets) were used to establish arbitrary relational control. For Subject 3, novel trial-types were employed that integrated both mutual and combinatorially entailed relations within a single trial (i.e., placing the A-B coins down first and then immediately after the subject's response, presenting the C coin). In Experiment 9, all three subjects failed to complete training with four coins presented in random positions without first being trained on two and three coins in random positions (providing yet more evidence for the functional separation of mutual and combinatorial entailment). Finally, all three subjects were also exposed to an intervention that involved specifying the relation of sameness among the relevant stimuli participating in a frame of opposite. This intervention appeared to work for Subjects 1 and 2, but not for Subject 3 (he eventually trained when three trials containing horizontal presentations were conducted before each block of eight trials containing random presentations). Although they may appear disparate, these four key interventions fall naturally out of RFT, and indeed are consistent with behaviour analytic principles more generally.

In the current study the operant contingencies were designed to establish contextual functions that one would expect to be acquired, sooner or later, through each subject's normal interactions with the English-speaking verbal community. In other words, it might be assumed that the Crel functions that were established in this study for the terms "more-than," "less-than," and "opposite" would have been acquired eventually during the course of each child's normal development. The use of "real words" in this way could be criticised on the grounds that natural learning (in the extra-experimental environment) may have in some undefined way facilitated the performances obtained during the study. Although this remains a possibility, it seems unlikely that natural learning played a significant role in generating the very specific and complex performances observed in the current study. Furthermore, the fact that two subjects were provided with extended baselines of non-contingent reinforcement, and still required extensive training thereafter, seriously undermines the plausibility of a natural learning explanation for the current data. But why were real words in the current studies? Relational frame theory constitutes a modern behavioural approach to human language and cognition (Hayes, et al., 2001), and thus it seemed important for research in this area to begin to work directly with natural language itself. Of course, whenever laboratory research aims to make direct contact with the natural environment, experimental precision is very often traded for ecological validity. At this point in the RFT research programme, the current shift towards greater ecological validity seemed important.

Perhaps the most critical feature of the current data is the insight they provide into the extent and nature of the training history that is required to establish responding in accordance with relational frames. Some researchers have asked, for example, whether explicit training in mutual and combinatorial entailment is required in order to establish responding in accordance with these two properties, or whether training in mutual entailment alone will suffice (e.g., Boelens, 1994; Horne & Lowe, 1996). The RFT perspective on this question was nicely summarised by Hayes and Wilson (1996):

> How much and what kind of training is needed for generalization of a relational response is an empirical matter. However, the general logic of RFT suggests that at least some direct training in combining relations (e.g., both A → C and C → A training [following A → B, B → C, B → A, and C → B training]) is necessary. Using RFT terms, this point has been made explicitly in early expositions; for example equivalence emerges because "mutual entailment, combinatorial entailment and transfer of functions are *directly* trained" (Hayes, 1991, p. 25). It is important to note here that combinatorial entailment subsumes both A → C and C → A relations. . . It does seem likely, however, that once the most basic relational unit is established through training in mutual and combinatorial entailment, relatively fewer trained instances of

> combinatorial entailment will be needed to build out this relational response. Were it not true, every level of relational complexity (e.g., with larger and larger sets of related stimuli) might have to be arduously trained. Consider, for instance, a case in which one was taught to select B in the presence of A, C in the presence of B, D in the presence of C, and so on to the 100th node. We doubt that an individual would have to have a history of direct training to match the 100th stimulus to the 1st, the 100th to the 2nd, the 98th to the 1st, . . . and so on for all possible transitive and equivalence relations among the 100 stimuli. *At some point, RFT would predict that the operant of combining relations would itself generalize (*emphasis added, p. 227*).*

Clearly, the current data provide support for the foregoing interpretation. For example, Subject 1 in Experiment 9 required explicit training in the relation of opposite using two, three, four, and five coins before responding in accordance with opposite generalised, without explicit training, to six, seven, and eight coins/objects. This specific effect was also observed with Subject 2 who required explicit training with six coins before the opposite responding generalised to seven, eight, nine, and ten coins/objects. A similar effect was observed with Subject 3 after training with only three coins.

A related finding from the current study is that an existing relational frame may be useful for facilitating the emergence of new or novel relational patterns (e.g., Hayes, et al., 2001). More specifically, a 'sameness' instruction appeared to facilitate opposite responding with Subjects 1 and 2 in Experiment 9. The possibility that different patterns of relational framing may overlap functionally presents an important empirical issue for researchers in this area, and thus the current findings are particularly interesting because they constitute the first evidence that such overlap may in fact occur. Nevertheless, one should remain cautious at this point because the 'sameness' intervention did not immediately facilitate opposite responding for both subjects (and failed to work at all for Subject 3). This is clearly an issue that requires systematic experimental analysis, not least because the applied implications of such work would likely be broad in scope.

A possibly important issue arising from the current research is that the subjects were already demonstrating a relatively advanced level of language ability before entering the study, and this may have played a critical role in generating the observed relational performances. Certainly, the facilitative effect of the 'sameness' instruction, and the relative ease with which 'would-not' control was established for all of the subjects, suggests that pre-experimental verbal skills were indeed important. One theoretical or interpretive problem that arises at this point is the possibility that very different behavioural processes were involved in the establishment of the language skills with which the children entered the study, than the operant processes that were the focus of the current research. In so far as this was the case, this would limit the theoretical implications of the current work, vis-a-vis RFT's analysis of human language and cognition. At the present time, however, there appears to be no reason to suspect that fundamentally different behavioural processes were involved in the subjects' pre-experimental language learning. In effect, the conservative and parsimonious assumption at this point is that the same operant processes that were used in the current study to establish the specific verbal or relational skills were also heavily involved in the establishment of the language skills that the children possessed before entering the study. Of course, further research will be needed to determine whether this conservative assumption proves to be correct. In any case, from a purely applied perspective, the current data clearly indicate the possible utility in adopting an RFT, operant approach to the establishment of generalised verbal or cognitive skills in young children.

At a more general level, approaching relational responding as generalised operant behaviour may provide new and possibly useful ways of conceptualising human language and cognition (Hayes, et al., 2001). From the perspective of RFT, relational activities are considered to be the functional-analytic bedrock of human cognitive and verbal abilities. This behaviour-analytic view avoids the typical approach taken by cognitive psychology, which has tended to emphasise "content" by focusing on specific words and/or the acquisition of specific concepts applicable in the real world. For RFT the key focus should be on the relational activities *per se*, rather than on particular words or concepts. In the present study, for example, large numbers of "pretend" coins, and a range of randomly selected objects, were used to establish generic patterns of relational responding. Perhaps a similar approach could be taken in educational settings in which learners are trained in both real world concepts and in various types of relational responding. Consider a classroom setting where games could be designed to improve the flexibility of a child's relational responding. Questions could be asked such as: "If X is the opposite of Y, and Y is the same as Z, do I like Z if I like X?" Of course, broadly similar training does occur during the course of normal educational practice. However, such practice is not designed specifically to target the key cognitive or relational skills (see Fredrick, Deitz, Bryceland & Hummel, 2000). In contrast, RFT is directly concerned with these core relational skills and how they might be harnessed for bringing about improved educational achievement. What is most exciting about this research agenda is that the same general process of relational framing may be at the heart of a very wide range of cognitive abilities. Indeed, in the next chapter empirical work is presented which attempts to extend RFT into the analysis of perspective-taking, a domain that has been completely dominated by traditional or mainstream cognitive/developmental psychology. As will become evident, RFT may well have an important contribution to make in this arena.

Chapter Six

Chapter 6

Perspective-Taking as Generalised Operant Behaviour: Developing Procedures with Two Young Children

Experiment 10

INTRODUCTION

The research reported in the current thesis thus far has focused on patterns of relational framing that have been examined in previous research. The current work is novel, however, in that an attempt has been made to analyse the experimental histories that are required to generate these patterns when they do not immediately emerge in the experimental context. A natural extension to this work would involve applying this general research strategy to the analysis of relational frames that have hitherto not been examined experimentally. Arguably, the most significant contribution that might be made in this regard would involve analysing what have been called the *deictic* relational frames. According to RFT, these frames are critical for perspective-taking, a psychological phenomenon that has received scant attention in the behavioural literature. The RFT focus on the verbal nature of perspective-taking may provide a valuable behaviour-analytic in-road to a research domain that has traditionally been dominated by mainstream cognitive and developmental psychology (Baron-Cohen, Tager-Flusberg & Cohen, 2000; Howlin, Baron-Cohen & Hadwin, 1999; Reed & Peterson, 1990; Taylor, 1988). The final empirical chapter of the current thesis, therefore, focused on this potentially important topic.

In the language of RFT, deictic relations, that specify a relation in terms of the perspective of the speaker, are a family of relational frames that appear to be critical for the development of perspective-taking skills. Consider, for example, the three frames of I and YOU, HERE and THERE and NOW and THEN. These frames, unlike other relational frames, do not appear to have formal or non-arbitrary counterparts, and cannot be traced to formal dimensions in the environment. It is the relationship between the individual and other events that serves as the constant variable upon which deictic frames are based. Learning to respond appropriately to, and ask, many of the questions contained within one's common verbal interactions with others (e.g., "What am *I* doing *now*?" or "What are *you* doing *there*?") appears to be critical in establishing these perspective-taking frames. Each time one or more of these questions is asked or answered, the physical environment is likely to be different. The only constants across these and many similar questions are the relational properties of I versus You, Here versus There, and Now versus Then. Furthermore, according to RFT, these properties themselves are abstracted through learning to talk about one's own perspective in relation to the perspective of others. For example, *I* is always from this perspective *here*, not from someone else's perspective *there*. Abstraction of an individual's perspective on the world, and that of others, requires a combination of a sufficiently well developed relational repertoire and an extensive history of exemplars that take advantage of that repertoire.

According to RFT, the three perspective-taking frames described above can generate a range of relational networks, including: I-HERE-NOW; YOU-HERE-NOW; I-HERE-THEN; YOU-HERE-THEN; I-THERE-NOW; YOU-THERE-NOW; I-THERE-THEN; and YOU-THERE-THEN. Many phrases common to daily discourse are derived from these eight relational networks. Consider, for example, the phrases; "I am here now, but you were here then";

"You were there then, but I am here now"; and "You and I are both here now, but I was here then." Of course, when used in actual dialogue, these phrases would often include or substitute words coordinated with particular individuals, places, and times. For illustrative purposes, consider the following. "It is six o'clock and I am at work [HERE and NOW], but Mary [YOU] is still at home" [THERE and NOW]. What makes perspective-taking frames particularly complex and useful is that they cannot be defined in terms of particular words, even the words, "I", "you", "here", "there", "now" and "then". According to RFT, words such as these (used to describe the perspective of the self and others) are merely examples of the relational cues that control the perspective-taking frames, and a range of other words and contextual features may serve the same function. As is the case for all relational frames, what is important is the generalised relational activity not the actual words themselves.

The aim of the current study was to develop RFT-based training and testing tasks that might be used to establish and analyse perspective-taking. The study also aimed to demonstrate that perspective-taking might be usefully considered a form of generalised relational operant behaviour. Given that no other published empirical research has attempted to analyse perspective-taking frames, the primary objective of the current study was to lay the procedural and empirical groundwork for further RFT analyses of perspective-taking behaviours in young children. This study focused specifically on establishing and manipulating two of the three relational frames of perspective-taking, I-YOU and HERE-THERE in a seven year old girl and a four year old boy. A series of tasks for analysing the third perspective-taking frame of NOW-THEN was also developed and is presented in Appendix 7, but these tasks were not employed in the current study.

For the purposes of the present study, the two perspective-taking frames of I-YOU and HERE-THERE were examined across six tasks, involving one or both frames or combinations thereof. These six tasks were combined into fifteen different blocks of training and testing (see Table 19), that were designed to establish highly flexible repertoires of relational responding in accordance with the frames of I-YOU and HERE-THERE. More specifically, the current research first determined whether particular relational perspective-taking responses were present in the behavioural repertoires of two young subjects. When these responses were found to be absent, an attempt was made to train them using interventions suggested by RFT.

METHOD

Subjects

Two subjects (1 & 2) participated in the study. At the beginning of the experiment, Subject 1, female, was 7 years and 3 months old, and at the end she was 7 years and 5 months. Subject 2, male, was 3 years and 8 months old at the beginning of the study and was 4 years old at the end. Both subjects were enrolled in a crèche in Dublin. They were chosen on the basis of parental consent, and that neither their parents nor their crèche supervisor (nor Subject 1's schoolteacher) had identified them as presenting a learning difficulty.

Apparatus

During the testing and training tasks a range of children's toys were employed, including two play bricks, one red and one green, a toy snake, and a book. A number of common items were also used; a pen, a cup, a key, an apple, a sweet, and a pasta shape. Two identically sized, differently coloured chairs were placed in the experimental room during trials conducted with each subject. With Subject 1, a blue chair and a black chair were used, one for the experimenter, and one for the subject (which chairs they sat on depended on the trial). With Subject 2, two smaller but identically sized chairs were used, one red and one white. Other materials included a tray with beads used with Subject 2 in exchange for reinforcers. The reinforcers employed for both subjects included small edibles (e.g., sweets) and two preferred toy cars for Subject 2.

General Procedure

Subjects were exposed to the experimental procedures individually. In general, sessions lasted no more than 20 mins. per day, and the children were exposed to a maximum of four sessions per week. When sessions lasted more than 10 mins., a break of 5 mins. was provided mid-way through the session. At the beginning of each block of testing or training trials, the experimenter asked the child "Do you want to do some more work?" If the child indicated that s/he did want to do more, the experimenter continued as planned. If, however, the child responded negatively (or indicated during a test or training block that s/he wished to stop), the experiment was terminated for that day. If the child had reached a training criterion or passed a test during the previous block, in the next session the experimenter normally continued with the next planned stage of the experiment.

Programmed Consequences

Each trial in the protocol consisted of two questions (e.g., "Where am I sitting? Where are you sitting?"). A correct response required that the child answer *both* questions correctly. If subjects indicated a choice by means of an alternative response (e.g., by pointing) the experimenter immediately asked "Please tell me what your answer is." After answering the first question, subjects were not given feedback, and the next question was asked immediately. Feedback only followed the subject's answer to the second question in a given trial. A correct response to the trial (i.e., answering both questions correctly) was followed by the words "Yes, both answers are correct. Good girl/boy". On training trials with Subject 2, the instruction "Take a bead" was also added after the subject's answer to the second question. Subject 1 was allowed to select a sweet after reaching the mastery criterion on a block of training trials. After collecting a specified number of beads, Subject 2 was allowed to select a sweet or to play with previously selected toy cars for thirty seconds. An incorrect response was defined as producing an incorrect answer to one or both of the questions contained within a trial, or emitting no response within 10s of a question. Punishment during training trials consisted of the experimenter saying: "No, the first/second answer is not correct" or "No, both answers are wrong." With Subject 2, the instruction "You lose a bead" was also added. The experimenter then removed a bead from the table and placed it back in the tray, and the next training trial began. No programmed consequences followed any test trial. If a child made any comment during a trial, the experimenter simply replied "We can talk after we have finished our work."

Testing and Training the Two Perspective-Taking Frames

The general procedure for testing and training the two perspective-taking frames is outlined below, and is hereafter referred to as the "*extended protocol*." The reader should note, however, that there were some differences between the experimental sequences to which the two subjects were exposed. This was largely due to the fact that this study was concerned with developing the relevant procedures, and to the fact that the two subjects in the current study differed significantly in age. The details of the procedural differences are provided in the individual Procedure and Results section for each subject. In the sections that follow the extended protocol will be described in detail.

The extended protocol consisted of two basic types of relational performance, involving responding to the two perspective-taking frames of I-YOU and HERE-THERE. These are referred to as Levels 1 and 2 of the extended protocol, respectively. The term "level" should not be taken to indicate a natural or invariant developmental sequence. Rather, the term merely reflects the level of complexity in the relational performances that emerges as these two frames are established. In the current study, therefore, an attempt was made to establish the two perspective-taking frames in the order of I-YOU first and HERE-THERE second.

Level 1 of the extended protocol focused on responding in accordance with the perspective-taking frame of I-YOU. This frame was analysed using two tasks; responding to simple I-YOU relations and responding to reversed I-YOU relations. These two tasks were presented separately and in combination across five blocks of testing/training trials. The two tasks and how they were combined across the five blocks are presented in Table 19. The reader is encouraged to study Table 19 carefully, and to refer to it regularly while reading the text. For illustrative purposes, two of the blocks from Level 1 will be described in detail.

Table 19
Details of the experimental tasks and blocks contained within the extended protocol

Level 1: I-YOU (Blocks 1-5)

Simple I-YOU Relations
Task 1: "I have a green brick and you have a red brick. Which brick do you have? Which brick do I have?" (The order in which the two *You* and *I* questions were presented was counterbalanced across trials throughout the entire study).

I-YOU Reversals
Task 2: "I have a green brick and you have a red brick. If I was you and you were me. Which brick would I have? Which brick would you have?"

Block 1: Simple I-YOU relations (6 trials of Task 1)
Block 2: I-YOU Reversals (6 trials of Task 2)
Block 3: Simple I-YOU Relations and I-YOU Reversals (6 trials; 3 of Task 1 and 3 of Task 2)
Block 4: Simple I-YOU Relations and I-YOU Reversals with possession of red and green bricks counterbalanced across trials (6 trials; 3 of Task 1 and 3 of Task 2)
Block 5: Simple I-YOU Relations and I-YOU Reversals with possession of novel objects (pen and cup) counterbalanced across trials (6 trials; 3 of Task 1 and 3 of Task 2).

Table 19 (Cont.)

Level 2: HERE-THERE (Blocks 6-15)

Simple I-YOU Relations within Simple HERE-THERE Relations
Task 3: "I am sitting here on the blue chair and you are sitting there on the black chair. Where are you sitting? Where am I sitting?"

I-YOU Reversals within Simple HERE-THERE Relations
Task 4: "I am sitting here on the blue chair and you are sitting there on the black chair. If I was you and you were me. Where would I be sitting? Where would you be sitting?"

Simple I-YOU Relations within HERE-THERE Reversals
Task 5: "I am sitting here on the blue chair and you are sitting there on the black chair. If here was there and there was here. Where would you be sitting? Where would I be sitting?"

I-YOU/HERE-THERE Double Reversals
Task 6: "I am sitting here on the blue chair and you are sitting there on the black chair. If I was you and you were me, and if here was there and there was here. Where would I be sitting? Where would you be sitting?"

Block 6: Simple I-YOU relations within Simple HERE-THERE relations (6 trials of Task 3)
Block 7: Simple I-YOU relations and I-YOU Reversals within Simple HERE-THERE relations (6 trials; 3 of Task 3 and 3 of Task 4)
Block 8: Simple I-YOU relations and I-YOU Reversals within Simple HERE-THERE relations with chair colour counterbalanced across trials (6 trials; 3 of Task 3 and 3 of Task 4)
Block 9: Simple I-YOU relations within Simple HERE-THERE relations and Simple I-YOU relations within HERE-THERE Reversals (6 trials; 3 of Task 3 and 3 of Task 5)
Block 10: Simple I-YOU relations within Simple HERE-THERE relations and Simple I-YOU relations within HERE-THERE Reversals with chair colour counterbalanced across trials (6 trials; 3 of Task 3 and 3 of Task 5)
Block 11: I-YOU Reversals within Simple HERE-THERE relations and Simple I-YOU relations within HERE-THERE Reversals (6 trials; 3 of Task 4 and 3 of Task 5)
Block 12: I-YOU Reversals within Simple HERE-THERE relations and Simple I-YOU relations within HERE-THERE Reversals with chair colour counterbalanced across trials (6 trials; 3 of Task 4 and 3 of Task 5)
Block 13: I-YOU Reversals within Simple HERE-THERE relations, Simple I-YOU relations within HERE-THERE Reversals, and I-YOU/HERE-THERE Double Reversals (12 trials; 4 each of Tasks 4, 5, and 6)
Block 14: I-YOU Reversals within Simple HERE-THERE relations, Simple I-YOU relations within HERE-THERE Reversals, and I-YOU/HERE-THERE Double Reversals with chair colour counterbalanced across trials (12 trials; 4 each of Tasks 4, 5, and 6)
Block 15: I-YOU Reversals within Simple HERE-THERE relations, Simple I-YOU relations within HERE-THERE Reversals, and I-YOU/HERE-THERE Double Reversals with novel actions and locations (standing at yellow and brown doors) counterbalanced across trials (12 trials; 4 each of Tasks 4, 5, and 6)

All blocks in Level 1 consisted of six trials. In Block 1, Task 1 was presented. The experimenter was seated adjacent to the subject at the experimental table, and this arrangement was employed in all subsequent parts of the study, unless specified otherwise. Two identically sized play bricks were used in all trials in Level 1, one green, the other red (these stimuli were not employed in subsequent levels). At the beginning of each trial the experimenter placed the bricks on the experimental table, one in front of herself and the other in front of the child (in Block 1, the experimenter always had the green brick and the child always had the red brick). The child was then given an instruction that specified possession of the two bricks; "I (experimenter) have a green brick, and you (child) have a red brick". The child was then asked, for example, "Which brick do I have? Which brick do you have?" All trials in Level 1 contained these two questions.

The order in which the "I" and "you" questions were presented was randomised across all trials in a test/training block. Subjects were required to respond correctly on all trials (i.e., 100%) in order to pass a test. When subjects passed a test they proceeded to the next test. Subjects who failed a test were re-exposed to the same procedure, but with the addition of programmed consequences. Training trials in Level 1 were also presented in blocks of six trials, but the number of blocks to which subjects were exposed depended on their performance. Subjects were required to reach a mastery criterion of six consecutively correct responses (i.e., all six trials in a block correct) in order to complete training. They were then re-exposed to the same test, and re-exposed to training until this test was passed.

In Block 2, Task 2 was presented. This procedure was identical to Task 1, in that the brick arrangements remained the same in all six trials. In Task 2, however, the instructions were altered and in each trial the experimenter now stated, for example, "I have a green brick, and you have a red brick. If I was you and you were me. Which brick would I have? Which brick would you have?" In the statement "If I was you and you were me" the I-YOU relation was explicitly reversed. This reversal was contained in all six test trials in Block 2. Correct responses to these questions were based on this relational reversal and were not based on the actual possession of the bricks. In other words, the correct answers to the questions were "a red brick" (experimenter) and "a green brick" (subject), respectively. Subjects who failed this test were exposed to the same procedure in the form of training until Block 2 was eventually passed. Block 3 involved combining the tasks from Blocks 1 and 2 across six trials, and Block 4 was identical to Block 3 except that the possession of the bricks was counterbalanced across trials. Block 5 was identical to Block 4, except that novel stimuli were employed (a pen and a cup replaced the two play bricks).

Level 2 of the extended protocol focused on the perspective-taking frame of HERE-THERE, and its relationship to the previously established I-YOU frame. This frame was analysed across four tasks involving; simple I-YOU relations within simple HERE-THERE relations (Task 3), I-YOU reversals within simple HERE-THERE relations (Task 4), simple I-YOU relations within HERE-THERE reversals (Task 5), and I-YOU/HERE-THERE double reversals (Task 6). These four tasks were presented in various combinations across ten blocks of testing/training. For illustrative purposes, one of these blocks (i.e., Block 14) will be described in detail.

All blocks in Level 2 consisted of either six or twelve trials (see Table 19). In Block 14, Tasks 4, 5 and 6 were presented four times each across twelve trials (in a quasi-random order). The experimenter was seated adjacent to the subject at the experimental table. For example, on some trials the experimenter sat on a blue chair and the subject sat on a black chair (these seating arrangements were counterbalanced across trials). For Task 4, the experimenter looked at the child and said, for example, "I (experimenter) am sitting here on the blue chair, and you (child) are sitting there on the black chair. If I was you and you were me. Where would you be sitting? Where would I be sitting?" For Task 5, the experimenter looked at the child and said, for example, "I am sitting here on the blue chair, and you are sitting there on the black chair. If here was there and there was here. Where would you be sitting? Where would I be sitting?" For Task 6, the experimenter looked at the child and said, for example, "I am sitting here on the blue chair, and you are sitting there on the black chair. If I was you and you were me, and if here was there and there was here. Where would you be sitting? Where would I be sitting?" Block 15 was identical to Block 14, except that sitting in chairs was replaced by standing at two differently coloured doors (see Table 19).

All trials in Level 2 contained the two questions; "Where would I/you be sitting?" The order in which these questions were presented was randomised across all trials in a test/training block. Subjects were required to respond correctly on all trials (i.e., 100%) in order to pass a test. Subjects who failed a test were exposed to the same procedure, with the addition of programmed consequences. Training trials were also presented in blocks of six or twelve trials, but the number of blocks to which subjects were exposed depended on their performance. Subjects were required to reach a mastery criterion of six or twelve consecutively correct responses (i.e., all trials in a block correct) in order to complete training. They were then re-exposed to the same test and re-exposed to training until the block was passed.

Following exposure to the extended protocol in whole or in part, subjects were exposed to further phases of relational testing and training (see below). From the total of fifteen blocks described in Table 19, five key blocks were selected. These five blocks incorporated the two perspective-taking frames (i.e., Levels 1 and 2) and all six tasks. These five blocks were as follows: Blocks, 4, 10, 12 14 and 15. Block 4 incorporated Tasks 1and 2 of Level 1 and Blocks 10, 12, and 14 incorporated Tasks 3, 4, 5, and 6 of Level 2 (see Table 19). Block 15 was a generalisation test. Only these five blocks, hereafter referred to as the "*abbreviated protocol*" were employed in *all* subsequent phases of the study.

Contingency Reversals

When subjects had completed the extended protocol, the reinforcement contingencies were reversed (i.e., Reversal 1) in order to determine the operant nature of the perspective-taking performances that had been demonstrated. In effect, subjects were now required to respond *away* from the choices that would have been reinforced previously. Reversal 1 consisted of the five blocks from the abbreviated protocol. After subjects had passed the tests contained in Reversal 1, a second reversal (i.e., Reversal 2) was introduced in order to complete an A-B-A reversal design. In Reversal 2, the contingencies were reversed a second time, and the original reinforcement contingencies were reinstated.

Inter-observer reliability. Approximately thirty percent of testing and training trials were observed by an independent observer, who had no knowledge of experimental psychology. The observer could not see the experimenter's data sheet during the experimental sessions. The observer and experimenter disagreed on six training trials and four test trials (all with Subject 2).

PROCEDURE AND RESULTS

Subject 1

The procedure and results for Subject 1 are presented in Table 20 in the form of a matrix. The raw data for this subject is also presented in Appendix 8. The matrix presents the following information: the type of procedure; level; block number; tasks; whether the subject was being trained or tested; whether the subject passed or failed; the number of correct responses during a test or the number of training trials required; and finally, the types of relations that were tested or trained (indicated by the dots).

Table 20. Procedure and Results matrix for Subject 1

Procedure	Level	Block	Tasks	Test/ Train	Pass/ Fail	No. Correct/ No. Training Trials	I-YOU	I-You Rev.	Here-There	Here-There Rev.	Dble Rev.	Change Stim's Loc's
Extended Protocol	1	1	1	Test	Pass	6/6	•					
	-	4	1,2	Test	Pass	6/6	•	•				•
	2	6	3	Test	Pass	6/6	•		•			
	-	8	3,4	Test	Pass	6/6	•	•	•			•
	-	10	3,5	Test	Pass	6/6	•		•	•		•
	-	13	4,5,6	Test	Fail	8/12	•	•	•	•	•	
	-	*	6	Train	-	7					•	•
	-	*	6	Test	Pass	6/6					•	•
	-	14	4,5,6	Test	Fail	6/12	•	•	•	•	•	•
	-	14	4,5,6	Train	-	23	•	•	•	•	•	•
	-	14	4,5,6	Test	Pass	12/12	•	•	•	•	•	•
Abbreviated Protocol Follow-Up Tests	1	4	1,2	Test	Pass	6/6	•	•				•
	2	10	3,5	Test	Pass	6/6	•		•	•		•
	-	12	4,5	Test	Pass	6/6	•	•	•	•		•
	-	14	4,5,6	Test	Fail	11/12	•	•	•	•	•	•
	-	14	4,5,6	Test	Fail	9/12	•	•	•	•	•	•
	-	14	4,5,6	Train	-	34	•	•	•	•	•	•
	-	14	4,5,6	Test	Pass	12/12	•	•	•	•	•	•
Generalisation Tests	1	4	1,2	Test	Pass	6/6	•	•				•
	2	10	3,5	Test	Pass	6/6	•		•	•		•
	-	12	4,5	Test	Pass	6/6	•	•	•	•		•
	-	14	4,5,6	Test	Pass	12/12	•	•	•	•	•	•
Reversal 1	1	4	1,2	Test	Fail	0/6	•	•				•
	-	4	1,2	Train	-	8	•	•				•
	-	4	1,2	Test	Fail	0/6	•	•				•
	-	4	1,2	Train	-	7	•	•				•
	-	4	1,2	Test	Pass	6/6	•	•				•
	2	10	3,5	Test	Fail	0/6	•		•	•		•
	-	10	3,5	Train	-	7	•		•	•		•
	-	10	3,5	Test	Fail	0/6	•		•	•		•
	-	10	3,5	Train	-	10	•		•	•		•
	-	10	3,5	Test	Fail	0/6	•		•	•		•
	-	10	3,5	Train	-	6	•		•	•		•
	-	10	3,5	Test	Fail	0/6	•		•	•		•
	-	10	3,5	Train	-	6	•		•	•		•
	-	10	3,5	Test	Fail	0/6	•		•	•		•
	-	10	3,5	Train	-	6	•		•	•		•
	-	10	3,5	Test	Fail	0/6	•		•	•		•
	-	10	3,5	Train	-	6	•		•	•		•
	-	10	3,5	Test	Fail	0/6	•		•	•		•
	-	10	3,5	Train	-	6	•		•	•		•
	-	10	3,5	Test	Fail	0/6	•		•	•		•
	1	4	1,2	Test	Fail	0/6	•	•				•
	-	4	1,2	Train	-	6	•	•				•
	-	4	1,2	Test	Fail	0/6	•	•				•
	-	4	1,2	Train	-	6	•	•				•
	-	4	1,2	Test	Pass	6/6	•	•				•
	2	10	3,5	Test	Pass	6/6	•		•	•		•

Table 20 (Cont.)

Procedure	Level	Block	Tasks	Test/ Train	Pass/ Fail	No. Correct/ No. Training Trials	I-YOU	I-You Rev.	Here-There	Here-There Rev.	Dble Rev.	Change Stim's Loc's
	-	12	4,5	Test	Pass	6/6	•	•	•	•		•
	-	14	4,5,6	Test	Fail	6/12	•	•	•	•	•	•
	-	14	4,5,6	Train	-	15	•	•	•	•	•	•
	-	14	4,5,6	Test	Fail	8/12	•	•	•	•	•	•
	-	14	4,5,6	Train	-	15	•	•	•	•	•	•
	-	14	4,5,6	Test	Pass	12/12	•	•	•	•	•	•
Generalisation Tests	1	4	1,2	Test	Pass	6/6	•	•				•
	2	10	3,5	Test	Pass	6/6	•		•	•		•
	-	12	4,5	Test	Pass	6/6	•	•	•	•		•
	-	14	4,5,6	Test	Fail	8/12	•	•	•	•	•	•
	-	14	4,5,6	Test	Pass	12/12	•	•	•	•	•	•
Reversal 2	1	4	1,2	Test	Fail	0/6	•	•				•
	-	4	1,2	Train	-	7	•	•				•
	-	4	1,2	Test	Pass	6/6	•	•				•
	2	10	3,5	Test	Fail	4/6	•		•	•		•
	-	10	3,5	Train	-	8	•		•	•		•
	-	10	3,5	Test	Pass	6/6	•		•	•		•
	-	12	4,5	Test	Pass	6/6	•	•	•	•		•
	-	14	4,5,6	Test	Pass	12/12	•	•	•	•	•	•
Generalisation Tests	1	4	1,2	Test	Pass	6/6	•	•				•
	2	10	3,5	Test	Pass	6/6	•		•	•		•
	-	12	4,5	Test	Pass	6/6	•	•	•	•		•
	-	14	4,5,6	Test	Pass	12/12	•	•	•	•	•	•

* Trained/tested I-YOU/HERE-THERE double reversals only.

Extended protocol. Subject 1 was exposed to 25 sessions of testing and training across a period of two months. There were a number of substantive modifications adopted with Subject 1, relative to the general procedure just described. First, she was exposed to a sample of the blocks rather than to all fifteen, due to her age and the verbal sophistication she demonstrated in the course of the experiment. Second, Subject 1 was not exposed to the generalisation blocks (i.e., Blocks 5 and 15), but was exposed to a complete series of generalisation tests in the form of the abbreviated protocol using novel stimuli. Third, she was exposed to a series of follow-up tests one month after completing the extended protocol. She was exposed to these generalisation tests at three points in the study -- after her initial exposure to the extended protocol and within each of the two contingency reversals.

In the extended protocol, Subject 1 immediately passed Blocks 1 and 4 (Level 1) and Blocks 6, 8, and 10 (Level 2). She failed for the first time on Block 13, with all errors occurring on the I-YOU/HERE-THERE double reversals. She received explicit training on double reversals and was exposed immediately to Block 14, but she failed. After one cycle of training on Block 14, she subsequently passed the test.

Follow-up tests. One month later, Subject 1 was exposed to the abbreviated protocol as a series of follow-up tests. The abbreviated protocol for this subject contained only four blocks (instead of five), with the exclusion of Block 15, as she was exposed to a separate series of generalisation tests. She passed three of the four blocks immediately, and required only one short cycle of explicit training to pass Block 14. These follow-up performances indicated that the majority of the previously established relational performances remained in the child's behavioural repertoire.

Generalisation tests. Subject 1 was then exposed to a series of generalisation tests, based on the abbreviated protocol with novel stimuli. In Block 4 (Level 1), the green and red bricks were replaced with a pen and a cup, respectively. In Blocks 10, 12, and 14 (Level 2), the blue and black chairs previously employed were removed, and the experimenter and subject were instead standing beside yellow and brown doors. Subject 1 passed all four generalisation tests immediately, thereby demonstrating that the previously established perspective-taking repertoires generalised to novel stimuli without additional training.

Reversal 1. In Reversal 1, Subject 1 was exposed to the abbreviated protocol with previously trained and novel stimuli, respectively, and the reinforcement contingencies previously employed were reversed. She failed the first exposure to Block 4 by responding consistently in accordance with the previous contingency arrangements. She required two short cycles of training before passing Block 4. She similarly failed the first exposure to Block 10 and continued to fail even after seven cycles of training. Specifically, during training she consistently responded correctly in accordance with the current (reversed) contingency arrangements, but during testing she consistently responded in accordance with the previous contingency arrangements. At this point in the experiment, she was re-exposed to Block 4, in which she had previously correctly responded in accordance with the current (reversed) contingencies and she now failed. She received two cycles of training before passing Block 4 and immediately passed Block 10 without further training. She passed Block 12 immediately but required explicit training on Block 14. In Reversal 1, therefore, Subject 1 required explicit training on three of the four blocks in Reversal 1. The subject then passed all four generalisation tests without training.

Reversal 2. After completing Reversal 1, Subject 1 was exposed to Reversal 2, in which the original contingency arrangements were reinstated. Reversal 2 was identical to Reversal 1 in that it contained the abbreviated protocol with previously-trained and novel stimuli, respectively. She failed the first exposure to Block 4 by responding consistently in accordance with the previous reversed contingency arrangements. After a short cycle of training, she passed the second exposure to Block 4. She required explicit training only on Block 10 and passed Blocks 12 and 14 without training. She immediately passed the four generalisation tests without training.

The performances of Subject 1 may be summarised as follows. In the extended protocol, she demonstrated Level 1 performances without training. At Level 2, she required explicit training in order to pass Block 14. On the follow-up tests, she required training only on Block 14. She required no training on the first generalisation tests. In Reversal 1 she required explicit training on all blocks, except Block 10. She passed all Reversal 1 generalisation tests without training. In Reversal 2, she required explicit training on Blocks 4 and 10 and passed all Reversal 2 generalisation tests without training.

Subject 2

Extended protocol. The procedure and results for Subject 2 are presented in matrix form in Table 21. The raw data for this subject is also presented in

Appendix 9. Subject 2 was exposed to 55 sessions of testing and training across a period of four months.

Table 21. Procedure and Results matrix for Subject 2

Procedure	Level	Block	Tasks	Test/ Train	Pass/ Fail	No. Corr/ No. Train Trials	I-YOU	I-You Rev.	Here-There	Here-There Rev.	Dble Rev.	Change Stim's Loc's	Gen
Extended Protocol	1	1	1	Test	Pass	6/6	•						
	-	2	2	Test	Fail	2/6		•					
	-	2	2	Train	-	12		•					
	-	2	2	Test	Fail	1/6		•					
	-	2	2	Train	-	49		•					
	-	2	2	Test	Fail	4/6		•					
	-	2	2	Train	-	26		•					
	-	2	2	Test	Pass	6/6		•					
	-	3	1.2	Test	Fail	2/6	•	•					
	-	3	1.2	Train	-	17	•	•					
	-	3	1.2	Test	Pass	6/6	•	•					
	-	4	1.2	Test	Pass	6/6	•	•				•	
	-	5	1.2	Test	Fail	4/6	•	•				•	•
	-	5	1.2	Train	-	9	•	•				•	
	-	5	1.2	Test	Fail	5/6	•	•				•	•
	-	5	1.2	Train	-	17	•	•				•	
	-	5	1.2	Test	Pass	6/6	•	•				•	•
	-	5	1.2	Test	Pass	6/6	•	•				•	•
	2	6	3	Test	Pass	6/6	•		•				
	-	7	3.4	Test	Fail	5/6	•	•	•				
	-	*	4	Train	-	6		•	•				
	-	*	4	Test	Pass	6/6		•	•				
	-	8	3.4	Test	Pass	6/6	•	•	•			•	
	-	8	3.4	Test	Pass	6/6	•	•	•			•	
	-	9	3.5	Test	Fail	5/6	•		•	•			
	-	**	5	Train	-	6	•			•			
	-	**	5	Test	Pass	6/6	•			•			
	-	9	3.5	Test	Fail	4/6	•		•	•			
	-	9	3.5	Train	-	6	•		•	•			
	-	9	3.5	Test	Pass	6/6	•		•	•			
	-	10	3.5	Test	Pass	6/6	•		•	•		•	
	-	11	4.5	Test	Fail	4/6	•	•	•	•			
	-	11	4.5	Train	-	6	•	•	•	•			
	-	11	4.5	Test	Pass	6/6	•	•	•	•			
	-	12	4,5	Test	Pass	6/6	•	•	•	•		•	
	-	13	4,5.6	Test	Fail	8/12	•	•	•	•	•		
	-	***	6	Train	-	25					•		
	-	***	6	Test	Pass	6/6					•		
	-	13	4.5.6	Test	Fail	7/12	•	•	•	•	•		
	-	13	4.5.6	Train	-	24*	•	•	•	•	•		
	-	*	4	Train	-	6		•	•			•	
	-	*	4	Test	Pass	6/6		•	•			•	
	-	**	5	Train	-	6	•			•		•	
	-	**	5	Test	Pass	6/6	•			•		•	
	-	12	4.5	Train	-	7	•	•	•	•		•	
	-	12	4.5	Test	Pass	6/6	•	•	•	•		•	
	-	***	6	Train	-	14					•	•	
	-	***	6	Test	Fail	5/6					•	•	
	-	***	6	Train	-	7					•	•	
	-	***	6	Test	Pass	6/6					•	•	
	-	13	4.5.6	Train	-	32*	•	•	•	•	•		

Table 21 (Cont.)

Procedure	Level	Block	Tasks	Test/ Train	Pass/ Fail	No. Corr/ No. Train Trials	I-YOU	I-You Rev.	Here-There	Here-There Rev.	Dble Rev.	Change Stim's Loc's	Gen
Alternating Trials	-	13	4,5,6	Train	-	60*	•	•	•	•	•		
Shaping to 6	1	8	3,4	Train	-	15	•	•	•			•	
"	2	10	3,5	Train	-	28	•		•	•		•	
"	-	***	6	Train	-	7					•	•	
Shaping to 4	1	8	3,4	Train	-	4	•	•	•			•	
"	2	10	3.5	Train	-	8	•		•	•		•	
"	-	***	6	Train	-	6					•	•	
Shaping to 2	1	8	3,4	Train	-	3	•	•	•			•	
"	2	10	3.5	Train	-	2	•		•	•		•	
"	-	***	6	Train	-	3					•	•	
Shaping to 1	1	8	3,4	Train	-	1	•	•	•			•	
"	2	10	3.5	Train	-	2	•		•	•		•	
"	-	***	6	Train	-	2					•	•	
	2	13	4,5,6	Train	-	25	•	•	•	•	•		
	2	13	4.5.6	Test	Pass	12/12	•	•	•	•	•		
Foils	2	13	4.5.6	Test	Pass	18/18	•	•	•	•	•		
	2	14	4,5,6	Test	Pass	12/12	•	•	•	•	•	•	
Foils	2	14	4,5,6	Test	Pass	18/18	•	•	•	•	•	•	
	2	15	4,5,6	Test	Pass	12/12	•	•	•	•	•	•	•
Foils	2	15	4,5,6	Test	Pass	18/18	•	•	•	•	•	•	•
	2	15	4,5,6	Test	Pass	18/18	•	•	•	•	•	•	•
Reversal 1	1	4	1,2	Test	Fail	0/6	•	•				•	
	-	4	1,2	Train	-	20	•	•				•	
	-	4	1,2	Test	Pass	6/6	•	•				•	
	2	10	3,5	Test	Fail	2/6	•		•	•		•	
	-	10	3,5	Train	-	12	•		•	•		•	
	-	10	3,5	Test	Pass	6/6	•		•	•		•	
	-	12	4,5	Test	Fail	2/6	•	•	•	•		•	
	-	12	4,5	Train	-	7	•	•	•	•		•	
	-	12	4,5	Test	Pass	6/6	•	•	•	•		•	
	-	14	4,5,6	Test	Fail	8/12	•	•	•	•	•	•	
	-	14	4,5,6	Train	-	15	•	•	•	•	•	•	
	-	14	4,5,6	Test	Pass	12/12	•	•	•	•	•	•	
	-	15	4,5,6	Test	Pass	12/12	•	•	•	•	•	•	•
Reversal 2	1	4	1,2	Test	Fail	0/6	•	•				•	
	-	4	1,2	Train	-	9	•	•				•	
	-	4	1,2	Test	Pass	6/6	•	•				•	
	2	10	3,5	Test	Pass	6/6	•		•	•		•	
	-	12	4.5	Test	Pass	6/6	•	•	•	•		•	
	-	14	4,5.6	Test	Fail	11/12	•	•	•	•	•	•	
	-	14	4,5.6	Train	-	15	•	•	•	•	•	•	
	-	14	4.5.6	Test	Pass	12/12	•	•	•	•	•	•	
	-	15	4,5.6	Test	Pass	12/12	•	•	•	•	•	•	•

* Trained/tested I-YOU reversals in simple HERE-THERE relations only.
** Trained/tested simple I-YOU relations in HERE-THERE reversals only.
*** Trained/tested I-YOU/HERE-THERE double reversals only.

At Level 1 in the extended protocol, Subject 2 passed Block 1 immediately, but required explicit training on Blocks 2 and 3. He passed Block 4 immediately, but failed the first exposure to Block 5 (generalisation test) with novel stimuli (a pen and a cup). He required two cycles of training (using a pen and a cup, and a key and a toy, respectively) before passing Block 5 with novel stimuli (using an apple and a book). After a short delay, he was subsequently re-exposed to Block 5 using another novel set of stimuli (a sweet and a pasta shape) and passed once again. To summarise his performances on Level 1, Subject 2 required explicit training on Blocks 2, 3 and 5 before responding in accordance with the perspective-taking frame of I-YOU generalised to novel stimuli.

At Level 2 of the extended protocol, he passed Block 6 immediately, but failed Block 7, with a single error on an I-YOU reversal in a simple HERE-THERE relation. After explicit training on I-YOU reversals in simple HERE-THERE relations, he was exposed immediately to Block 8 and passed. After a four-week delay in which the subject was not available, he was re-exposed to Block 8 and passed for the second time. He was subsequently exposed to Block 9 and failed, with a single error occurring on a HERE-THERE reversal. After explicit training on HERE-THERE reversals he was re-exposed to Block 9, but failed for the second time. After explicit training on both tasks in Block 9 he passed the test. He passed Block 10 immediately, but required explicit training on Block 11. He passed Block 12 immediately, but failed Block 13, with all errors occurring on the I-YOU/HERE-THERE double reversals. He received explicit training on double reversals, but failed a second exposure to Block 13. He subsequently commenced explicit training on all three tasks in Block 13, but after

24 trials, the training terminated when the subject indicated that he did not wish to continue.

At this point in the experiment with Subject 2, each of the three individual tasks contained within Block 13 was identified: I-YOU reversals within simple HERE-THERE relations, HERE-THERE reversals, and I-YOU/HERE-THERE double reversals. Subject 2 received explicit training and testing on each of the three tasks, beginning with I-YOU reversals in simple HERE-THERE relations. This was followed by training and testing on HERE-THERE reversals. The subject was then exposed to training and testing on a combination of these two tasks (i.e., Block 12) and he passed. He was then exposed to two cycles of explicit training and testing on double reversals. After completing explicit training and testing on each of the three tasks in Block 13, he received explicit training for the second time on this block. After 32 trials, there appeared to be little improvement in the subject's performance, so alternating the presentation of single and double reversals was introduced. That is, each trial containing a single reversal (either an I-YOU reversal or a HERE-THERE reversal) was followed by a double reversal. In addition, in order to facilitate discrimination of these two types of reversal, the words "Listen very carefully" were introduced before the instructions in double reversals (but not in single reversals). After a further 60 trials, there appeared to be no improvement in the subject's performance and the training terminated. In summary, although Subject 2 had received explicit training, and demonstrated competence, on the three individual tasks contained within Block 13, he had failed on two occasions to complete training on the whole block.

At this point, the experiment focused once again on the three individual tasks in Block 13 and a "shaping" procedure was implemented in order to establish correct responding on the whole block. During the shaping intervention, each task was trained consecutively to a criterion of six consecutively correct responses (i.e., six out of six I-YOU reversals in simple HERE-THERE relations, followed by six out of six HERE-THERE reversals, followed by six out of six I-YOU/HERE-THERE double reversals). This same procedure was then repeated, except that each task was trained to a criterion of four consecutively correct responses. This procedure was then repeated twice more, except that the criterion was set at two and one consecutively correct response(s), respectively. Immediately thereafter, the subject was exposed to the standard (randomised) procedure for training Block 13. He required one cycle of training on Block 13 as a whole before eventually passing the test.

In summary, Subject 2 required extensive training in order to complete the second level of the extended protocol. He demonstrated particular difficulty with Block 13 as a whole, in which I-YOU reversals in simple HERE-THERE relations, HERE-THERE reversals and I-YOU/HERE-THERE double reversals were combined, and yet he trained with relative ease when these relations were presented individually. He eventually passed Block 13 with the implementation of a shaping procedure.

At this point in the study, a possible spurious form of stimulus control was identified that may have been operating across most, if not all, of the reversal trials. More specifically, it seemed possible that the presentation of one "if" statement (e.g., "If I was you and you were me") controlled the appropriate response, irrespective of the content of the statement. Similarly, the presentation of two "if" statements (e.g., "If I was you and you were me, and if here was there and there was here") might also control the appropriate response based on the presence of two "if's" rather than the actual content of these statements. In order to check for this form of stimulus control, a *foil* for each of the three tasks presented in Block 13 was introduced before continuing with this subject. There were three types of foil, one for I-YOU reversals in simple HERE-THERE relations, one for HERE-THERE reversals, and one for I-YOU/HERE-THERE double reversals. Each foil was presented twice and the presentation of foils was randomised among the twelve trials normally presented in Block 13 (i.e., making a total of eighten trials). During a foil for an I-YOU reversal, the experimenter said "If I was me and you were you" rather than "If I was you and you were me". During a foil for a HERE-THERE reversal, the experimenter said "If here was here and there was there" rather than "If here was there and there was here". The foil for the double reversal contained the combination of the two previous foils, and the experimenter said "If I was me and you were you, and if here was here and there was there". In order for the subject to respond correctly when presented with each of these foils, he would have to discriminate the actual content of the statements rather than simply responding to the absence or number of "if" statements. Subject 2 passed his first exposure to Block 13 when it contained foils, thus indicating that the spurious form of stimulus control described above had not in fact emerged for this subject. He subsequently passed Block 14 and Block 14 with foils, respectively.

After completing Block 14 with foils, he was exposed to Block 15. During this generalisation test, the red and white chairs were replaced by yellow and brown doors (as with the previous subject), and Subject 2 passed Block 15 immediately and subsequently passed the same test with foils. He was subsequently re-exposed to Block 15 with foils using another novel set of stimuli (blue and black walls) and passed immediately. This marked the end of the extended protocol for Subject 2.

To summarise his performances on Levels 1 and 2, Subject 2 required limited training on Level 1 and extensive training on Level 2, especially with Block 13. After the successful implementation of a shaping procedure, he subsequently passed Blocks 13 and 14 with foils and also passed Block 15 with novel stimuli and with foils. Because of time constraints, follow-up tests were not employed with Subject 2 and he was immediately exposed to the abbreviated protocol after completing Level 2. The abbreviated protocol for this subject consisted of five blocks; 4, 10, 12, 14 and 15.

Reversal 1. In Reversal 1, Subject 2 failed the first exposure to Block 4 by responding consistently in accordance with the previous contingency arrangements. He required one cycle of training before passing Block 4. He also required explicit training on Blocks 10, 12, and 14, but passed Block 15 (generalisation test) immediately.

Reversal 2. After completing Reversal 1, Subject 2 was exposed to Reversal 2, in which the original contingency arrangements were reinstated. He failed the first exposure to Block 4 by responding consistently in accordance with the previous reversed contingency arrangements. After a short cycle of training, he passed the second exposure to Block 4. He passed blocks 10, 12 and 15 immediately, but required one short cycle of training in order to pass Block 14. This marked the end of the experiment for Subject 2.

The performances of Subject 2 may be summarised as follows. In the extended protocol, Subject 2 required explicit training on Blocks 2, 3 and 5 of Level 1 before responding in accordance with the perspective-taking frame of I-YOU generalised to novel stimuli. He required extensive training at Level 2, especially on Block 13 and he eventually passed this test with the successful implementation of a shaping procedure. After this intervention, he subsequently passed Blocks 13 and 14 with foils, and also passed Block 15 with novel stimuli and foils. In Reversal 1 he required explicit training on four of the five blocks, but he passed the generalisation test without training. In Reversal 2, he required explicit training on Blocks 4 and 14 and passed the generalisation test immediately.

DISCUSSION

The primary purpose of the current study was to develop a training and testing protocol for analysing two of the three deictic perspective-taking frames, namely I-YOU and HERE-THERE, and some of the relational networks that may be constructed from these frames. The study also attempted to demonstrate that responding in accordance with these frames and networks can be usefully approached as generalised operant behaviour. In broad terms, the current research appears to have achieved these two goals.

A total of six table-top tasks were developed to test and train the two perspective-taking frames and relational networks, and a protocol of fifteen testing/training blocks was developed that incorporated these tasks. The fifteen tasks were divided into two levels: Level 1 involved I-YOU relations and Level 2 involved HERE-THERE relations. Subject 2 demonstrated that many of the relations tested within the protocol did not appear to be present in his behavioural repertoire prior to the training employed in the current study. Furthermore, this training successfully established not only the relations targeted by the protocol, but also facilitated generalisation to novel stimuli. Both subjects were exposed to ABA contingency reversals and the results indicated that the perspective-taking repertoires established in the protocol were a class of generalised operant behaviours.

Although overall, the two subjects successfully completed all parts of the training and testing to which they were exposed, each of them showed specific difficulties in various parts of the protocol. For Subject 1, her primary difficulty appeared to occur on the double reversals in Level 2. At the present time, one can only speculate as to the reasons for these specific difficulties. It does seem likely, however, that double reversals are rarely, if ever, encountered in natural discourse, and this may account in part for the difficulty observed on these tasks. Other issues of complexity are almost certainly involved, however. This was perhaps best illustrated by the difficulty encountered by Subject 2 in Block 13. This subject successfully responded in accordance with each of the three tasks in this block when they were presented independently, but repeatedly failed to do so when the tasks were presented randomly within a single block. These data indicate that individual relational responses may be present in a child's repertoire, but subsequently break down when a series of tasks requires that each of these responses be emitted successively in a relatively random order. Reasons for such break-down are again unclear at the present time, but the phenomenon of behavioural momentum may well be relevant here (Mace, Mauro, Boyajlan & Eckert, 1997). For example, it could be argued that the shaping intervention used with Subject 2 served to increase behavioural momentum for each of the relational responses before they were again presented randomly in a single block. Thus, any competition among the relational responses was overcome by this increased momentum. Of course, future research will be required to examine this issue more fully.

The current procedures were clearly successful in generating the target relational performances, but it does seem likely that the subjects' pre-experimental histories played a significant role. The protocol employed the language of the wider verbal community within which the children resided, and until the contingency reversals were introduced, all of the reinforced performances were consistent with the practices of that verbal community. The difficulty displayed by Subject 1 in Reversal 1 is a case in point. Admittedly, this approach reduces the experimental precision within the study, but employing natural language makes it more likely that non-behavioural researchers will find the current work more relevant to their own interests. Furthermore, the current work may have more immediate applied significance than a study that employed non-linguistic stimuli such as nonsense syllables or abstract shapes. But of course, there is no reason to suspect that, with appropriate training, such stimuli could not be substituted for the natural language stimuli used in the current study.

The current study was designed to develop a protocol that would provide the first experimental analysis of perspective-taking from a purely behaviour-analytic approach. From the outset, an attempt was made to incorporate into the protocol a wide variety of the relational networks that can be constructed from two of the three deictic relational frames. It was not intended, however, to analyse with detailed precision the specific sources of stimulus control involved in the subjects' performances. Nevertheless, a check was made for artifactual stimulus control by the simple absence and presence of "if" statements when a number of foils were introduced into some of the blocks used with Subject 2. Of course, other sources of spurious stimulus control might be identified in future studies, and this will constitute one important direction for subsequent research involving the protocol developed here.

The work presented in this chapter constitutes the final piece of empirical research of the current thesis. In the next and final chapter, a summary of each of the studies is provided and some of the broader theoretical and conceptual issues raised by the work are considered.

Chapter Seven

Chapter 7

General Discussion

The purpose of this chapter is to provide the reader with a brief summary of the empirical work presented in Chapters 2-6. Having summarised the work from Chapter 2 and 3, some of the relevant theoretical issues arising from these two chapters will be considered. Summaries of Chapters 4 and 5 will then be provided, and once again some of the broader theoretical issues reviewed. A summary of Chapter 6 will then follow including consideration of one specific theoretical issue arising from this work.

Chapters 2 and 3: Summary

The main purpose of the first study (Chapter 2) was to determine whether exemplar training would readily facilitate the transformation of function in accordance with symmetry. Sixteen children, aged between four and five years, were employed across four experiments (i.e., four children each in Experiments 1 to 4). In Experiment 1, subjects were first trained to name two actions and two objects by demonstrating listening, echoic and tacting behaviours (e.g., hear name → point to object, hear name → say name, see object→ say name, respectively). This name training served to establish that each of the subjects could clearly discriminate the experimental stimuli. Subjects were then trained in an action-object conditional discrimination using the previously named actions and objects (e.g., when the experimenter waved, choosing a toy car was reinforced, and when the experimenter clapped, choosing a doll was reinforced). Subjects were then re-exposed to the name training, before exposure to a test for derived object-action symmetry relations (e.g., experimenter presents toy car → child waves and experimenter presents doll → child claps). Across subsequent sessions, a multiple-baseline design was used to introduce exemplar training (i.e., explicit symmetry training) for those subjects who failed the symmetry test. Experiment 2 replicated Experiment 1, except that the name retraining (between the conditional discrimination training and symmetry test) was removed. Experiment 3 replicated Experiment 1, except that subjects were trained to tact all of the actions and objects during conditional discrimination training and symmetry testing. Experiment 4 replicated Experiment 1, except that the trained and tested relations were reversed (i.e., train object-action, test action-object relations). Across the four experiments, thirteen out of sixteen subjects failed to show derived object-action (Experiments 1-3) or action-object (Experiment 4) symmetry until they received explicit symmetry training. Overall, the data were consistent with RFT.

The main purpose of the second study was to extend the findings in Chapter 2, and to determine whether exemplar training in symmetry relations would readily facilitate the transformation of function in accordance with symmetry when subjects were *not* provided with explicit name training. The study also examined whether pretraining that was formally similar to the symmetry test, but did not reinforce symmetry relations, would have the same facilitative effect as exemplar training. Sixteen children, aged between four and five years, were employed across three experiments (i.e., four children each in Experiments 5 and 6, and eight children in Experiment 7). In Experiment 5, subjects were trained in an action-object conditional discrimination using familiar actions and objects (e.g., when the experimenter waved, choosing a toy car was reinforced, and when the experimenter clapped, choosing a doll was reinforced). Subjects were then exposed to a test for derived object-action symmetry relations (e.g., experimenter presents toy car → child waves and experimenter presents doll → child claps). Across subsequent sessions, a multiple-baseline design was used once again to introduce exemplar training (i.e., explicit symmetry training) for those subjects who failed the symmetry test. Experiment 6 replicated Experiment 5, except that the trained and tested relations were reversed (i.e., train object-action, test action-object relations). Experiment 7 replicated Experiment 5, except that subjects were exposed to object-action pretraining. Across Experiments 5 to 6, none of the eight subjects show derived object-action (Experiment 5) or action-object (Experiment 6) symmetry until they received explicit symmetry training. Pretraining object-action responding in Experiment 7 appeared to facilitate symmetry, but only for four of the eight subjects. For the four subjects who failed, symmetry emerged following exposure to exemplar training. Overall, the data were very similar to those obtained in Chapter 2, and were once again consistent with RFT.

Theoretical Issues

Chapter 2. One might be tempted to view the data presented in Chapter 2 as evidence against the argument that naming mediates, or plays an important role in, derived symmetry responding (e.g., Dugdale & Lowe, 1990; Eikeseth & Smith, 1992; Horne & Lowe, 1996; see also Stromer, McKay & Remmington, 1996). More specifically, thirteen of the sixteen subjects in Chapter 2 failed to demonstrate derived symmetry although they had been trained to name all of the relevant actions and objects. Perhaps, however, it might be argued that the name training provided was in some way inappropriate for facilitating symmetry responding. For example, training intraverbal name-sequences (e.g., car-doll-car-doll, etc.) might have been more effective than training listening, echoic, and tacting behaviours for each individual stimulus (see Lowe & Beasty, 1987). Alternatively, training a common name to the stimuli in each of the designated classes might have proven more successful than training different names (see Dugdale & Lowe, 1990; Eikeseth & Smith, 1990). In any case, perhaps a history of naming was necessary for the explicit symmetry training to generate the derived symmetry observed in this study. Indeed, it could be argued that such a history was instrumental in providing the subjects with some form of covert naming strategy (such as intraverbal naming) that was only brought into play after the explicit symmetry training was introduced. Many more studies will be required to address these issues.

One might also argue that the name training employed here might have hindered the derivation of symmetry because the trained names were incongruent with the experimenter-designated classes. Perhaps, for example, a subject incorrectly clapped when presented with a toy car because the names "car" and "clap" participated in pre-experimentally established relations. Although this may have occurred in some instances, there was no reason to suspect that these types of relations were widely established in the behavioural repertoires of the subjects (e.g., why would the words "clap" and "car" be related more strongly than "clap" and "doll"?). Furthermore, the assignment of objects and actions was randomised across subjects, and thus it is difficult to explain, in terms of incongruent name training, why all but three subjects failed to show symmetry before exemplar training in Experiments 1 to 4. In other words, if previously established relations between the names employed in the study were a powerful determinant of test performance. then surely the random assignment of objects and actions would have. by chance, produced many more successful test performances before the exemplar training was introduced. Finally, if one argues that the previously established name relations hindered symmetry responding, it remains unclear why explicit symmetry training was so effective, even when subjects continued to name the stimuli and actions (e.g., during Experiment 3).

The study in Chapter 2 was clearly based on RFT, and the data appear to be broadly consistent with this theory. As outlined in the discussion of that chapter, however, the data do not directly contradict naming theory (Horne & Lowe, 1996). Nevertheless, it would be difficult to argue that the data are consistent with this account. On balance, the data *are* consistent with accounts other than RFT, such as the Stimulus Control Topography Coherence (SCT) Theory offered by Dube and McIlvane (1996). More specifically, one could argue that the exemplar training served to establish coherence between the SCTs the experimenter intended to generate and the SCTs actually generated by the contingencies (McIlvane, Serna, Dube & Stromer, 2000). At this point, it is important to stress, however, that the current study was not designed to render one or more theoretical accounts invalid. In fact, it seems unlikely that such a study will ever be forthcoming (see Barnes, 1994; Barnes & Roche, 1996). Nevertheless, in due course one of the currently available theoretical accounts may be found to pertain to a broader array of data, or suggest a larger number of new and useful empirical investigations. In this regard, it is noteworthy that RFT set the occasion for the present study and others like it (e.g., Healy, Barnes-Holmes & Smeets, 1998; 2000).

Chapter 3. Although the data from Chapter 3 provide further evidence to support the efficacy of exemplar training in generating derived relational responding in young children, it would be unwise to assume that exemplar training is the only relevant behavioural process responsible for these effects. Most of the actions and objects that were used in the study were familiar to the children, and thus these stimuli may well have participated in pre-experimentally established name relations. Insofar as this was the case, this history of pre-experimental naming may have played an important role in generating the derived symmetry performances. On balance, it should be noted that none of the children consistently named aloud all of the actions and objects during the experiments, and furthermore some of the children failed to name any of the stimuli throughout their participation in the study. Nonetheless, it could be argued that private or covert naming occurred, and thus one must be cautious in dismissing any role for naming in accounting for the observed performances. However, adopting this particular stance renders the naming hypothesis, as articulated by Horne and Lowe (1996), almost unfalsifiable (i.e., it is notoriously difficult to monitor reliably the private verbal behaviour of research participants; see Hayes, 1986).

Perhaps a broader theoretical issue is more relevant in the current context. When the findings from Chapter 3 are considered alongside the data obtained in Chapter 2, Horne and Lowe's naming hypothesis, relative to RFT, appears to be the weaker account. From the perspective of RFT, naming behaviour makes available large numbers of stimuli and responses (i.e., heard and spoken words) by which numerous examples of bi-directional responding may be explicitly trained. Specifically, RFT suggests that explicitly reinforced name-object and object-name relations provide a history of explicit symmetry training. In this way, naming provides one important way in which the generalised operant of derived symmetry may be established across exemplars (see Barnes, 1994, 1996; Barnes & Holmes, 1991; Barnes & Roche, 1996; Barnes-Holmes & Barnes-Holmes, 2000; Hayes, 1991, 1994; Hayes & Hayes, 1989). From this RFT perspective, therefore, naming does not produce symmetry directly, but instead provides the type of history and some of the contextual cues that control the relational operant of symmetry. Accordingly, a history of naming may enhance symmetry responding, but it is neither necessary nor sufficient for such responding to occur (Hayes, 1996). The key process is symmetry training, not naming *per se*. The naming hypothesis and RFT, therefore, make different predictions regarding the facilitative effect of naming on symmetry responding. The former predicts that naming should normally function as a very powerful intervention for remediating deficits in derived symmetrical responding. In contrast, RFT predicts that exemplar training should be the most powerful intervention in this regard. Clearly, the research reported in Chapters 2 and 3 provide strong support for RFT, relative to the naming hypothesis, in that explicit symmetry training proved to be far more effective in generating derived symmetry than name training.

Chapters 4 and 5: Summary

The study described in Chapter 4 constituted the first attempt to generate repertoires of relational responding, as generalised operant behaviours, when they were found to be absent in young children, using interventions suggested by RFT. Three children, aged between four and six years, were employed in the study. A basic problem-solving task was developed to test and train patterns of relational responding in accordance with more-than and less-than. This task involved presenting a child with two or three identically sized paper coins. On each trial, the experimenter described how the coins compared to one another in terms of their value, and the child was then asked to pick the coin that would buy as many sweets as possible. All three subjects failed to pass baseline tests for responding in accordance with the relational frames of more-than and less-than. Interventions suggested by RFT, including training and testing across stimulus sets, were then successfully used with all subjects to establish these relational responses. These procedures were also used to establish increasingly complex patterns of relational responding in all three subjects. Generalisation tests also demonstrated that the relational responding successfully generalised to novel stimuli and experimenters. In addition, the use of a non-contingent reinforcement condition for one subject, during which no improvement was made, together with contingency reversals for all three subjects, indicated that the trained and tested relational responding in accordance with more-than and less-than may be considered a form of generalised operant behaviour. These findings lend positive support to RFT's approach to derived relational responding, and to the functional analysis of human language and cognition.

The study described in Chapter 5 constituted another attempt to generate specific repertoires of relational responding, as generalised operant behaviours, when they were found to be absent in young children, using interventions suggested by RFT. Three children, aged between four and six years, were employed in the study. A basic problem-solving task was developed to test and train patterns of relational responding in accordance with opposite. To test and train responding in accordance with the relational frame of opposite, another problem-solving task was designed, in which subjects were presented with various numbers of coins and instructed, for example: "This coin buys many (or few) sweets, and is opposite to this coin, which would you take to buy as many sweets as possible". All three subjects failed to pass baseline tests for specific patterns of opposite responding. Interventions suggested by RFT, including training and testing across stimulus sets, were then successfully used with all subjects to establish these relational responses. These procedures were also used to establish increasingly complex patterns of relational responding in all three subjects. Generalisation tests also demonstrated that the relational responding successfully generalised to novel stimuli and experimenters. In addition, the use of a non-contingent reinforcement condition for one subject, during which no improvement was made, together with contingency reversals for all three subjects, indicated that the trained and tested relational responding in accordance with the relational frame of opposite may be considered a form of generalised operant behaviour. These findings once again lend positive support to RFT's approach to derived relational responding, and to the functional analysis of human language and cognition.

Theoretical Issues

Chapters 4 and 5. Although the research presented in these chapters was clearly generated by RFT, alternative interpretations of the data are possible. In Experiment 8, for example, it could be argued that the children learned initially to respond to the first coin in the sequence when given "More" (i.e., when the experimenter specified a "more-than" relation) and to respond to the last coin in the sequence when given "Less" (i.e., when the experimenter specified a "less-than" relation). In other words, the training procedures established two stimulus classes, with the S+ and S- functions of the two classes determined by the words "More" and "Less." One might argue that a functionally similar effect was reported by Vaughan (1988) who established two stimulus classes by means of repeated reversal training with pigeons. Nevertheless, it is important to recognise that Vaughan employed the same stimuli throughout the entire study, and thus the two stimulus classes were directly trained (see Hayes, 1989). In Experiment 8, however, many novel stimulus sets were introduced and responding to these sets came under the contextual control of "More" and "Less" in the absence of explicit reinforcement. Furthermore, this performance itself came under the contextual control of "Would" and "Would-Not," and finally these contextually controlled performances were successfully manipulated across two contingency reversals. Even if one chooses not to interpret these data in terms of RFT, the results of Experiment 8 do significantly extend the findings reported by Vaughan (1988).

A broadly similar argument could be made with respect to the data reported in Experiment 9. In this experiment subjects often chose multiple coins or objects in particular sequences, and thus one might interpret these performances in terms of sequence classes or order relations (see Green, Stromer & Mackay, 1993). One problem in doing so, however, is that all three subjects spontaneously reversed their response sequences during some of the test trials, and this pattern contradicts one of the key definitions of a sequence class or order relation (i.e., such relations are asymmetrical). In any case, even if one employs the language of sequence classes, the current data clearly extend the research in this area by demonstrating that such classes can come under complex forms of contextual control (Many/Few and Would/Would-Not), and can be manipulated via contingency reversals. Furthermore, the directly trained sequence responses that define such classes can generalise to novel stimuli, even when those stimuli are greater in number than those presented during the initial sequence class training. At the very least, therefore, the RFT-based research presented here has helped to supplement and extend previous findings reported in the literature on stimulus classes.

Notwithstanding the foregoing argument, RFT points to complexities that are not immediately apparent using class-based interpretations of the data from Chapters 8 and 9. For example, the relational performances obtained in these studies constitute only a small number of the possible response patterns that define a relational frame. Consider, for instance, the frame of more-than and less-than. As indicated in the introduction to Chapter 4, with three elements a total of 12 different trial-types could be constructed using the linear problem-solving task. Furthermore, this number increases to 24 trial-types if both linear and nonlinear sequences with the A, B and C coins/objects are presented in all possible positions (e.g., B>A<C, etc.). If additional elements are then added, this number increases exponentially (i.e., four elements requires 192 trial-types and five requires 1,920 trial-types). Clearly, an exhaustive analysis of the more-than/less-than relational frame is far from a simple matter. As demonstrated in Experiment 9, however, it seems unlikely that an individual would have to be trained on all possible trial-types in order to produce all possible response patterns in accordance with a particular relational frame. What subset of trial-types must be taught is an empirical matter and could well be the source of many studies over the coming years.

The foregoing points to one possible criticism of Experiment 8. Because the children were trained and tested on the same four trial-types using only two or three elements, one might argue that the test performances, even on novel stimulus sets, were not indicative of *derived* relational responding (i.e., the children were exposed to novel stimuli, but not novel trial-types, during the tests). In transitive inference research (Bryant & Trabasso, 1971; Russell, McCormack, Robinson & Lillis, 1996; von Ferson, Wynne, Delius & Staddon, 1991; see also Green, Stromer & Mackay, 1993, for an excellent review), for example, subjects may be trained on a number of stimulus pairs (e.g., A>B; B>C; C>D; D>E) and then tested on two or more nonadjacent pairs (B>D?). In this case, different trial-types are used across training and testing, and thus one might argue that the test performances are genuinely derived. Notwithstanding this issue, in Experiment 9 subjects were systematically exposed to novel trial-types by increasing the number of coins/objects, and in each case the subjects eventually produced derived relational performances (i.e., response patterns that had not been trained using a previous stimulus set). In any case, it is important to recognise that the work presented in Chapters 4 and 5 was primarily concerned with developing procedures for establishing and manipulating relational performances, as defined by RFT, and demonstrating their generalised operant-like qualities, rather than testing a particular cognitive or non-human model of transitive inference.

Chapter 6: Summary

From a relational-frame perspective, a child learns to take a perspective through a history of exemplar training in arbitrarily applicable relational responding. In Chapter 6 it was argued that the emergence of deictic relations such as "I and you", "here and there" and "now and then" is critical to the development of perspective-taking. A testing and training protocol was developed to analyse responding in accordance with the deictic relations of I-YOU and HERE-THERE. Two case studies that employed this protocol were presented in which complex forms of generalised perspective-taking were established for two young children. The findings suggested that behaviour analysis may have an important contribution to make to the study of perspective-taking.

Theoretical Issues

Once again this study was clearly generated by RFT, but an alternative interpretation of the data in terms of stimulus classes is possible. It could be argued, for example, that simple I-YOU and HERE-THERE training established stimulus classes rather than what were called deictic relations. Consider, for example, the following questions; “I am sitting on the blue chair and you are sitting on the black chair. Where am I sitting? Where are you sitting?” The correct answers to these questions may be interpreted as demonstrating the formation of two two-member stimulus classes, in which “I” enters into a class with “blue chair” and “you” enters into a class with “black chair”. Furthermore, when I-YOU reversals were trained, this simply demonstrated a form of contextual control over class membership. That is, given the statement “If I was you and you were me” the “blue chair” enters into a class with “you” and “I” enters into a class with “black chair”. This same general interpretive strategy might also be applied to all of the performances reported in Chapter 6, but of course the complexity of such analyses would likely become extremely cumbersome. Furthermore, the data were not generated by a class-based approach to perspective-taking and there would appear to be little advantage in adopting such an approach in a purely post-hoc fashion. In addition, class-based analyses of complex relational responding have previously been shown to be problematic (e.g., Dymond & Barnes, 1995; Hayes & Barnes, 1997).

A more general issue arising from the work reported in Chapter 6 relates to the fact that a traditional single subject, behaviour-analytic approach to the analysis of deictic relational responding was employed. In contrast, future research might incorporate the protocol developed here into a cross-sectional developmental study. That is, large groups of children of differing ages could be exposed to selected tasks from the protocol to determine whether there are characteristic developmental patterns across age groups. In conducting this type of research, however, RFT predicts that there would likely be necessary and important interactions between deictic frames and networks, and other relational frames and networks (e.g., if . . then, before-after, and hierarchical frames) (see Hayes et al, 2001).

Clearly, the RFT approach to perspective-taking is relatively new, but there are more established approaches in mainstream psychology. Perspective-taking has traditionally been interpreted within the broader context of 'Theory of Mind' (Baron-Cohen, Tager-Flusberg & Cohen, 2000). Tasks derived from this theory are often conducted as part of training programmes for establishing or facilitating theory of mind skills in young children such as those diagnosed as autistic (Howlin, Baron-Cohen & Hadwin, 1999; Reed & Peterson, 1990). According to RFT, the tasks commonly used to establish theory of mind indirectly involve training in relational perspective-taking (i.e., establishing responding in accordance with I-YOU, HERE-THERE and NOW-THEN). From this perspective, therefore, a more effective means of establishing these repertoires would be to target the relational frames directly, thereby focusing the training on the largely verbal nature of the behaviour involved. Clearly, considerable research will be required to fully test this bold prediction by RFT.

The RFT approach to perspective-taking might also be of some interest to cultural psychologists. Benson (2001), for example, has argued recently that a very important aspect of the development of a sense of self is the verbal location of oneself in a time and place relative to others. In a sense, therefore, perhaps behavioural psychology and cultural psychology are beginning to approach the treatment of self in broadly similar ways. That is, both psychologies see the "self" as largely verbally constructed, but adopt different approaches to the study and definition of what it means to *verbally construct oneself.* Indeed, the fact that two different psychological traditions are drawing broader similar conclusions would seem to suggest that the current approach to perspective-taking may well have significant value.

Concluding Comment

In the studies reported in the current thesis, operant contingencies were employed to train and manipulate specific patterns of relational responding in young children. In closing I would like to make clear my rationale in conducting this type of research. I attempted to use a behavioural theory (RFT), grounded largely in basic research, to guide me in my efforts to establish particular behavioural repertoires in young children. As such, I see the current research as making a contribution towards building bridges between basic and applied research domains. I clearly acknowledge that many of the so-called RFT interventions reported here are similar to those reported previously in the applied literature, and I am not attempting to suggest otherwise. In fact, RFT is a behavioural theory insofar as it draws on a range of different behavioural principles and procedures to explain complex human behaviour (see Barnes-Holmes, Dymond, Roche & Grey, 1999; Hayes, 1996; Hayes et al., 2001). The overarching aim of the research reported here, therefore, was to determine whether RFT, as a basic behavioural theory, would successfully guide me in my efforts to establish and manipulate specific patterns of relational responding in young normally developing children. The data gathered thus far indicate that RFT may indeed be useful in this regard.

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Appendices

Subject 1: Experiment 8: Responding in Accordance with More-than and Less-than

Proced.	Type	W/Not	S'n	Set	Coins	A-B More	A-B Less	B-C More	B-C Less	A-B-C More	A-B-C Less	Total Corr.	Perf.
						/ 4	/ 4	/ 4	/ 4	/ 4	/ 4	/ 24	
	Baseline												
Test	**Arbitrary**	W	1	1		2	0	1	2	3	0	**8**	Fail
"		"	2			2	0	1	2	2	1	**8**	Fail
"		"	3	2		4	0	2	0	4	0	**10**	Fail
"		"	4			2	1	2	3	4	1	**13**	Fail
"		"	5	3		3	1	1	1	2	0	**8**	Fail
"		"	6			2	2	1	3	0	2	**10**	Fail
	Intervention												
Train	To 8 CCR's	W	7		(A-B)	1	0						
						3	3						
						2	3						
			8			2	3						
						2	3						
	Remove & Retry					3	2						
						3	3						
						4	2						
						3	3						
						3	2 *						77
	"		9		(B-C)			3	3				
								4	3				
								4	3				
								1	*				25
	"		10		(A-B-C)					3	2		
										1	2		
										4	2		
			11							3	3		
										1	1 *		34
													136
Test		W		4		4	4	4	4	4	1	**21**	Fail
Train		W	12		(A-B-C)					4	3		
										2	4 *		**14**
Test		W		5		4	4	3	4	4	4	**23**	Pass
						W	**N**	**W**	**N**	**W**	**N**		
Test		W/N	13			2	4	4	3	4	3	**20**	Fail
Train		W/N	14		(A-B)	3	4						
						3	1 *						12
					(B-C)			4	4 *				8
					(A-B-C)					4	4 *		8
													28
Test		W/N		6		4	4	2	4	4	3	**21**	Fail
Train		W/N	15		(A-B)	3	4						
						4	3						
						4	3						
						2	4						

Appendix 1
Subject 1: Experiment 8

						A-B		B-C		A-B-C		Total	
Proced.	**Type**	**W/Not**	**S'n**	**Set**	**Coins**	**More**	**Less**	**More**	**Less**	**More**	**Less**	**Corr.**	**Perf.**
						/ 4	**/ 4**	**/ 4**	**/ 4**	**/ 4**	**/ 4**	**/ 24**	
						4	3						
						1	1 *						42
			16		(B-C)			4	4 *				8
					(A-B-C)					4	3		
										3	3 *		14
													64
Test		W/N		7		4	3	4	2	4	4	**21**	Fail
Test		W/N	17			3	4	4	4	4	4	**23**	Pass
Test	**Text Only**	W/N	18			4	2	4	3	4	4	**21**	Fail
Test	**Text Only**	W/N	19			4	4	4	4	4	4	**24**	Pass
Test	**Vertical**	W/N	20			4	4	3	4	4	4	**23**	Pass
Test	**Vertical**	W/N	21	8		4	4	4	4	4	3	**23**	Pass
Test	**Gen.**	W/N	22	CD's		4	4	4	4	4	4	**24**	Pass
Test	**Follow-up**	W/N	23	9		4	4	3	3	3	3	**20**	Fail
Test	**Follow-up**	W/N	24			4	4	4	4	4	4	**24**	Pass
	Reversal 1												
						More	Less	More	Less	More	Less		
Train		W	25		(A-B)	3	3						
						1	1*						10
					(B-C)			0	4				
								3	4				
								1	1*				18
			26		(A-B-C)					1	1		
										3	1		
										4	4*		24
													52
												13/24	
Test		W	27	10		3	4	2	1	1	0	**11**	Fail
Train		W	28		(A-B)	4	4*						8
					(B-C)			4	4*				8
					(A-B-C)					4	4*		8
													24
												17/24	
Test		W		11		1	3	0	3	0	0	7	Fail
Train		W	29		(A-B)	2	2						
						2	3						
						3	3						
						4	3						
						1	2*						35
					(B-C)			3	4				
								3	4				
Train		W	29		(B-C)			1	1*				18
					(A-B-C)					3	4		
			30							4	4*		16
													69

Appendix 1
Subject 1: Experiment 8

Proced.	Type	W/Not	S'n	Set	Coins	A-B More	Less	B-C More	Less	A-B-C More	Less	Total Corr.	Perf.
						/ 4	/ 4	/ 4	/ 4	/ 4	/ 4	/ 24	
												(2/24)	
Test		W		12		4	4	3	4	3	4	**22**	Pass
						W	N	W	N	W	N	**(2/24)**	
Test		W/N	31			4	3	4	4	3	4	**22**	Pass
												(1/24)	
Test	**Gen.**	W/N	32	Books		3	4	4	4	4	4	**23**	Pass
	Reversal 2												
Train		W	33		(A-B)	3	3						
						2	2*						12
					(B-C)			4	4*				8
					(A-B-C)					4	4*		8
													28
Test		W		13		3	1	1	1	3	0	**9**	Fail
Train		W	34		(A-B)	4	3						
						-	1*						9
					(B-C)			4	4*				8
					(A-B-C)					4	4*		8
													25
Test		W		14		4	1	0	1	4	0	**10**	Fail
Train		W	35		(A-B)	4	3						
						-	1*						9
					(B-C)			4	4*				8
					(A-B-C)					4	4*		8
													25
Test		W		15		3	4	2	4	4	4	**21**	Fail
Test		W				4	4	4	4	4	4	**24**	Pass
						W	N	W	N	W	N		
Test		W/N				4	3	4	4	4	3	**22**	Pass
Test	**Gen.**	W/N		Pencils		4	4	4	4	4	4	**24**	Pass

* Indicates that the subject reached the mastery criterion.
** Indicates that the subject failed to reach the mastery criterion.
Gen. = Generalisation test

Subject 2: Experiment 8: Responding in Accordance with More-than and Less-than

						A-B		B-C		A-B-C		Total	
Proced.	**Type**	**W/Not**	**S'n**	**Set**	**Coins**	**More**	**Less**	**More**	**Less**	**More**	**Less**	**Corr**	**Perf.**
						/ 4	/ 4	/ 4	/ 4	/ 4	/ 4	/ 24	
	Baseline												
Test	**Arbitrary**	W	1	1		3	4	2	1	1	3	**14**	Fail
"		"				0	4	1	3	0	4	**12**	Fail
"		"	2	2		0	2	1	3	0	4	**10**	Fail
"		"				0	4	1	4	0	3	**12**	Fail
	Intervention												
Train	To 8 CCR's.		3		(A-B)	0	1						
						1	2						
						1	4						
	Remove & Retry					1	2						
						1	3						
			4			0	2						
						0	3						
						1	4						
						0	3						
			5			0	4						
						1	3						
						1	3						
						2	3						**104****
	Non-Arbitrary					**A**	**B**	**B**	**A**				
						More	**Less**	**More**	**Less**				
Test		W	6	N	(A-B)	2	2	2	2			**8**	Pass
						A-B		**B-C**		**A-B-C**			
	Arbitrary					**More**	**Less**	**More**	**Less**	**More**	**Less**		
						/ 4	/ 4	/ 4	/ 4	/ 4	/ 4	/ 24	
Test		W		3		0	4	1	4	0	3	**12**	Fail
	Arbitrary:Non-Arbitrary Interpolated					(Only Arbitrary Recorded)							
Train		W	7		(A-B)	1	2						
						1	3						
						2	3						
			8			1	1						
						1	3						
						4	3						
						3	2						
	Non-Arbitrary Correction Procedure												
			9			1	1						
						2	3						
						0	1						
						4	3						
						1	2*						35
													91
	Arbitrary					**More**	**Less**					/ 8	
Test		W		4	(AB)	2	2					**4**	Fail

Appendix 2
Subject 2: Experiment 8

Proced.	Type	W/Not	S'n	Set	Coins	A-B More	A-B Less	B-C More	B-C Less	A-B-C More	A-B-C Less	Total Corr	Perf.
						/4	/4	/4	/4	/4	/4	/24	
Train		W	10		(A-B)	4	4*						8
					(B-C)			4	4*				8
					(A-B-C)					4	4*		8
													24
Test		W	11	5		4	4	4	4	4	3	**23**	Pass
						W	**N**	**W**	**N**	**W**	**N**		
Test		W/N				4	4	4	3	4	4	**23**	Pass
Test	**Text Only**	W/N				4	4	4	3	4	4	**23**	Pass
Test	**Vertical**	W/N	12			4	3	3	4	2	4	**20**	Fail
Test	**Vertical**	W/N				2	2	1	3	1	2	**11**	Fail
Train	**Vertical**		13		(A-B)	2	3						
						3	4						
						3	1*						
					(B-C)			4	2				
								3	3*				
					(A-B-C)					4	4*		**42**
Test	**Vertical**			6		4	3	4	4	4	3	**22**	Pass
Test	**Gen.**		14	Glasses		4	3	4	4	4	4	**23**	Pass
Test	**Follow-up**		15	7		4	4	3	4	4	4	**23**	Pass
						A-B		**B-C**		**A-B-C**			
						More	**Less**	**More**	**Less**	**More**	**Less**		
	Reversal 1												
Train		W			(A-B)	3	3						
						1	1*						10
			16		(B-C)			4	4*				8
					(A-B-C)					4	4*		8
													26
												(2/24)	
Test		W		8		4	4	4	3	4	3	**22**	Pass
						W	**N**	**W**	**N**	**W**	**N**	**(1/24)**	
Test		W/N	17			4	3	4	4	4	4	**23**	Pass
												(1/24)	
Test	**Gen.**	W/N		Books		4	3	4	4	4	4	**23**	Pass
						More	**Less**	**More**	**Less**	**More**	**Less**		
	Reversal 2												
Train		W	18		(A-B)	3	2						
						1	2*						11
					(B-C)			4	4*				8
					(A-B-C)					4	3		
										1	1*		10
													29
Test		W		9		4	2	4	4	4	4	**22**	Pass
						W	**N**	**W**	**N**	**W**	**N**		
Test		W/N				1	0	1	0	0	0	**2**	Fail
Train		W/N	19		(A-B)	3	4						
						1*							9

Subject 2: Experiment 8

						A-B		B-C		A-B-C		Total	
Proced.	**Type**	**W/Not**	**S'n**	**Set**	**Coins**	**More**	**Less**	**More**	**Less**	**More**	**Less**	**Corr**	**Perf.**
						/ 4	**/ 4**	**/ 4**	**/ 4**	**/ 4**	**/ 4**	**/ 24**	
					(B-C)			4	3				
								3	4				
								1*					17
					(A-B-C)					4	4*		8
													34
Test		W/N		10		4	4	4	3	4	4	**23**	Pass
Test	**Gen.**	W/N		Pencils		3	4	3	4	4	4	**22**	Pass

* Indicates that the subject reached the mastery criterion.

** Indicates that the subject failed to reach the mastery criterion.

Gen. = Generalisation test

Subject 3: Experiment 8: Responding in Accordance with More-than and Less-than

Proced.	Type	W/Not	S'n	Set	Coins	A-B More	Less	B-C More	Less	A-B-C More	Less	Total Corr.	Perf.
						/ 4	/ 4	/ 4	/ 4	/ 4	/ 4	/ 24	
	Baseline 1												
Test	Arbitrary	W	1	1		3	1	2	2	0	2	**10**	Fail
"		"	2			4	3	1	2	2	2	**14**	Fail
"		"		2		1	2	2	2	1	2	**10**	Fail
	Non-Contingent Reinforcement												
	To 8 CCR's	W	3		(A-B)	1	3						
						2	2						
						2	2						
						2	2						
						2	3						
						2	3						
			4			3	2						
						2	2						
						1	2						
						2	3						
						4	1						
						3	2						
						1	1						
						4	2						
						3	2						
			5			2	3						
						2	2						
						1	3						
						2	2						
			6			3	2						
						2	2						
						1	2						
						3	2						
						2	2						
						1	2						
			7			2	2						
						2	2						
						2	2						**224***
	Baseline 2												
Test		W	8	2		1	1	2	4	1	3	**12**	Fail
"		"	9			2	1	2	2	1	1	**9**	Fail
"		"	10	3		2	1	3	2	1	1	**10**	Fail
	Intervention												
Train		W	11		(A-B)	1	1						
						3	2						
			12			3	2						
						3	2						
			13			3	1						
						3	1						

Proced.	Type	W/Not	S'n	Set	Coins	A-B More	A-B Less	B-C More	B-C Less	A-B-C More	A-B-C Less	Total Corr.	Perf.
						/4	/4	/4	/4	/4	/4	/24	
						4	1						
			14			3	2						
						2	2						
						2	2						
			15			1	2						
						2	1						
			16	3		4	1						
						3	2						
			17			4	3						
						-	1*						121
			18		(B-C)			3	1				
								2	3				
								4	2				
			19					2	2				
								3	1				
								3	2				
			20					3	1				
								3	3				
								4	3				
								1	2*				75
			21		(A-B-C)					2	2		
										2	2		
			22							0	3		
										1	2		
			23							0	4		**40****
Train		W	24		(A-B)	4	2						
						3	4						
						1	1*						18
			25		(B-C)			4	4*				8
					(A-B-C)					1	2		**8****
													34**
	2 Coins down first, then third												
			26		(A-B-C)					3	4		
										4	3		
			27							3	3		
										3	4		
										1*	-		33
	Intervention removed												
			28		(A-B-C)					3	4		
										1*	-		9
													293
Test		W	29	4		4	4	4	3	4	4	**23**	Pass
						W	**N**	**W**	**N**	**W**	**N**		
Test		W/N	30			4	2	3	2	4	3	**18**	Fail
Train		W/N	31		(A-B)	3	4						
						2	1*						11
			32		(B-C)			3	4				

Subject 3: Experiment 8

Proced.	Type	W/Not	S'n	Set	Coins	A-B More	Less	B-C More	Less	A-B-C More	Less	Total Corr.	Perf.
						/ 4	/ 4	/ 4	/ 4	/ 4	/ 4	/ 24	
						W	N	W	N	W	N		
								2	1*				11
										4	4*		8
													29
Test		W/N	33	5		3	4	4	4	3	4	22	Pass
Test	Text Only	W/N	34			4	4	4	4	4	3	23	Pass
Test	Vertical	W/N		6		4	4	4	4	4	4	24	Pass
Test	Gen.	W/N	35	CD's		4	4	4	4	4	4	24	Pass
						A-B		B-C		A-B-C			
	Reversal 1					More	Less	More	Less	More	Less		
Train		W	36	6	(A-B)	2	0						
						4	3						
						3	4						
						1	1*						26
					(B-C)			4	4*				8
					(A-B-C)					1	1		
										3	1		
										4	4*		24
	4 Week delay-Returned to AB												
			37		(A-B)	4	3						
						-	1*						9
					(B-C)			4	4*				8
					(A-B-C)					4	4*		8
													83
												(0/24)	
Test		W		7		4	4	4	4	4	4	24	Pass
						W	N	W	N	W	N		
												(0/24)	
Test		W/N				4	4	4	4	4	4	24	Pass
												(0/24)	
Test	Gen.	W/N		Spoons		4	4	4	4	4	4	24	Pass
						More	Less	More	Less	More	Less		
						/ 4	/ 4	/ 4	/ 4	/ 4	/ 4		
Train	Reversal 2	W	38		(A-B)	3	3						
						3	2*						13
					(B-C)			4	4*				8
					(A-B-C)					4	4*		8
													29
Test		W		8		4	4	4	4	4	4	24	Pass
						W	N	W	N	W	N		
Test		W/N				4	4	4	4	4	4	24	Pass
Test	Gen.	W/N		Books		4	4	4	4	4	4	24	Pass

* Indicates that the subject reached the mastery criterion.

** Indicates that the subject failed to reach the mastery criterion.

Gen. = Generalisation test

Subject 1: Experiment 9: Responding in Accordance with Opposite

Proced.	Type	W/N	S'n	Set	No. Coins	Seq.	Coins	A Many		A Few		D Many		D Few		Total Corr.	Perf.
								/ 2		/ 2		/ 2		/ 2			
	Baseline																
Test		W	1	1	**4**	**Hz**		1	1	0	0	0	0	1	1	0	Fail
	Intervention																
Train		W			**4**	**Hz**		2	0	0	0	2	0	2	0		
								0	0	0	0	0	0	0	0		**16****
								A		**B**							
								Many	**Few**	**Many**	**Few**						
	8 CCR's							/ 1	/ 1	/ 1	/ 1						
Train		W	2		**2**	**Rm**	(A-B)	1	1	1	0						
								0	1	1	1						
								1	1	1	1						
								1*									12
										B		**C**					
										Many	**Few**	**Many**	**Few**				
										/ 1	/ 1	/ 1	/ 1				
							(B-C)			1	1	1	1				
										1	1	1	1*				8
																	20
Test		W		2	**2**	**Rm**	(A-B)	1	1	1	1					/ 16	
								1	1	1	1						
							(B-C)			1	1	1	1				
										1	1	1	1			**15**	Pass
								A		**A**		**C**		**C**			
								Many		**Few**		**Many**		**Few**			
								/ 2		/ 1		/ 2		/ 1			
Train		W			**3**	**Hz**		0	0	1	1	1	0	0	1		
			3					0	1	0	0	1	0	1	0		
								0	0	1	0	0	1	1	0		
								0	0	1	0	0	1	1	0		
								0	0	0	0	0	0	0	0		**40****
								A		**B**		**C**					
								Many	**Few**	**Many**	**Few**	**Many**	**Few**				
								/ 1	/ 1	/ 1	/ 1	/ 1	/ 1				
Train		W	4		**2**	**Rm**	(A-B)	0	0	1	1						
								1	1	1	1						
								1	1*								10
							(B-C)			1	1	1	1				
										1	1	1	1*				8
																	18
Test		W		3	**2**	**Rm**	(A-B)	1	1	1	1					/ 16	
								1	1	1	1						
							(B-C)			0	1	1	1				
										1	1	1	1			**15**	Pass

Proced	Type	W/N	S'n	Set	No. Coins	Seq.	Coins	A Many		A Few		C Many		C Few		Total Corr.	Perf.
								/ 2	/ 2	/ 1	/ 1	/ 2	/ 2	/ 1	/ 1		
Train		W			3	Hz		0	1	0	0	1	0	0	0		
								0	1	0	0	0	0	1	0		16**
	"Same"		5					0	0	1	1	0	1	0	1		
								0	2	1	1	2	2	1	1		
								1*									17
Test		W		4	3	Hz		0	2	1	1	2	2	1	1	7	Pass
Test		W	6		3	Rm		2	2	1	1	0	0	0	1	5	Fail
Train		W			3	Rm		1	1	0	1	1	0	0	0		
								2	0	2	2	0	2	2	2		
								0	2	1	1	2	2	1	1		
								2*									25
Test		W	7	5	3	Rm		2	2	1	1	2	2	1	1	8	Pass
								A Many		A Few		D Many		D Few			
								/ 2		/ 2		/ 2		/ 2			
Test		W			4	Hz		0	0	2	0	2	0	0	2	3	Fail
	"Same"																
Train		W	8		4	Hz		2	2	2	2	2	0	0	2		
								2	-	2	-	2	-	2	2*		13
Test		W		6	4	Hz		2	2	2	2	2	2	2	2	8	Pass
Test		W	9		4	Rm		2	2	2	2	2	2	2	2	8	Pass
								A Many		A Few		E Many		E Few			
								/ 3		/ 2		/ 3		/ 2			
Test		W			5	Hz		3	3	0	1	3	3	0	1	4	Fail
Train		W	10		5	Hz		3	3	2	2	3	3	1	2		
								-	-	2*							9
Test		W		7	5	Hz		3	3	2	2	3	3	2	2	8	Pass
Test		W			5	Rm		3	3	2	2	3	3	2	2	8	Pass
								A Many		A Few		F Many		F Few			
								/ 3	/ 3	/ 3	/ 3	/ 3	/ 3	/ 3	/ 3		
Test		W	11		6	Hz		3	3	3	3	3	3	3	3	8	Pass
Test		W			6	Rm		3	3	3	3	3	3	3	3	8	Pass
								W	N	W	N	W	N	W	N		
Test		W/N	12		6	Rm		3	3	3	3	3	3	3	3	8	Pass
Test	Gen.			Cups				3	3	3	3	3	3	3	3	8	Pass
Test	F/Up	W/N	13	8	6	Rm		3	3	3	3	3	3	3	3	8	Pass
								A Many		A Few		D Many		D Few			
	Reversal 1							/ 2	/ 2	/ 2	/ 2	/ 2	/ 2	/ 2	/ 2		
Train		W			4	Hz		0	2	2	2	2	2	2	2		
								-	-	2*							9
	Reversal 1																(0/8)
Test		W		9	4	Hz		2	2	2	2	2	2	2	2	8	Pass
																	(0/8)
Test		W			4	Rm		2	2	2	2	2	2	2	2	8	Pass

Subject 1: Experiment 9

Proced	Type	W/N	S'n	Set	No. Coins	Seq.	Coins	A Many		A Few		E Many		E Few		Total Corr.	Perf.
								/2	/2	/3	/3	/2	/2	/3	/3		(0/8)
Test		W			5	Hz		2	2	3	3	2	2	3	3	8	Pass
																	(0/8)
Test		W			5	Rm		2	2	3	3	2	2	3	3	8	Pass
								A Many		A Few		F Many		F Few			
								/3	/3	/3	/3	/3	/3	/3	/3		(0/8)
Test		W			6	Hz		3	3	3	3	3	3	3	3	8	Pass
																	(0/8)
Test		W			6	Rm		3	3	3	3	3	3	3	3	8	Pass
								W	N	W	N	W	N	W	N		
								/3	/3	/3	/3	/3	/3	/3	/3		(0/8)
Test		W/N			6	Rm		3	3	3	3	3	3	3	3	8	Pass
																	(0/8)
Test	Gen.	W/N		Books	6	Rm		3	3	3	3	3	3	3	3	8	Pass
								A Many		A Few		F Many		F Few			
								W	N	W	N	W	N	W	N		
	Reversal 2							/3	/3	/3	/3	/3	/3	/3	/3		
Train		W/N	14	10	6	Rm		3	3	3	3	3	3	3	3		8
								A Many		A Few		G Many		G Few			
								W	N	W	N	W	N	W	N		
								/4	/3	/3	/4	/4	/3	/3	/4		
Test		W/N		11	7	Rm		4	3	3	4	4	3	3	4	8	Pass
								A Many		A Few		H Many		H Few			
								W	N	W	N	W	N	W	N		
								/4	/4	/4	/4	/4	/4	/4	/4		
Test	Gen.	W/N		Pencils	8	Rm		4	4	4	4	4	4	4	4	8	Pass

* Indicates that the subject reached the mastery criterion.

** Indicates that the subject failed to reach the mastery criterion.

Gen. = Generalisation test

Subject 2: Experiment 9: Responding in Accordance with Opposite

Proced	Type	W/N	S'n	Set	No. Coins	Seq Coins	A Many		A Few		D Many		D Few		Total Corr.	Perf.
	Baseline						/ 2		/ 2		/ 2		/ 2			
Test		W	1	1	4	Hz	2	2	1	2	2	2	1	2	6	Fail
"		"			4	Hz	1	1	1	2	1	1	2	2	3	Fail
"		"		2	4	Hz	1	2	2	2	1	1	2	2	5	Fail
"		"			4	Hz	1	2	2	1	1	2	2	1	4	Fail
"		"		3	4	Hz	1	1	2	2	1	1	2	2	4	Fail
"		"			4	Hz	1	1	2	2	1	1	2	2	4	Fail
	Intervention															
Train	8 CCR's	W	2		4	Hz	1	1	2	2	2	2	1	1		
							2	2	2	2	2	2	2	2*		16
Test		W		4	4	Hz	2	1	1	2	1	1	2	2	4	Fail
Train		W			4	Hz	2	1	1	2	2	1	1	2		
							2	2	2	2	2	1	2	2		
							2	2	2	2	2	1	2	2		
							1	2	2	2	1	2	1	2		
			3				2	-	-	-	2	-	2*	-		35
Test		W		5	4	Hz	2	2	2	2	2	2	2	2	8	Pass
Test		W			4	Rm	1	1	1	1	2	2	2	2	4	Fail
Train		W	4		4	Rm	1	1	1	1	1	1	2	2		
							1	1	1	1	1	1	1	1		16**
	"Same"						1	1	1	2	1	1	2	1		
			5				1	1	1	2	1	1	1	1		
							1	1	1	1	1	2	1	1		24**
							A		A		C		C			
							Many		Few		Many		Few			
							/ 2		/ 1		/ 2		/ 1			
Train		W	6		3	Rm	1	2	2	0	1	2	2	1		
							1	1	1	1	1	1	1	1		
							1	0	1	1	1	2	0	1		
							2	2	0	0	1	2	0	0		
			7				2	2	1	0	1	2	0	1		
							2	2	0	0	2	1	0	0		
							2	2	0	0	1	1	0	0		
							1	2	0	0	2	2	0	1		
							2	2	0	0	2	2	0	0		72**
							A		B							
							Many	Few	Many	Few						
							/ 1	/ 1	/ 1	/ 1						
Train		W			2	Rm (A-B)	1	1	1	1						
							1	1	1	1*						8
						(B-C)			1	1	1	1				
									1	1	1	1*				8
																16

Appendix 5
Subject 2: Experiment 9

Proced Type	W/N	S'n	Set	No. Coins	Seq	Coins	A Many	A Few	B Many	B Few	C Many	C Few			Total Corr.	Perf.
							/ 1	/ 1	/ 1	/ 1	/ 1	/ 1				
Test	W		6	2	Rm	(A-B)	1	1	1	1					/ 16	
							1	1	1	1						
						(B-C)			1	1	1	1				
									1	1	1	1			16	Pass
							A Many		A Few		C Many		C Few			
							/ 2		/ 1		/ 2		/ 1			
Train	W	8		3	Rm		2	2	1	1	2	1	0	1		
							1	1	0	0	2	1	1	1		
							1	1	1	1	2	1	1	1		
		9					1	1	1	1	1	2	1	1		
							2	2	1	0	2	1	0	1		
		10					1	1	0	0	2	2	1	0		
							2	2	1	0	2	1	0	1		
							2	2	0	0	1	1	0	0		64**
"Same"																
Train	W	11		3	Rm		2	2	0	1	2	2	0	2		
							2	2	1	0	1	2	1	0		
							2	2	0	1	2	2	1	0		
							2	2	1	0	2	2	0	1		
		12					2	2	0	0	2	2	1	1		
							2	2	1	0	2	1	0	1		
							2	2	0	0	2	2	1	0		
							2	1	1	1	2	2	1	0		
		13					2	2	0	1	2	1	0	1		
							2	2	1	1	1	1	1	0		
							1	2	1	0	2	2	0	0		
							2	2	0	0	2	2	0	1		
							1	2	0	1	2	2	0	1		
							2	2	0	1	2	2	1	1		
							2	-	1	-	-	-	1*	-		115
Test	W		7	3	Rm		2	0	0	0	2	2	1	1	5	Fail
Train	W	14		3	Rm		2	2	1	1	2	2	1	1*		8
Test	W		8	3	Rm		2	2	1	1	2	2	1	1	8	Pass
							A Many		A Few		D Many		D Few			
							/ 2		/ 2		/ 2		/ 2			
Test	W			4	Rm		1	1	1	1	1	1	1	1	0	Fail
Train	W			4	Rm		2	1	1	2	1	2	0	0		
		15					1	2	1	1	2	2	2	2		
							2	2	2	2	2	2	1	1		
							2	2	2	2	2	2	2	1		
							2	2	2	2	2	2	2	2*		40
Test	W		9	4	Rm		2	2	2	2	2	2	2	2	8	Pass

Appendix 5
Subject 2: Experiment 9

Proced	Type	W/N	S'n	Set	No. Coins	Seq	Coins A Many		A Few		E Many		E Few		Total Corr.	Perf.
							/3		/2		/3		/2			
Test		W	16		5	Hz	2	2	2	2	2	2	0	2	3	Fail
Train		W			5	Hz	2	3	3	3	3	3	2	2		
							3	3	2	2	3	-	2	2*		15
Test		W		10	5	Hz	3	3	2	2	3	3	2	2	8	Pass
Test		W	17		5	Rm	2	3	2	2	3	3	2	2	7	Pass
							A Many		A Few		F Many		F Few			
							/3	/3	/3	/3	/3	/3	/3	/3		
Test		W			6	Hz	3	3	1	1	3	3	2	1	4	Fail
Train		W			6	Hz	3	3	3	3	3	2	2	3		
			18				3	3	2	3	3	3	3	3		
							3	3	3	-	-	-	3*	-		20
Test		W		11	6	Hz	3	3	3	3	3	3	3	3	8	Pass
Test		W			6	Rm	3	3	3	3	3	3	3	3	8	Pass
							W	N	W	N	W	N	W	N		
Test		W/N			6	Rm	3	3	3	3	3	3	3	3	8	Pass
Test	Gen.	W/N	19	Pencils	6	Rm	3	3	3	3	3	3	3	3	8	Pass
							A Many		A Few		D Many		D Few			
	Reversal 1						/2	/2	/2	/2	/2	/2	/2	/2		
Train		W			4	Hz	2	0	1	2	0	0	0	1		
							1	0	2	2	0	0	1	2		
							2	2	2	2	0	2	2	2		
							-	-	-	-	2*	-	-	-		25
																(6/8)
Test		W		12	4	Hz	0	0	2	2	0	0	0	0	2	Pass
Train		W	20		4	Hz	1	2	2	2	0	2	0	2		
							2	-	2	-	2	2	2*	-		13
																(0/8)
Test		W		13	4	Hz	2	2	2	2	2	2	2	2	8	Pass
																(0/8)
Test		W			4	Rm	2	2	2	2	2	2	2	2	8	Pass
							A Many		A Few		E Many		E Few			
							/2	/2	/3	/3	/2	/2	/3	/3		(3/8)
Test		W	21		5	Hz	0	2	3	3	0	1	3	3	5	Fail
Train		W	22		5	Hz	2	2	3	3	2	2	3	3*		8
																(0/8)
Test		W		14	5	Hz	2	2	3	3	2	2	3	3	8	Pass
																(0/8)
Test		W			5	Rm	2	2	3	3	2	2	3	3	8	Pass
							A Many		A Few		F Many		F Few			
							/3	/3	/3	/3	/3	/3	/3	/3		(0/8)
Test		W	23		6	Hz	3	3	3	3	3	3	3	3	8	Pass
																(0/8)
Test		W			6	Rm	3	3	3	3	3	3	3	3	8	Pass

Appendix 5
Subject 2: Experiment 9

Proced	Type	W/N	S'n	Set	No. Coins	Seq	Coins	A Many		A Few		F Many		F Few		Total Corr.	Perf.
								W	N	W	N	W	N	W	N		
								/ 3	/ 3	/ 3	/ 3	/ 3	/ 3	/ 3	/ 3		
Test		W/N			**6**	**Rm**		0	1	3	3	3	3	3	0	**5**	**(3/8)** Fail
Test		W/N	24		**6**	**Rm**		3	3	3	3	3	3	3	3	**8**	**(0/8)** Pass
Test	**Gen.**	W/N		Spoons	**6**	**Rm**		3	3	3	3	3	3	3	3	**8**	**(0/8)** Pass
	Reversal 2																
Train		W/N		14	**6**	**Rm**		0	3	3	3	0	0	0	0		
								0	3	3	3	3	3	3	3		
								3	3	-	-	-	-	3*	-		**19**
Test		W/N		15	**6**	**Rm**		3	3	3	3	3	3	3	3	**8**	Pass
								A Many		**A Few**		**G Many**		**G Few**			
								W	**N**	**W**	**N**	**W**	**N**	**W**	**N**		
								/ 4	**/ 3**	**/ 3**	**/ 4**	**/ 4**	**/ 3**	**/ 3**	**/ 4**		
Test		W/N	25		**7**	**Rm**		4	3	3	4	0	3	3	4	**7**	Pass
								A Many		**A Few**		**H Many**		**H Few**			
								W	**N**	**W**	**N**	**W**	**N**	**W**	**N**		
								/ 4	**/ 4**	**/ 4**	**/ 4**	**/ 4**	**/ 4**	**/ 4**	**/ 4**		
Test	**Gen.**	W/N		Beads	**8**	**Rm**		4	4	4	4	4	4	4	4	**8**	Pass
								A Many		**A Few**		**J Many**		**J Few**			
								W	**N**	**W**	**N**	**W**	**N**	**W**	**N**		
								/ 5	**/ 4**	**/ 4**	**/ 5**	**/ 5**	**/ 4**	**/ 4**	**/ 5**		
Test	**Gen.**	W/N		Cups	**9**	**Rm**		5	4	4	5	5	4	4	5	**8**	Pass
								A Many		**A Few**		**K Many**		**K Few**			
								W	**N**	**W**	**N**	**W**	**N**	**W**	**N**		
								/ 5	**/ 5**	**/ 5**	**/ 5**	**/ 5**	**/ 5**	**/ 5**	**/ 5**		
Test	**Gen.**	W/N		Pasta Shapes	**10**	**Rm**		5	5	5	5	5	5	5	5	**8**	Pass

* Indicates that the subject reached the mastery criterion.
** Indicates that the subject failed to reach the mastery criterion.
Gen. = Generalisation test

Subject 3: Experiment 9: Responding in Accordance with Opposite

Proced	Type	W/N	S'n	Set	No. Coins	Seq	Coins	A Many		A Few		D Many		D Few		Total Corr.	Perf.
								/ 2		/ 2		/ 2		/ 2			
Baseline 1																	
Test		W	1	1	**4**	**Hz**		1	1	0	1	0	0	0	0	**0**	Fail
"		"			**4**	**Hz**		1	1	0	0	0	1	1	0	**0**	Fail
"		"	2	2	**4**	**Hz**		0	1	1	0	0	0	1	0	**0**	Fail
"		"			**4**	**Hz**		1	0	0	1	0	0	0	0	**0**	Fail
"		"	3	3	**4**	**Hz**		0	0	1	0	0	1	1	1	**0**	Fail
"		"			**4**	**Hz**		0	1	1	1	0	1	1	1	**0**	Fail
Non-Contingent Reinforcement																	
	8 CCR's.	W	4	3	**4**	**Hz**		1	0	0	1	1	0	1	1		
								0	0	1	1	0	0	0	1		
								0	0	1	1	0	0	1	1		
								0	0	0	1	1	1	1	1		
								1	1	0	1	1	0	1	1		
			5					1	1	1	0	0	1	1	1		
								1	0	0	0	0	0	1	0		
								0	0	0	1	0	0	0	0		
								0	0	1	1	0	0	1	0		
			6					1	0	0	1	1	0	1	0		
								1	1	0	0	0	1	0	0		
								0	1	0	1	0	0	0	0		
								0	0	1	0	0	0	1	0		
								1	0	0	1	1	1	1	1		
			7					1	0	0	1	0	1	0	1		
								1	0	1	0	0	1	1	0		
								0	0	0	1	1	1	1	1		
			8					0	0	1	0	0	0	0	1		
								0	1	0	1	0	0	0	0		
								0	1	0	1	0	0	1	0		
			9					0	1	1	1	0	0	1	0		
								1	1	0	1	1	0	1	1		
								0	1	1	1	1	0	1	0		
								1	1	0	1	1	0	1	1		
								0	0	0	1	1	1	1	1		
								1	1	1	1	0	1	1	1		
								0	0	0	1	1	1	1	1		
								1	1	0	0	1	0	0	1		**224****
Baseline 2																	
Test		W	10	3	**4**	**Hz**		1	0	0	1	1	1	0	1	**0**	Fail
"					**4**	**Hz**		0	1	0	0	1	0	0	1	**0**	Fail
"				4	**4**	**Hz**		1	1	1	0	1	0	1	0	**0**	Fail
"					**4**	**Hz**		0	0	0	1	1	1	0	1	**0**	Fail
"			11	5	**4**	**Hz**		1	1	1	0	0	0	0	0	**0**	Fail
"					**4**	**Hz**		1	1	0	1	1	1	1	1	**0**	Fail
"				6	**4**	**Hz**		1	1	1	1	0	0	1	0	**0**	Fail

Subject 3: Experiment 9

Proced	Type	W/N	S'n	Set	No. Coins	Seq Coins	A Many		A Few		D Many		D Few		Total Corr.	Perf.
							/ 2		/ 2		/ 2		/ 2			
"					4	Hz	1	1	0	0	0	1	1	0	0	Fail
Intervention																
Train		W	12		4	Hz	0	2	1	1	0	1	1	1		
			13				2	2	0	2	0	2	0	2		
							2	-	2	-	2	-	2*			**20**
Test		W		7	4	Hz	2	1	1	1	1	1	1	1	**1**	Fail
Train		W	14		4	Hz	2	1	2	1	1	2	1	2		
							2	1	2	2	1	2	2	1		
			15				1	2	2	2	1	2	1	2		
							1	2	2	2	2	2	2	2		
							1	2	2	2	2	2	2	2		
			16				2	2	2	2	2	2	2	2*		**48**
Test		W		8	4	Hz	2	2	2	2	2	2	2	2	**8**	Pass
Test		W	17		4	Rm	1	2	1	2	1	1	2	1	**3**	Fail
Train		W			4	Rm	1	1	2	2	1	1	2	0		
			18				1	2	2	2	1	1	1	2		
			19				1	2	1	2	2	0	1	2		
			20				1	2	1	1	2	2	1	1		
			21				1	1	1	2	1	2	2	2		
							1	2	1	2	1	2	1	2		
			22				1	2	1	2	2	1	1	1		
			23				2	1	2	1	2	2	2	2		
			24				2	1	2	1	2	2	2	2		
			25				1	2	1	1	1	1	1	1		
							2	-	1	-	1	-	1	-		**84****
							A Many		**A** Few		**C** Many		**C** Few			
							/ 2	**/ 2**	**/ 1**	**/ 1**	**/ 2**	**/ 2**	**/ 1**	**/ 1**		
Train		W	26		3	**Rm**	1	1	0	0	2	1	2	0		
							1	1	2	2	1	1	2	2		**16****
							A		**B**							
							Many	**Few**	**Many**	**Few**						
							/ 1	**/ 1**	**/ 1**	**/ 1**						
Train		W			2	**Rm** (A-B)	0	1	1	1						
							1	1	1	1						
							1	1*								**10**
							A		**B**		**C**					
							Many	**Few**	**Many**	**Few**	**Many**	**Few**				
							/ 1	**/ 1**	**/ 1**	**/ 1**	**/ 1**	**/ 1**				
						(B-C)			1	1	1	1				
									1	1	1	1*				8
																18
Test		W	27	9	2	**Rm**	1	1	1	1						
							1	1	1	1						
									1	1	1	1				
									1	1	1	1			**16**	Pass

Proced	Type	W/N	S'n	Set	No. Coins	Seq	Coins	A Many		A Few		C Many		C Few		Total Corr.	Perf.
								/ 2	/ 2	/ 1	/ 1	/ 2	/ 2	/ 1	/ 1		
Train		W	28		3	Rm		2	2	0	1	2	1	0	1		
								1	1	0	0	1	0	0	0		16**
	"Same"		29					0	2	0	0	1	1	0	2		
								1	2	1	2	1	2	2	0		
			30					2	2	0	2	2	2	0	2		
								0	2	0	2	2	1	2	2		
			31					1	2	2	2	2	2	2	2		
								1	-	-	-	-	-	0	-		42**
								A		B		C					
								Many	Few	Many	Few	Many	Few				
								/ 1	/ 1	/ 1	/ 1	/ 1	/ 1				
Train		W			2	Rm	(A-B)	1	1	1	1						
								1	1	1	1*						8
							(B-C)			1	1	1	1				
										1	1	1	1*				8
																	16
Test		W		10	2	Rm		1	1	1	1						
								1	1	1	1						
										1	1	1	1				
										1	1	1	1			16	Pass
								A		A		C		C			
								Many		Few		Many		Few			
								/ 2	/ 2	/ 1	/ 1	/ 2	/ 2	/ 1	/ 1		
Train		W	32		3	Hz		1	2	0	2	2	2	0	1		
								2	2	1	1	2	2	2	1		
								2	-	-	-	-	-	1*	-		18
Test		W	33	11	3	Hz		1	2	0	0	2	1	0	0	2	Fail
Train		W			3	Hz		1	2	1	1	2	2	0	1		
								2	-	-	-	-	-	1*			10
Test		W		12	3	Hz		2	2	1	1	2	2	1	1	8	Pass
	Trained first to maintain momentum																
Train		W	34		3	Rm		2	2	0	0	0	2	1	1		
			35					2	1	0	0	2	1	0	0		
								2	2	1	0	1	2	0	1		
								1	2	0	0	1	1	2	0		32**
Train		W	36		3	Hz		2	2	1	1	2	2	1	1		8
Test		W		13	3	Hz		2	2	1	1	2	2	1	1	8	Pass
	Each block commenced with 3 Hz trials																
Train		W	36			Hz		2	1	1	0	1	2	1	0		
			37					2	2	1	1	2	2	0	1		
			38					2	1	1	0	2	1	0	0		
								2	1	1	0	2	2	0	1		
			39					2	2	1	0	2	2	1	0		
								2	2	0	1	2	2	1	0		
								2	2	2	1	2	2	2	1		
								2	-	1	-	-	-	1*			76
Test		W	40	14	3	Rm		2	2	1	1	2	2	1	1	8	Pass

Appendix 6
Subject 3: Experiment 9

Proced	Type	W/N	S'n	Set	No. Coins	Seq	Coins A Many		A Few		D Many		D Few		Total Corr.	Perf.
							/ 2		/ 2		/ 2		/ 2			
Test		W			4	Rm	2	2	2	2	2	2	2	2	8	Pass
							A		A		E		E			
							Many		Few		Many		Few			
							/ 3		/ 2		/ 3		/ 2			
Test		W			5	Hz	3	3	2	2	3	3	2	2	8	Pass
Test		W			5	Rm	3	3	2	2	3	3	2	2	8	Pass
							A		A		F		F			
							Many		Few		Many		Few			
							/ 3	/ 3	/ 3	/ 3	/ 3	/ 3	/ 3	/ 3		
Test		W			6	Hz	3	3	3	3	3	3	3	3	8	Pass
Test		W			6	Rm	3	3	3	3	3	3	3	3	8	Pass
							W	N	W	N	W	N	W	N		
Test		W/N	41	15	6	Rm	3	3	3	3	3	3	3	3	8	Pass
Test	Gen.	W/N		Pencils			3	3	3	3	3	3	3	3	8	Pass
							A		A		D		D			
							Many		Few		Many		Few			
Reversal 1							/ 2	/ 2	/ 2	/ 2	/ 2	/ 2	/ 2	/ 2		
Train		W			4	Hz	2	0	2	0	0	0	2	0		
							2	2	2	2	0	2	2	2		
							-	-	-	-	2*					17
																(0/8)
Test		W	42	16	4	Hz	2	2	2	2	2	2	2	2	8	Pass
																(0/8)
Test		W			4	Rm	2	2	2	2	2	2	2	2	8	Pass
							A		A		E		E			
							Many		Few		Many		Few			
							/ 2	/ 2	/ 3	/ 3	/ 2	/ 2	/ 3	/ 3		(0/8)
Test		W			5	Hz	2	2	3	3	2	2	3	3	8	Pass
																(0/8)
Test		W			5	Rm	2	2	3	3	2	2	3	3	8	Pass
							A		A		F		F			
							Many		Few		Many		Few			
							/ 3	/ 3	/ 3	/ 3	/ 3	/ 3	/ 3	/ 3		(0/8)
Test		W			6	Hz	3	3	3	3	3	3	3	3	8	Pass
																(0/8)
Test		W			6	Rm	3	3	3	3	3	3	3	3	8	Pass
							W	N	W	N	W	N	W	N		
							/ 3	/ 3	/ 3	/ 3	/ 3	/ 3	/ 3	/ 3		(0/8)
Test		W/N			6	Rm	3	3	3	3	3	3	3	3	8	Pass
				Tape												(0/8)
Test	Gen.	W/N		Boxes	6	Rm	3	3	3	3	3	3	3	3	8	Pass
							A		A		F		F			
							Many		Few		Many		Few			
							W	N	W	N	W	N	W	N		
Reversal 2							/ 3	/ 3	/ 3	/ 3	/ 3	/ 3	/ 3	/ 3		
Train		W/N		16	6	Rm	0	0	0	3	3	3	0	3		
			43				0	0	3	0	3	3	3	0		

					No.			A		A		F		F		Total	
Proced	**Type**	**W/N**	**S'n**	**Set**	**Coins**	**Seq**	**Coins**	**Many**		**Few**		**Many**		**Few**		**Corr.**	**Perf.**
								W	**N**	**W**	**N**	**W**	**N**	**W**	**N**		
								/ 3	**/ 3**	**/ 3**	**/ 3**	**/ 3**	**/ 3**	**/ 3**	**/ 3**		
								3	3	-	3	-	-	-	3*		**20**
Test		W/N		17	**6**	**Rm**		3	3	3	3	3	3	3	0	7	Pass
								A		**A**		**G**		**G**			
								Many		**Few**		**Many**		**Few**			
								W	**N**	**W**	**N**	**W**	**N**	**W**	**N**		
								/ 4	**/ 3**	**/ 3**	**/ 4**	**/ 4**	**/ 3**	**/ 3**	**/ 4**		
Test	**Gen.**	W/N		Spoons	7	**Rm**		4	3	3	4	4	3	0	4	7	Pass
								A		**A**		**H**		**H**			
								Many		**Few**		**Many**		**Few**			
								W	**N**	**W**	**N**	**W**	**N**	**W**	**N**		
								/ 4	**/ 4**	**/ 4**	**/ 4**	**/ 4**	**/ 4**	**/ 4**	**/ 4**		
Test	**Gen.**	W/N		Cups	**8**	**Rm**		4	4	4	4	4	4	4	4	**8**	Pass

* Indicates that the subject reached the mastery criterion.

** Indicates that the subject failed to reach the mastery criterion.

Gen. = Generalisation test

Appendix 7

Details of the experimental tasks and blocks contained within the protocol for testing and training the perspective-taking frame of NOW-THEN

Level 3: NOW-THEN (Blocks 16-30)

Simple I within Simple NOW-THEN Relations
Task 7: "Yesterday I was watching television, today I am reading (across trials, for Tasks 7 to 10, watching television and reading were counterbalanced in terms of yesterday and today). What am I doing now? What was I doing then?" (The order in which the two *now* and *then* questions were presented was counterbalanced across trials throughout the entire study). On each trial the experimenter placed two pictures in front of herself, one of a television and the other of a book. These were positioned with the top edge of one picture approximately two inches below the bottom edge of the second picture (the relative positions of the pictures were counterbalanced across trials). The picture depicting today's activity was always the bottom picture, whereas "yesterday's picture" was always placed at the top. This practice was employed with Tasks 7 to 10 (pictures were not employed in the remaining tasks).

Simple YOU within Simple NOW-THEN Relations
Task 8: "Yesterday you were watching television, today you are reading. What are you doing now? What were you doing then?" (on Tasks 8 and 10, the two pictures were placed in front of the subject, rather than the experimenter).

Simple I within NOW-THEN Reversals
Task 9: "Yesterday I was watching television, today I am reading. If now was then and then was now. What would I be doing then? What would I be doing now?"

Simple YOU within NOW-THEN Reversals
Task 10: "Yesterday you were watching television, today you are reading. If now was then and then was now. What would you be doing then? What would you be doing now?"

Simple I within Simple HERE-THERE Relations within Simple NOW-THEN Relations
Task 11: "Yesterday I was sitting there on the blue chair, today I am sitting here on the black chair. Where was I sitting then? Where am I sitting now?" During these trials (and those in Tasks 13, 15, and 17) only the experimenter was seated on either of the chairs, and the subject remained standing a short distance from the experimental table. Across all trials, for Tasks 11 to 18, chair colour was counterbalanced in terms of yesterday and today.

Simple YOU within Simple HERE-THERE Relations within Simple NOW-THEN Relations
Task 12: "Yesterday you were sitting there on the blue chair, today you are sitting here on the black chair. Where were you sitting then? Where are you sitting now?" During these trials (and those in Tasks 14, 16, and 18) only the subject was seated on either of the chairs, and the experimenter remained standing a short distance from the experimental table.

Simple I within HERE-THERE Reversals within Simple NOW-THEN Relations
Task 13: "Yesterday I was sitting there on the blue chair, today I am sitting here on the black chair. If here was there and there was here. Where would I be sitting then? Where would I be sitting now?"

Simple YOU within HERE-THERE Reversals within Simple NOW-THEN Relations
Task 14: "Yesterday you were sitting there on the blue chair, today you are sitting here on the black chair. If here was there and there was here. Where would you be sitting then? Where would you be sitting now?"

Simple I within Simple HERE-THERE Relations within NOW-THEN Reversals
Task 15: "Yesterday I was sitting there on the blue chair, today I am sitting here on the black chair. If now was then and then was now. Where would I be sitting then? Where would I be sitting now?"

Simple YOU within Simple HERE-THERE Relations within NOW-THEN Reversals
Task 16: "Yesterday you were sitting there on the blue chair, today you are sitting here on the black chair. If now was then and then was now. Where would you be sitting then? Where would you be sitting now?"

Simple I within HERE-THERE/NOW-THEN Double Reversals
Task 17: "Yesterday I was sitting there on the blue chair, today I am sitting here on the black chair. If here was there and there was here and if now was then and then was now. Where would I be sitting now? Where would I be sitting then?"

Simple YOU within HERE-THERE/NOW-THEN Double Reversals
Task 18: "Yesterday you were sitting there on the blue chair, today you are sitting here on the black chair. If here was there and there was here and if now was then and then was now. Where would you be sitting now? Where would you be sitting then?"

Block 16: Simple I within Simple NOW-THEN relations (6 trials of Task 7)
Block 17: Simple YOU within Simple NOW-THEN relations (6 trials of Task 8)
Block 18: Simple I within Simple NOW-THEN relations and Simple I within NOW-THEN Reversals (6 trials; 3 of Task 7 and 3 of Task 9)
Block 19: Simple YOU within Simple NOW-THEN relations and Simple YOU within NOW-THEN Reversals (6 trials; 3 of Task 8 and 3 of Task 10)
Block 20: Simple I and Simple YOU within Simple NOW-THEN relations and Simple I and Simple You within NOW-THEN Reversals (12 trials; 3 each of Tasks 7, 8, 9, and 10)
Block 21: Simple I and Simple YOU within Simple NOW-THEN relations and Simple I and Simple You within NOW-THEN Reversals with actions (reading and watching television) counterbalanced across trials (12 trials; 3 each of Tasks 7, 8, 9, and 10)
Block 22: Simple I and Simple YOU within Simple HERE-THERE relations within Simple NOW-THEN relations (12 trials; 6 each of Tasks 11, and 12)
Block 23: Simple I and Simple YOU within Simple HERE-THERE relations within Simple NOW-THEN relations with chair colour counterbalanced across trials (12 trials; 6 each of Tasks 11, and 12)
Block 24: Simple I and Simple You within Simple HERE-THERE relations within Simple NOW-THEN relations; and Simple I and Simple YOU within HERE-THERE Reversals within Simple NOW-THEN relations (12 trials; 3 each of Tasks 11, 12, 13, and 14)
Block 25: Simple I and Simple You within Simple HERE-THERE relations within Simple NOW-THEN relations; and Simple I and Simple YOU within HERE-THERE Reversals within Simple NOW-THEN relations with chair colour counterbalanced across trials (12 trials; 3 each of Tasks 11, 12, 13, and 14)
Block 26: Simple I and Simple YOU within HERE-THERE Reversals within Simple NOW-THEN relations, and Simple I and Simple YOU within Simple HERE-THERE Relations within NOW-THEN Reversals (12 trials; 3 each of Tasks 13, 14, 15, and 16)
Block 27: Simple I and Simple YOU within HERE-THERE Reversals within Simple NOW-THEN relations, and Simple I and Simple YOU within Simple HERE-THERE Relations within NOW-THEN Reversals with chair colour counterbalanced across trials (12 trials; 3 each of Tasks 13, 14, 15, and 16)
Block 28: Simple I and Simple YOU within HERE-THERE Reversals within Simple NOW-THEN relations; Simple I and Simple YOU within Simple HERE-THERE Relations within NOW-THEN Reversals; and Simple I and Simple YOU within HERE-THERE/NOW-THEN Double Reversals (12 trials; 2 each of Tasks 13, 14, 15, 16, 17, and 18)
Block 29: Simple I and Simple YOU within HERE-THERE Reversals within Simple NOW-THEN relations; Simple I and Simple YOU within Simple HERE-THERE Relations within NOW-THEN Reversals; and Simple I and Simple YOU within HERE-THERE/NOW-THEN Double Reversals with chair colour counterbalanced across trials (12 trials; 2 each of Tasks13, 14, 15, 16, 17, and 18)

Appendix 7 (Cont.)

Block 30: Simple I and Simple YOU within HERE-THERE Reversals within Simple NOW-THEN relations; Simple I and Simple YOU within Simple HERE-THERE Relations within NOW-THEN Reversals; and Simple I and Simple YOU within HERE-THERE/NOW-THEN Double Reversals with novel actions and objects counterbalanced across trials (12 trials; 2 each of Tasks 13, 14, 15, 16, 17, and 18)

Subject 1: Responding in Accordance with the Perspective-taking Frames of I-YOU and HERE-THERE.

EXTENDED PROTOCOL

			EXP.	CHILD	Order	Correct	Total	Perf.
LEVEL 1								
BLOCK 1		**SIMPLE 1-YOU**						
TEST	1	Simple	Green	Red	I/Y	1.1		
			"	"	Y/I	1.1		
			"	"	I/Y	1.1		
			"	"	I/Y	1.1		
			"	"	Y/I	1.1		
			"	"	I/Y	1.1	6	Pass
BLOCK 4		**I-YOU SIMPLE & REVERSAL - C.S.L.**						
TEST		Simple	Green	Red	I/Y	1.1		
		Reversal	Green	Red	I/Y	1.1		
		Simple	Red	Green	Y/I	1.1		
		Reversal	Green	Red	Y/I	1.1		
		Reversal	Red	Green	Y/I	1.1		
		Simple	Red	Green	I/Y	1.1	6	Pass
LEVEL 2								
BLOCK 6		**SIMPLE I-YOU IN SIMPLE HERE-THERE**						
TEST	2		Blue	Black	Y/I	1.1		
			"	"	I/Y	1.1		
			"	"	I/Y	1.1		
			"	"	I/Y	1.1		
			"	"	Y/I	1.1		
			"	"	I/Y	1.1	6	Pass
BLOCK 8		**I-YOU SIMPLE & REVERSAL IN SIMPLE HERE-THERE - C.S.L.**						
TEST		Simple	Blue	Black	I/Y	1.1		
		Reversal	Blue	Black	I/Y	1.1		
		Simple	Black	Blue	Y/I	1.1		
		Reversal	Blue	Black	Y/I	1.1		
		Reversal	Black	Blue	Y/I	1.1		
		Simple	Black	Blue	I/Y	1.1	6	Pass
BLOCK 10		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
TEST		Simple	Blue	Black	I/Y	1.1		
		Reversal	Blue	Black	I/Y	1.1		
		Simple	Black	Blue	Y/I	1.1		
		Reversal	Blue	Black	Y/I	1.1		
		Reversal	Black	Blue	Y/I	1.1		
		Simple	Black	Blue	I/Y	1.1	6	Pass
BLOCK 13		**I-YOU REVERSAL, HERE-THERE REVERSAL,**						
TEST		**& I-YOU/HERE-THERE DOUBLE REVERSAL**						
		I-YOU	Blue	Black	I/Y	1.1		
		HERE-THERE	"	"	I/Y	1.1		
		I-YOU/HERE-THERE	"	"	Y/I	0.0		
		HERE-THERE	"	"	Y/I	1.1		
		I-YOU/HERE-THERE	"	"	Y/I	0.0		

		I-YOU	"	"	I/Y	1.1		
		I-YOU/HERE-THERE	"	"	I/Y	0.0		
		HERE-THERE	"	"	I/Y	1.1		
		I-YOU	"	"	Y/I	1.1		
		I-YOU/HERE-THERE	"	"	Y/I	0.0		
		I-YOU	"	"	Y/I	1.1		
		HERE-THERE	"	"	I/Y	1.1	**8**	Fail
		Failed all double reversals.						
TRAIN		**I-YOU/HERE-THERE DOUBLE REVERSAL ONLY-C.S.L.**						
TASK 6	3	I-YOU/HERE-THERE	Blue	Black	I/Y	0.1		
			Black	Blue	I/Y	1.1		
			Blue	Black	Y/I	1.1		
			Blue	Black	I/Y	1.1		
			Black	Blue	I/Y	1.1		
			Black	Blue	Y/I	1.1		
			Black	Blue	I/Y	1.1		7
TEST		**I-YOU/HERE-THERE DOUBLE REVERSAL ONLY-C.S.L.**						
TASK 6		I-YOU/HERE-THERE	Blue	Black	I/Y	1.1		
			Black	Blue	Y/I	1.1		
			Blue	Black	Y/I	1.1		
			Blue	Black	I/Y	1.1		
			Black	Blue	I/Y	1.1		
			Black	Blue	Y/I	1.1	**6**	Pass
BLOCK 14		**I-YOU REVERSAL, HERE-THERE REVERSAL,**						
TEST		**& I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.**						
		I-YOU	Blue	Black	I/Y	0.0		
		HERE-THERE	Black	Blue	I/Y	0.0		
		I-YOU/HERE-THERE	Blue	Black	Y/I	0.0		
		HERE-THERE	Blue	Black	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Blue	Black	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	Y/I	0.0		
		I-YOU	Black	Blue	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	I/Y	0.0		
		I-YOU	Blue	Black	Y/I	0.0		
		HERE-THERE	Blue	Black	I/Y	1.1	**6**	Fail
		Errors on both I-YOU & HERE-THERE individually-performances breaking down.						
		Errors on double reversals, esp. with location change.						
BLOCK 14		**I-YOU REVERSAL, HERE-THERE REVERSAL,**						
TRAIN		**& I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.**						
	4	I-YOU	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	Y/I	0.1		
		HERE-THERE	Blue	Black	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	Y/I	0.1		
		I-YOU	Blue	Black	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	I/Y	0.1		
		HERE-THERE	Black	Blue	Y/I	0.1		
		I-YOU	Black	Blue	Y/I	1.1		

	I-YOU/HERE-THERE	Black	Blue	I/Y	1.1		
	I-YOU	Blue	Black	Y/I	0.1		
	HERE-THERE	Blue	Black	I/Y	1.1		
	I-YOU	Blue	Black	I/Y	1.1		
	HERE-THERE	Black	Blue	I/Y	1.1		
	I-YOU/HERE-THERE	Blue	Black	Y/I	1.1		
	HERE-THERE	Blue	Black	Y/I	1.1		
	I-YOU/HERE-THERE	Black	Blue	Y/I	1.1		
	I-YOU	Blue	Black	I/Y	1.1		
	I-YOU/HERE-THERE	Blue	Black	I/Y	1.1		
	HERE-THERE	Black	Blue	Y/I	1.1		
	I-YOU	Black	Blue	Y/I	1.1		
	I-YOU/HERE-THERE	Black	Blue	I/Y	1.1		
	I-YOU	Blue	Black	I/Y	1.1		**23**
BLOCK 14	**I-YOU REVERSAL, HERE-THERE REVERSAL,**						
TEST	**& I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.**						
	I-YOU	Blue	Black	I/Y	1.1		
	HERE-THERE	Black	Blue	I/Y	1.1		
	I-YOU/HERE-THERE	Blue	Black	Y/I	1.1		
	HERE-THERE	Blue	Black	Y/I	1.1		
	I-YOU/HERE-THERE	Black	Blue	Y/I	1.1		
	I-YOU	Blue	Black	I/Y	1.1		
	I-YOU/HERE-THERE	Blue	Black	I/Y	1.1		
	HERE-THERE	Black	Blue	Y/I	1.1		
	I-YOU	Black	Blue	Y/I	1.1		
	I-YOU/HERE-THERE	Black	Blue	I/Y	1.1		
	I-YOU	Blue	Black	Y/I	1.1		
	HERE-THERE	Blue	Black	I/Y	1.1	**12**	Pass
	ABBREVIATED PROTOCOL: FOLLOW-UP TESTS						
LEVEL 1		**EXP.**	**CHILD**	**Order**	**Correct**	**Total**	**Perf.**
BLOCK 4	**I-YOU SIMPLE & REVERSAL - C.S.L.**						
TEST 5	Simple	Green	Red	I/Y	1.1		
	Reversal	Green	Red	I/Y	1.1		
	Simple	Red	Green	Y/I	1.1		
	Reversal	Green	Red	Y/I	1.1		
	Reversal	Red	Green	Y/I	1.1		
	Simple	Red	Green	I/Y	1.1	6	Pass
LEVEL 2	**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
BLOCK 10	Simple	Blue	Black	I/Y	1.1		
TEST	Reversal	Blue	Black	I/Y	1.1		
	Simple	Black	Blue	Y/I	1.1		
	Reversal	Blue	Black	Y/I	1.1		
	Reversal	Black	Blue	Y/I	1.1		
	Simple	Black	Blue	I/Y	1.1	6	Pass
BLOCK 12	**I-YOU REVERSAL & HERE-THERE REVERSAL - C.S.L.**						
TEST	I-YOU	Blue	Black	I/Y	1.1		
	HERE-THERE	Black	Blue	I/Y	1.1		
	HERE-THERE	Black	Blue	Y/I	1.1		

		I-YOU	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Black	Blue	Y/I	1.1	**6**	Pass
BLOCK 14 TEST		**I-YOU REVERSAL, HERE-THERE REVERSAL, & I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.**						
		I-YOU	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	Y/I	1.1		
		HERE-THERE	Blue	Black	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Blue	Black	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Black	Blue	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	I/Y	0.0		
		I-YOU	Blue	Black	Y/I	1.1		
		HERE-THERE	Blue	Black	I/Y	1.1	**11**	Fail
BLOCK 14 TEST		**I-YOU REVERSAL, HERE-THERE REVERSAL, & I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.**						
	6	I-YOU	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	Y/I	0.0		
		HERE-THERE	Blue	Black	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	Y/I	0.0		
		I-YOU	Blue	Black	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Black	Blue	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	I/Y	0.0		
		I-YOU	Blue	Black	Y/I	1.1		
		HERE-THERE	Blue	Black	I/Y	1.1	**9**	Fail
BLOCK 14 TRAIN		**I-YOU REVERSAL, HERE-THERE REVERSAL, & I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.**						
	7	I-YOU	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	I/Y	0.0		
		I-YOU/HERE-THERE	Blue	Black	Y/I	0.0		
		HERE-THERE	Blue	Black	Y/I	0.0		
		I-YOU/HERE-THERE	Black	Blue	Y/I	0.0		
		I-YOU	Blue	Black	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Black	Blue	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	I/Y	0.0		
		I-YOU	Blue	Black	Y/I	1.1		
		HERE-THERE	Blue	Black	I/Y	1.1		
		I-YOU	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	I/Y	0.0		
		I-YOU/HERE-THERE	Blue	Black	Y/I	1.1		
		HERE-THERE	Blue	Black	Y/I	0.0		
		I-YOU/HERE-THERE	Black	Blue	Y/I	0.0		

	8	I-YOU	Blue	Black	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Black	Blue	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	I/Y	0.0		
		I-YOU	Blue	Black	Y/I	1.1		
		HERE-THERE	Blue	Black	I/Y	1.1		
		I-YOU	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	Y/I	1.1		
		HERE-THERE	Blue	Black	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Blue	Black	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Black	Blue	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	I/Y	1.1		**34**
BLOCK 14		**I-YOU REVERSAL, HERE-THERE REVERSAL,**						
TEST		**& I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.**						
		I-YOU	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	Y/I	1.1		
		HERE-THERE	Blue	Black	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Blue	Black	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Black	Blue	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	I/Y	1.1		
		I-YOU	Blue	Black	Y/I	1.1		
		HERE-THERE	Blue	Black	I/Y	1.1	**12**	Pass
		GENERALISATION TESTS						
LEVEL 1			**EXP.**	**CHILD**	**Order**	**Correct**	**Total**	**Perf.**
BLOCK 4		**I-YOU SIMPLE & REVERSAL - C.S.L.**						
TEST	9	Simple	Pen	Cup	Y/I	1.1		PEN/CUP
		Reversal	Cup	Pen	I/Y	1.1		
		Reversal	Pen	Cup	Y/I	1.1		
		Simple	Pen	Cup	I/Y	1.1		
		Reversal	Pen	Cup	Y/I	1.1		
		Simple	Cup	Pen	I/Y	1.1	**6**	Pass
LEVEL 2								
BLOCK 10		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
TEST		Simple	Yellow	Brown	I/Y	1.1		YELLOW/
		Reversal	Yellow	Brown	I/Y	1.1		BROWN
		Simple	Brown	Yellow	Y/I	1.1		DOORS
		Reversal	Yellow	Brown	Y/I	1.1		
		Reversal	Brown	Yellow	Y/I	1.1		
		Simple	Brown	Yellow	I/Y	1.1	**6**	Pass

BLOCK 12		**I-YOU REVERSAL & HERE-THERE REVERSAL - C.S.L.**						
TEST		I-YOU	Yellow	Brown	I/Y	1.1		
		HERE-THERE	Brown	Yellow	I/Y	1.1		
		HERE-THERE	Brown	Yellow	Y/I	1.1		
		I-YOU	Yellow	Brown	I/Y	1.1		
		HERE-THERE	Brown	Yellow	Y/I	1.1		
		I-YOU	Brown	Yellow	Y/I	1.1	6	Pass
BLOCK 14		**I-YOU REVERSAL, HERE-THERE REVERSAL,**						
TEST		**& I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.**						
	10	I-YOU	Yellow	Brown	I/Y	1.1		
		HERE-THERE	Brown	Yellow	I/Y	1.1		
		I-YOU/HERE-THERE	Yellow	Brown	Y/I	1.1		
		HERE-THERE	Yellow	Brown	Y/I	1.1		
		I-YOU/HERE-THERE	Brown	Yellow	Y/I	1.1		
		I-YOU	Yellow	Brown	I/Y	1.1		
		I-YOU/HERE-THERE	Yellow	Brown	I/Y	1.1		
		HERE-THERE	Brown	Yellow	Y/I	1.1		
		I-YOU	Brown	Yellow	Y/I	1.1		
		I-YOU/HERE-THERE	Brown	Yellow	I/Y	1.1		
		I-YOU	Yellow	Brown	Y/I	1.1		
		HERE-THERE	Yellow	Brown	I/Y	1.1	12	Pass
		REVERSAL 1						
LEVEL 1			**EXP.**	**CHILD**	**Order**	**Correct**	**Total**	**Perf.**
BLOCK 4		**I-YOU SIMPLE & REVERSAL - C.S.L.**						
TEST	11	Simple	Green	Red	I/Y	0.0		
		Reversal	Green	Red	I/Y	0.0		
		Simple	Red	Green	Y/I	0.0		
		Reversal	Green	Red	Y/I	0.0		
		Reversal	Red	Green	Y/I	0.0		
		Simple	Red	Green	I/Y	0.0	0	Fail
BLOCK 4		**I-YOU SIMPLE & REVERSAL - C.S.L.**						
TRAIN		Simple	Green	Red	I/Y	0.1		
		Reversal	Green	Red	I/Y	0.1		
		Simple	Red	Green	Y/I	1.1		
		Reversal	Green	Red	Y/I	1.1		
		Reversal	Red	Green	Y/I	1.1		
		Simple	Red	Green	I/Y	1.1		
		Simple	Green	Red	I/Y	1.1		
		Reversal	Green	Red	I/Y	1.1		8
BLOCK 4		**I-YOU SIMPLE & REVERSAL - C.S.L.**						
TEST		Simple	Green	Red	I/Y	0.0		
		Reversal	Green	Red	I/Y	0.0		
		Simple	Red	Green	Y/I	0.0		
		Reversal	Green	Red	Y/I	0.0		
		Reversal	Red	Green	Y/I	0.0		
		Simple	Red	Green	I/Y	0.0	0	Fail
BLOCK 4		**I-YOU SIMPLE & REVERSAL - C.S.L.**						
TRAIN		Simple	Green	Red	I/Y	0.1		

		Reversal	Green	Red	I/Y	1.1		
		Simple	Red	Green	Y/I	1.1		
		Reversal	Green	Red	Y/I	1.1		
		Reversal	Red	Green	Y/I	1.1		
		Simple	Red	Green	I/Y	1.1		
		Simple	Green	Red	I/Y	1.1		7
BLOCK 4		**I-YOU SIMPLE & REVERSAL - C.S.L.**						
TEST		Simple	Green	Red	I/Y	1.1		
		Reversal	Green	Red	I/Y	1.1		
		Simple	Red	Green	Y/I	1.1		
		Reversal	Green	Red	Y/I	1.1		
		Reversal	Red	Green	Y/I	1.1		
		Simple	Red	Green	I/Y	1.1	**6**	Pass
LEVEL 2								
BLOCK 10		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
TEST	12	Simple	Blue	Black	I/Y	0.0		
		Reversal	Blue	Black	I/Y	0.0		
		Simple	Black	Blue	Y/I	0.0		
		Reversal	Blue	Black	Y/I	0.0		
		Reversal	Black	Blue	Y/I	0.0		
		Simple	Black	Blue	I/Y	0.0	**0**	Fail
BLOCK 10		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
TRAIN		Simple	Blue	Black	I/Y	0.1		
		Reversal	Blue	Black	I/Y	1.1		
		Simple	Black	Blue	Y/I	1.1		
		Reversal	Blue	Black	Y/I	1.1		
		Reversal	Black	Blue	Y/I	1.1		
		Simple	Black	Blue	I/Y	1.1		
		Simple	Blue	Black	I/Y	1.1		**7**
BLOCK 10		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
TEST		Simple	Blue	Black	I/Y	0.0		
		Reversal	Blue	Black	I/Y	0.0		
		Simple	Black	Blue	Y/I	0.0		
		Reversal	Blue	Black	Y/I	0.0		
		Reversal	Black	Blue	Y/I	0.0		
		Simple	Black	Blue	I/Y	0.0	**0**	Fail
BLOCK 10		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
TRAIN		Simple	Blue	Black	I/Y	0.1		
		Reversal	Blue	Black	I/Y	1.1		
		Simple	Black	Blue	Y/I	1.1		
		Reversal	Blue	Black	Y/I	0.0		
		Reversal	Black	Blue	Y/I	1.1		
		Simple	Black	Blue	I/Y	1.1		
		Simple	Blue	Black	I/Y	1.1		
		Reversal	Blue	Black	I/Y	1.1		
		Simple	Black	Blue	Y/I	1.1		
		Reversal	Blue	Black	Y/I	1.1		**10**
BLOCK 10		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
TEST		Simple	Blue	Black	I/Y	0.0		
		Reversal	Blue	Black	I/Y	0.0		

		Simple	Black	Blue	Y/I	0.0		
		Reversal	Blue	Black	Y/I	0.0		
		Reversal	Black	Blue	Y/I	0.0		
		Simple	Black	Blue	I/Y	0.0	**0**	Fail
BLOCK 10		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
TRAIN	13	Simple	Blue	Black	I/Y	1.1		
		Reversal	Blue	Black	I/Y	1.1		
		Simple	Black	Blue	Y/I	1.1		
		Reversal	Blue	Black	Y/I	1.1		
		Reversal	Black	Blue	Y/I	1.1		
		Simple	Black	Blue	I/Y	1.1		**6**
BLOCK 10		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
TEST		Simple	Blue	Black	I/Y	0.0		
		Reversal	Blue	Black	I/Y	0.0		
		Simple	Black	Blue	Y/I	0.0		
		Reversal	Blue	Black	Y/I	0.0		
		Reversal	Black	Blue	Y/I	0.0		
		Simple	Black	Blue	I/Y	0.0	**0**	Fail
BLOCK 10		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
TRAIN		Simple	Blue	Black	I/Y	1.1		
		Reversal	Blue	Black	I/Y	1.1		
		Simple	Black	Blue	Y/I	1.1		
		Reversal	Blue	Black	Y/I	1.1		
		Reversal	Black	Blue	Y/I	1.1		
		Simple	Black	Blue	I/Y	1.1		**6**
BLOCK 10		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
TEST		Simple	Blue	Black	I/Y	0.0		
		Reversal	Blue	Black	I/Y	0.0		
		Simple	Black	Blue	Y/I	0.0		
		Reversal	Blue	Black	Y/I	0.0		
		Reversal	Black	Blue	Y/I	0.0		
		Simple	Black	Blue	I/Y	0.0	**0**	Fail
BLOCK 10		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
TRAIN	14	Simple	Blue	Black	I/Y	1.1		
		Reversal	Blue	Black	I/Y	1.1		
		Simple	Black	Blue	Y/I	1.1		
		Reversal	Blue	Black	Y/I	1.1		
		Reversal	Black	Blue	Y/I	1.1		
		Simple	Black	Blue	I/Y	1.1		**6**
BLOCK 10		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
TEST		Simple	Blue	Black	I/Y	0.0		
		Reversal	Blue	Black	I/Y	0.0		
		Simple	Black	Blue	Y/I	0.0		
		Reversal	Blue	Black	Y/I	0.0		
		Reversal	Black	Blue	Y/I	0.0		
		Simple	Black	Blue	I/Y	0.0	**0**	Fail
BLOCK 10		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
TRAIN		Simple	Blue	Black	I/Y	1.1		
		Reversal	Blue	Black	I/Y	1.1		
		Simple	Black	Blue	Y/I	1.1		

		Reversal	Blue	Black	Y/I	1.1		
		Reversal	Black	Blue	Y/I	1.1		
		Simple	Black	Blue	I/Y	1.1		6
BLOCK 10		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
TEST	15	Simple	Blue	Black	I/Y	0.0		
		Reversal	Blue	Black	I/Y	0.0		
		Simple	Black	Blue	Y/I	0.0		
		Reversal	Blue	Black	Y/I	0.0		
		Reversal	Black	Blue	Y/I	0.0		
		Simple	Black	Blue	I/Y	0.0	**0**	Fail
BLOCK 10		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
TRAIN		Simple	Blue	Black	I/Y	1.1		
		Reversal	Blue	Black	I/Y	1.1		
		Simple	Black	Blue	Y/I	1.1		
		Reversal	Blue	Black	Y/I	1.1		
		Reversal	Black	Blue	Y/I	1.1		
		Simple	Black	Blue	I/Y	1.1		6
BLOCK 10		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
TEST		Simple	Blue	Black	I/Y	0.0		
		Reversal	Blue	Black	I/Y	0.0		
		Simple	Black	Blue	Y/I	0.0		
		Reversal	Blue	Black	Y/I	0.0		
		Reversal	Black	Blue	Y/I	0.0		
		Simple	Black	Blue	I/Y	0.0	**0**	Fail
LEVEL 1		Return to Block 4						
BLOCK 4		**I-YOU SIMPLE & REVERSAL - C.S.L.**						
TEST	16	Simple	Green	Red	I/Y	0.0		
		Reversal	Green	Red	I/Y	0.0		
		Simple	Red	Green	Y/I	0.0		
		Reversal	Green	Red	Y/I	0.0		
		Reversal	Red	Green	Y/I	0.0		
		Simple	Red	Green	I/Y	0.0	**0**	Fail
BLOCK 4		**I-YOU SIMPLE & REVERSAL - C.S.L.**						
TRAIN		Simple	Green	Red	I/Y	1.1		
		Reversal	Green	Red	I/Y	1.1		
		Simple	Red	Green	Y/I	1.1		
		Reversal	Green	Red	Y/I	1.1		
		Reversal	Red	Green	Y/I	1.1		
		Simple	Red	Green	I/Y	1.1		6
BLOCK 4		**I-YOU SIMPLE & REVERSAL - C.S.L.**						
TEST		Simple	Green	Red	I/Y	0.0		
		Reversal	Green	Red	I/Y	0.0		
		Simple	Red	Green	Y/I	0.0		
		Reversal	Green	Red	Y/I	0.0		
		Reversal	Red	Green	Y/I	0.0		
		Simple	Red	Green	I/Y	0.0	**0**	Fail
BLOCK 4		**I-YOU SIMPLE & REVERSAL - C.S.L.**						
TRAIN	17	Simple	Green	Red	I/Y	1.1		
		Reversal	Green	Red	I/Y	1.1		
		Simple	Red	Green	Y/I	1.1		

		Reversal	Green	Red	Y/I	1.1		
		Reversal	Red	Green	Y/I	1.1		
		Simple	Red	Green	I/Y	1.1		6
BLOCK 4		**I-YOU SIMPLE & REVERSAL - C.S.L.**						
TEST		Simple	Green	Red	I/Y	1.1		
		Reversal	Green	Red	I/Y	1.1		
		Simple	Red	Green	Y/I	1.1		
		Reversal	Green	Red	Y/I	1.1		
		Reversal	Red	Green	Y/I	1.1		
		Simple	Red	Green	I/Y	1.1	6	Pass
LEVEL 2		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
BLOCK 10		Simple	Blue	Black	I/Y	1.1		
TEST		Reversal	Blue	Black	I/Y	1.1		
		Simple	Black	Blue	Y/I	1.1		
		Reversal	Blue	Black	Y/I	1.1		
		Reversal	Black	Blue	Y/I	1.1		
		Simple	Black	Blue	I/Y	1.1	6	Pass
BLOCK 12		**I-YOU REVERSAL & HERE-THERE REVERSAL - C.S.L.**						
TEST	18	I-YOU	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	I/Y	1.1		
		HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Black	Blue	Y/I	1.1	6	Pass
BLOCK 14		**I-YOU REVERSAL, HERE-THERE REVERSAL,**						
TEST		**& I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.**						
		I-YOU	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	Y/I	0.0		
		HERE-THERE	Blue	Black	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Blue	Black	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	I/Y	0.0		
		HERE-THERE	Black	Blue	Y/I	0.0		
		I-YOU	Black	Blue	Y/I	0.0		
		I-YOU/HERE-THERE	Black	Blue	I/Y	0.0		
		I-YOU	Blue	Black	Y/I	1.1		
		HERE-THERE	Blue	Black	I/Y	0.0	6	Fail
BLOCK 14		**I-YOU REVERSAL, HERE-THERE REVERSAL,**						
TRAIN		**& I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.**						
	19	I-YOU	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	Y/I	0.0		
		HERE-THERE	Blue	Black	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Blue	Black	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Black	Blue	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	I/Y	1.1		

		I-YOU	Blue	Black	Y/I	1.1		
		HERE-THERE	Blue	Black	I/Y	1.1		
		I-YOU	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	Y/I	1.1		**15**
BLOCK 14 TEST		**I-YOU REVERSAL, HERE-THERE REVERSAL, & I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.**						
		I-YOU	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	Y/I	0.0		
		HERE-THERE	Blue	Black	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	Y/I	0.0		
		I-YOU	Blue	Black	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	I/Y	0.0		
		HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Black	Blue	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	I/Y	0.0		
		I-YOU	Blue	Black	Y/I	1.1		
		HERE-THERE	Blue	Black	I/Y	1.1	**8**	Fail
BLOCK 14 TRAIN		**I-YOU REVERSAL, HERE-THERE REVERSAL, & I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.**						
	20	I-YOU	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	Y/I	0.1		
		HERE-THERE	Blue	Black	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Blue	Black	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Black	Blue	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	I/Y	1.1		
		I-YOU	Blue	Black	Y/I	1.1		
		HERE-THERE	Blue	Black	I/Y	1.1		
		I-YOU	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	Y/I	1.1		**15**
BLOCK 14 TEST		**I-YOU REVERSAL, HERE-THERE REVERSAL, & I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.**						
		I-YOU	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	Y/I	1.1		
		HERE-THERE	Blue	Black	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Blue	Black	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Black	Blue	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	I/Y	1.1		
		I-YOU	Blue	Black	Y/I	1.1		
		HERE-THERE	Blue	Black	I/Y	1.1	**12**	Pass

REVERSAL 1: GENERALISATION TESTS

			EXP.	CHILD	Order	Correct	Total	Perf.
LEVEL 1								
BLOCK 4		**I-YOU SIMPLE & REVERSAL - C.S.L.**						
TEST	21	Simple	Pen	Cup	Y/I	1.1		
		Reversal	Cup	Pen	I/Y	1.1		
		Reversal	Pen	Cup	Y/I	1.1		
		Simple	Pen	Cup	I/Y	1.1		
		Reversal	Pen	Cup	Y/I	1.1		
		Simple	Cup	Pen	I/Y	1.1	**6**	Pass
LEVEL 2		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
BLOCK 10		Simple	Yellow	Brown	I/Y	1.1		
TEST		Reversal	Yellow	Brown	I/Y	1.1		
		Simple	Brown	Yellow	Y/I	1.1		
		Reversal	Yellow	Brown	Y/I	1.1		
		Reversal	Brown	Yellow	Y/I	1.1		
		Simple	Brown	Yellow	I/Y	1.1	**6**	Pass
BLOCK 12		**I-YOU REVERSAL & HERE-THERE REVERSAL - C.S.L.**						
TEST		I-YOU	Yellow	Brown	I/Y	1.1		
		HERE-THERE	Brown	Yellow	I/Y	1.1		
		HERE-THERE	Brown	Yellow	Y/I	1.1		
		I-YOU	Yellow	Brown	I/Y	1.1		
		HERE-THERE	Brown	Yellow	Y/I	1.1		
		I-YOU	Brown	Yellow	Y/I	1.1	**6**	Pass
BLOCK 14		**I-YOU REVERSAL, HERE-THERE REVERSAL,**						
TEST		**& I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.**						
		I-YOU	Yellow	Brown	I/Y	1.1		
		HERE-THERE	Brown	Yellow	I/Y	1.1		
		I-YOU/HERE-THERE	Yellow	Brown	Y/I	1.1		
		HERE-THERE	Yellow	Brown	Y/I	1.1		
		I-YOU/HERE-THERE	Brown	Yellow	Y/I	1.1		
		I-YOU	Yellow	Brown	I/Y	1.1		
		I-YOU/HERE-THERE	Yellow	Brown	I/Y	1.1		
		HERE-THERE	Brown	Yellow	Y/I	1.1		
		I-YOU	Brown	Yellow	Y/I	1.1		
		I-YOU/HERE-THERE	Brown	Yellow	I/Y	1.1		
		I-YOU	Yellow	Brown	Y/I	1.1		
		HERE-THERE	Yellow	Brown	I/Y	1.1	**12**	Pass

REVERSAL 2

			EXP.	CHILD	Order	Correct	Total	Perf.
LEVEL 1								
BLOCK 4		**I-YOU SIMPLE & REVERSAL - C.S.L.**						
TEST	22	Simple	Green	Red	I/Y	0.0		
		Reversal	Green	Red	I/Y	0.0		
		Simple	Red	Green	Y/I	0.0		
		Reversal	Green	Red	Y/I	0.0		
		Reversal	Red	Green	Y/I	0.0		
		Simple	Red	Green	I/Y	0.0	**0**	Fail

BLOCK 4		**I-YOU SIMPLE & REVERSAL - C.S.L.**						
TRAIN		Simple	Green	Red	I/Y	0.1		
		Reversal	Green	Red	I/Y	1.1		
		Simple	Red	Green	Y/I	1.1		
		Reversal	Green	Red	Y/I	1.1		
		Reversal	Red	Green	Y/I	1.1		
		Simple	Red	Green	I/Y	1.1		
		Simple	Green	Red	I/Y	1.1		7
BLOCK 4		**I-YOU SIMPLE & REVERSAL - C.S.L.**						
TEST		Simple	Green	Red	I/Y	1.1		
		Reversal	Green	Red	I/Y	1.1		
		Simple	Red	Green	Y/I	1.1		
		Reversal	Green	Red	Y/I	1.1		
		Reversal	Red	Green	Y/I	1.1		
		Simple	Red	Green	I/Y	1.1	6	Pass
LEVEL 2		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
BLOCK 10	23	Simple	Blue	Black	I/Y	1.1		
TEST		Reversal	Blue	Black	I/Y	1.1		
		Simple	Black	Blue	Y/I	1.1		
		Reversal	Blue	Black	Y/I	0.0		
		Reversal	Black	Blue	Y/I	0.0		
		Simple	Black	Blue	I/Y	1.1	4	Fail
BLOCK 10		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
TRAIN		Simple	Blue	Black	I/Y	1.1		
		Reversal	Blue	Black	I/Y	0.0		
		Simple	Black	Blue	Y/I	1.1		
		Reversal	Blue	Black	Y/I	1.1		
		Reversal	Black	Blue	Y/I	1.1		
		Simple	Black	Blue	I/Y	1.1		
		Simple	Blue	Black	I/Y	1.1		
		Reversal	Blue	Black	I/Y	1.1		8
BLOCK 10		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
TEST	24	Simple	Blue	Black	I/Y	1.1		
		Reversal	Blue	Black	I/Y	1.1		
		Simple	Black	Blue	Y/I	1.1		
		Reversal	Blue	Black	Y/I	1.1		
		Reversal	Black	Blue	Y/I	1.1		
		Simple	Black	Blue	I/Y	1.1	6	Pass
BLOCK 12		**I-YOU REVERSAL & HERE-THERE REVERSAL - C.S.L.**						
TEST		I-YOU	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	I/Y	1.1		
		HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Black	Blue	Y/I	1.1	6	Pass
BLOCK 14		**I-YOU REVERSAL, HERE-THERE REVERSAL,**						
TEST		**& I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.**						
		I-YOU	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	Y/I	1.1		

		HERE-THERE	Blue	Black	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Blue	Black	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Black	Blue	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	I/Y	1.1		
		I-YOU	Blue	Black	Y/I	1.1		
		HERE-THERE	Blue	Black	I/Y	1.1	**12**	Pass
		REVERSAL 2: GENERALISATION TESTS						
LEVEL 1			**EXP.**	**CHILD**	**Order**	***Correct***	**Total**	**Perf.**
BLOCK 4		**I-YOU SIMPLE & REVERSAL - C.S.L.**						
TEST	25	Simple	Pen	Cup	I/Y	1.1		
		Reversal	Pen	Cup	I/Y	1.1		
		Reversal	Cup	Pen	Y/I	1.1		
		Simple	Pen	Cup	Y/I	1.1		
		Reversal	Cup	Pen	Y/I	1.1		
		Simple	Cup	Pen	I/Y	1.1	**6**	Pass
LEVEL 2		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
BLOCK 10		Simple	Yellow	Brown	I/Y	1.1		
TEST		Reversal	Yellow	Brown	I/Y	1.1		
		Simple	Brown	Yellow	Y/I	1.1		
		Reversal	Yellow	Brown	Y/I	1.1		
		Reversal	Brown	Yellow	Y/I	1.1		
		Simple	Brown	Yellow	I/Y	1.1	**6**	Pass
BLOCK 12		**I-YOU REVERSAL & HERE-THERE REVERSAL - C.S.L.**						
TEST		I-YOU	Yellow	Brown	I/Y	1.1		
		HERE-THERE	Brown	Yellow	I/Y	1.1		
		HERE-THERE	Brown	Yellow	Y/I	1.1		
		I-YOU	Yellow	Brown	I/Y	1.1		
		HERE-THERE	Brown	Yellow	Y/I	1.1		
		I-YOU	Brown	Yellow	Y/I	1.1	**6**	Pass
BLOCK 14		**I-YOU REVERSAL, HERE-THERE REVERSAL,**						
TEST		**& I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.**						
		I-YOU	Yellow	Brown	I/Y	1.1		
		HERE-THERE	Brown	Yellow	I/Y	1.1		
		I-YOU/HERE-THERE	Yellow	Brown	Y/I	1.1		
		HERE-THERE	Yellow	Brown	Y/I	1.1		
		I-YOU/HERE-THERE	Brown	Yellow	Y/I	1.1		
		I-YOU	Yellow	Brown	I/Y	1.1		
		I-YOU/HERE-THERE	Yellow	Brown	I/Y	1.1		
		HERE-THERE	Brown	Yellow	Y/I	1.1		
		I-YOU	Brown	Yellow	Y/I	1.1		
		I-YOU/HERE-THERE	Brown	Yellow	I/Y	1.1		
		I-YOU	Yellow	Brown	Y/I	1.1		
		HERE-THERE	Yellow	Brown	I/Y	1.1	**12**	Pass

* Indicates that the subject did not reach the mastery criterion

Subject 2: Responding in Accordance with the Perspective-taking Frames of I-YOU and HERE-THERE.

EXTENDED PROTOCOL

			EXP.	CHILD	Order	Correct	Total	Perf.
LEVEL 1 BLOCK 1 TEST		**SIMPLE I-YOU**						
	1	Simple	Green	Red	I/Y	1.1		
			"	"	Y/I	1.1		
			"	"	Y/I	1.1		
			"	"	I/Y	1.1		
			"	"	Y/I	1.1		
			"	"	I/Y	1.1	**6**	Pass
BLOCK 2 TEST		**I-YOU REVERSAL**						
		Reversal	Green	Red	I/Y	0.0		
			"	"	Y/I	0.1		
			"	"	Y/I	1.1		
			"	"	I/Y	1.1		
			"	"	Y/I	0.0		
			"	"	I/Y	0.0	**2**	Fail
BLOCK 2 TRAIN		**I-YOU REVERSAL**						
		Reversal	Green	Red	I/Y	1.1		
			"	"	Y/I	1.1		
			"	"	Y/I	1.0		
			"	"	I/Y	0.1		
			"	"	Y/I	0.1		
			"	"	Y/I	0.1		
	2		"	"	Y/I	1.1		
			"	"	I/Y	1.1		
			"	"	Y/I	1.1		
			"	"	Y/I	1.1		
			"	"	I/Y	1.1		
			"	"	Y/I	1.1		**12**
BLOCK 2 TEST		**I-YOU REVERSAL**						
		Reversal	Green	Red	Y/I	1.1		
			"	"	I/Y	1.0		
			"	"	I/Y	1.0		
			"	"	Y/I	0.1		
			"	"	Y/I	1.0		
			"	"	I/Y	1.0	**1**	Fail
BLOCK 2 TRAIN		**I-YOU REVERSAL**						
		Reversal	Green	Red	Y/I	0.1		
			"	"	I/Y	1.0		
			"	"	I/Y	0.1		
			"	"	Y/I	1.1		
			"	"	Y/I	1.1		
			"	"	I/Y	1.1		
			"	"	Y/I	0.1		
			"	"	I/Y	0.1		

		"	"	I/Y	0.0		
3		Green	Red	Y/I	1.1		
		"	"	I/Y	1.0		
		"	"	I/Y	0.0		
		"	"	Y/I	1.1		
		"	"	Y/I	1.0		
		"	"	I/Y	0.0		
		"	"	Y/I	1.1		
		"	"	I/Y	0.1		
		"	"	I/Y	1.0		
		"	"	Y/I	0.1		
		"	"	Y/I	1.1		
		"	"	I/Y	1.1		
		"	"	Y/I	1.1		
		"	"	I/Y	1.1		
		"	"	I/Y	1.1		
		"	"	Y/I	0.0		
	1 sweet for @ correct reversal trial						
4		Green	Red	Y/I	1.0		
		"	"	I/Y	1.0		
		"	"	I/Y	1.1		
		"	"	Y/I	0.0		
		"	"	Y/I	0.1		
		"	"	I/Y	0.1		
		"	"	Y/I	0.1		
		"	"	I/Y	1.1		
		"	"	I/Y	0.1		
		"	"	Y/I	0.1		
		"	"	Y/I	1.1		
		"	"	I/Y	1.1		
		"	"	Y/I	0.1		
		"	"	I/Y	1.1		
		"	"	I/Y	1.1		
		"	"	Y/I	1.1		
		"	"	Y/I	1.1		
		"	"	I/Y	0.0		
		"	"	Y/I	1.1		
		"	"	I/Y	1.1		
		"	"	I/Y	1.1		
		"	"	Y/I	1.1		
		"	"	Y/I	1.1		
		"	"	I/Y	1.1		**49**
BLOCK 2	**I-YOU REVERSAL**						
TEST	Reversal	Green	Red	Y/I	0.1		
		"	"	I/Y	0.0		
		"	"	I/Y	1.1		
		"	"	Y/I	1.1		
		"	"	Y/I	1.1		
		"	"	I/Y	1.1	**4**	Fail
BLOCK 2	**I-YOU REVERSAL**						

TRAIN	5	Reversal	Green	Red	Y/I	1.0		
			"	"	I/Y	0.0		
			"	"	I/Y	0.1		
			"	"	Y/I	1.1		
			"	"	Y/I	1.1		
			"	"	I/Y	0.1		
			"	"	Y/I	1.1		
			"	"	I/Y	1.1		
			"	"	I/Y	1.1		
			"	"	Y/I	0.0		
			"	"	Y/I	0.0		
			"	"	I/Y	0.1		
			"	"	Y/I	1.1		
			"	"	I/Y	0.1		
			"	"	I/Y	1.1		
			"	"	Y/I	1.1		
			"	"	Y/I	0.1		
			"	"	I/Y	0.1		
	6		Green	Red	Y/I	1.1		
			"	"	I/Y	0.1		
			"	"	I/Y	1.1		
			"	"	Y/I	1.1		
			"	"	Y/I	1.1		
			"	"	I/Y	1.1		
			"	"	Y/I	1.1		
			"	"	I/Y	1.1		**26**
BLOCK 2		**I-YOU REVERSAL**						
TEST	7	Reversal	Green	Red	Y/I	1.1		
			"	"	I/Y	1.1		
			"	"	I/Y	1.1		
			"	"	Y/I	1.1		
			"	"	Y/I	1.1		
			"	"	I/Y	1.1	6	Pass
BLOCK 3		**I-YOU - SIMPLE & REVERSAL**						
TEST		Simple	Green	Red	I/Y	0.1		
		Reversal	"	"	Y/I	0.0		
		Reversal	"	"	Y/I	0.0		
		Simple	"	"	Y/I	1.1		
		Reversal	"	"	I/Y	0.0		
		Simple	"	"	I/Y	1.1	2	Fail
BLOCK 3		**I-YOU - SIMPLE & REVERSAL**						
TRAIN	8	Simple	Green	Red	I/Y	1.0		
		Reversal	"	"	Y/I	0.1		
		Reversal	"	"	Y/I	0.1		
		Simple	"	"	Y/I	1.1		
		Reversal	"	"	I/Y	1.1		
		Simple	"	"	I/Y	0.1		
		Simple	"	"	I/Y	0.1		
		Reversal	"	"	Y/I	1.1		
		Reversal	"	"	Y/I	0.1		

		Simple	"	"	Y/I	1.1		
		Reversal	"	"	I/Y	0.1		
		Simple	"	"	I/Y	1.1		
		Simple	"	"	I/Y	1.1		
		Reversal	"	"	Y/I	1.1		
		Reversal	"	"	Y/I	1.1		
		Simple	"	"	Y/I	1.1		
		Reversal	"	"	I/Y	1.1		**17**
BLOCK 3		**I-YOU - SIMPLE & REVERSAL**						
TEST		Simple	Green	Red	I/Y	1.1		
		Reversal	"	"	Y/I	1.1		
		Reversal	"	"	Y/I	1.1		
		Simple	"	"	Y/I	1.1		
		Reversal	"	"	I/Y	1.1		
		Simple	"	"	I/Y	1.1	**6**	Pass
BLOCK 4		**I-YOU - SIMPLE & REVERSAL - C.S.L.**						
TEST	9	Simple	Green	Red	Y/I	1.1		
		Reversal	Red	Green	I/Y	1.1		
		Reversal	Green	Red	Y/I	1.1		
		Simple	Green	Red	I/Y	1.1		
		Reversal	Green	Red	Y/I	1.1		
		Simple	Red	Green	I/Y	1.1	**6**	Pass
BLOCK 5		**GEN. I-YOU SIMPLE & REVERSAL - C.S.L.**						
TEST	10	Simple	Pen	Cup	Y/I	1.1		PEN/CUP
		Reversal	Cup	Pen	I/Y	1.1		
		Reversal	Pen	Cup	Y/I	1.1		
		Simple	Pen	Cup	I/Y	1.1		
		Reversal	Pen	Cup	Y/I	0.0		
		Simple	Cup	Pen	I/Y	0.0	**4**	Fail
BLOCK 5		**GEN. I-YOU SIMPLE & REVERSAL - C.S.L.**						
TRAIN		Simple	Pen	Cup	Y/I	1.1		
		Reversal	Cup	Pen	I/Y	1.1		
		Reversal	Pen	Cup	Y/I	0.0		
		Simple	Pen	Cup	I/Y	1.1		
		Reversal	Pen	Cup	Y/I	1.1		
		Simple	Cup	Pen	I/Y	1.1		
		Simple	Pen	Cup	Y/I	1.1		
		Reversal	Cup	Pen	I/Y	1.1		
		Reversal	Pen	Cup	Y/I	1.1		**9**
BLOCK 5		**GEN. I-YOU SIMPLE & REVERSAL - C.S.L.**						
TEST		Simple	Key	Toy	Y/I	1.1		KEY/TOY
		Reversal	Toy	Key	I/Y	1.1		
		Reversal	Key	Toy	Y/I	1.1		
		Simple	Key	Toy	I/Y	1.1		
		Reversal	Key	Toy	Y/I	0.0		
		Simple	Toy	Key	I/Y	1.1	**5**	Fail
BLOCK 5		**GEN. I-YOU SIMPLE & REVERSAL - C.S.L.**						
TRAIN	11	Simple	Key	Toy	Y/I	1.1		
		Reversal	Toy	Key	I/Y	1.1		
		Reversal	Key	Toy	Y/I	1.1		

		Simple	Key	Toy	I/Y	0.1		
		Reversal	Key	Toy	Y/I	0.1		
		Simple	Toy	Key	I/Y	0.1		
		Simple	Key	Toy	Y/I	1.1		
		Reversal	Toy	Key	I/Y	1.1		
		Reversal	Key	Toy	Y/I	1.1		
		Simple	Key	Toy	I/Y	1.1		
		Reversal	Key	Toy	Y/I	0.1		
		Simple	Toy	Key	I/Y	1.1		
		Simple	Key	Toy	Y/I	1.1		
		Reversal	Toy	Key	I/Y	1.1		
		Reversal	Key	Toy	Y/I	1.1		
		Simple	Key	Toy	I/Y	1.1		
		Reversal	Key	Toy	Y/I	1.1		**17**
BLOCK 5		**GEN. I-YOU SIMPLE & REVERSAL - C.S.L.**						
TEST		Simple	Apple	Book	Y/I	1.1		APPLE/BOOK
		Reversal	Book	Apple	I/Y	1.1		
		Reversal	Apple	Book	Y/I	1.1		
		Simple	Apple	Book	I/Y	1.1		
		Reversal	Apple	Book	Y/I	1.1		
		Simple	Book	Apple	I/Y	1.1	**6**	Pass
BLOCK 5		**GEN. I-YOU SIMPLE & REVERSAL - C.S.L.**						
TEST	12	Simple	Sweet	Shape	Y/I	1.1		SWEET/SHAPE
		Reversal	Shape	Sweet	I/Y	1.1		
		Reversal	Sweet	Shape	Y/I	1.1		
		Simple	Sweet	Shape	I/Y	1.1		
		Reversal	Sweet	Shape	Y/I	1.1		
		Simple	Shape	Sweet	I/Y	1.1	**6**	Pass
LEVEL 2								
BLOCK 6		**SIMPLE I-YOU IN SIMPLE HERE-THERE**						
TEST		Simple	Red	White	Y/I	1.1		RED/WHITE
			"	"	I/Y	1.1		CHAIRS
			"	"	Y/I	1.1		
			"	"	I/Y	1.1		
			"	"	Y/I	1.1		
			"	"	I/Y	1.1	**6**	Pass
BLOCK 7		**I-YOU SIMPLE & REVERSAL IN SIMPLE HERE-THERE**						
TEST		Simple	Red	White	I/Y	1.1		
		Reversal	"	"	I/Y	0.0		
		Simple	"	"	Y/I	1.1		
		Reversal	"	"	Y/I	1.1		
		Reversal	"	"	Y/I	1.1		
		Simple	"	"	I/Y	1.1	**5**	Fail
TRAIN		**I-YOU REVERSAL ONLY IN SIMPLE HERE-THERE**						
TASK 4	13	Reversal	Red	White	I/Y	1.1		
			"	"	Y/I	1.1		
			"	"	Y/I	1.1		
			"	"	I/Y	1.1		
			"	"	I/Y	1.1		
			"	"	Y/I	1.1		**6**

TEST		**I-YOU REVERSAL ONLY IN SIMPLE HERE-THERE**						
TASK 4		Reversal	Red	White	I/Y	1.1		
			"	"	Y/I	1.1		
			"	"	Y/I	1.1		
			"	"	I/Y	1.1		
			"	"	I/Y	1.1		
			"	"	Y/I	1.1	**6**	**Pass**
BLOCK 8		**I-YOU SIMPLE & REVERSAL IN SIMPLE HERE-THERE - C.S.L.**						
TEST		Simple	Red	White	I/Y	1.1		
		Reversal	White	Red	Y/I	1.1		
		Reversal	Red	White	I/Y	1.1		
		Simple	Red	White	I/Y	1.1		
		Simple	White	Red	Y/I	1.1		
		Reversal	White	Red	Y/I	1.1	**6**	**Pass**
		4 Weeks delay-Repeated Block						
BLOCK 8		**I-YOU SIMPLE & REVERSAL IN SIMPLE HERE-THERE - C.L.**						
TEST	14	Simple	Red	White	I/Y	1.1		
		Reversal	White	Red	Y/I	1.1		
		Reversal	Red	White	I/Y	1.1		
		Simple	Red	White	I/Y	1.1		
		Simple	White	Red	Y/I	1.1		
		Reversal	White	Red	Y/I	1.1	**6**	**Pass**
BLOCK 9		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL**						
TEST		Simple	Red	White	I/Y	1.1		
		Reversal	"	"	I/Y	0.0		
		Simple	"	"	Y/I	1.1		
		Reversal	"	"	Y/I	1.1		
		Reversal	"	"	Y/I	1.1		
		Simple	"	"	I/Y	1.1	**5**	**Fail**
TRAIN		**SIMPLE I-YOU IN HERE-THERE REVERSAL ONLY**						
TASK 5	15	Reversal	Red	White	I/Y	1.1		
			"	"	I/Y	1.1		
			"	"	Y/I	1.1		
			"	"	Y/I	1.1		
			"	"	Y/I	1.1		
			"	"	I/Y	1.1		**6**
TEST		**SIMPLE I-YOU IN HERE-THERE REVERSAL ONLY**						
TASK 5		Reversal	Red	White	I/Y	1.1		
			"	"	I/Y	1.1		
			"	"	Y/I	1.1		
			"	"	Y/I	1.1		
			"	"	Y/I	1.1		
			"	"	I/Y	1.1	6	Pass
BLOCK 9		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL**						
TEST	16	Simple	Red	White	I/Y	0.0		
		Reversal	"	"	I/Y	1.1		
		Simple	"	"	Y/I	1.1		
		Reversal	"	"	Y/I	1.1		
		Reversal	"	"	Y/I	1.1		
		Simple	"	"	I/Y	0.0	4	Fail

BLOCK 9		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL**						
TRAIN		Simple	Red	White	I/Y	1.1		
		Reversal	"	"	I/Y	1.1		
		Simple	"	"	Y/I	1.1		
		Reversal	"	"	Y/I	1.1		
		Reversal	"	"	Y/I	1.1		
		Simple	"	"	I/Y	1.1		**6**
BLOCK 9		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL**						
TEST		Simple	Red	White	I/Y	1.1		
		Reversal	"	"	I/Y	1.1		
		Simple	"	"	Y/I	1.1		
		Reversal	"	"	Y/I	1.1		
		Reversal	"	"	Y/I	1.1		
		Simple	"	"	I/Y	1.1	**6**	Pass
BLOCK 10		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
TEST		Simple	Red	White	I/Y	1.1		
		Reversal	Red	White	I/Y	1.1		
		Simple	White	Red	Y/I	1.1		
		Reversal	Red	White	Y/I	1.1		
		Reversal	White	Red	Y/I	1.1		
		Simple	White	Red	I/Y	1.1	**6**	Pass
BLOCK 11		**I-YOU REVERSAL & HERE-THERE REVERSAL**						
TEST	17	I-YOU	Red	White	I/Y	1.1		
		HERE-THERE	"	"	I/Y	1.1		
		HERE-THERE	"	"	Y/I	1.1		
		I-YOU	"	"	I/Y	0.0		
		HERE-THERE	"	"	Y/I	0.0		
		I-YOU	"	"	Y/I	1.1	**4**	Fail
BLOCK 11		**I-YOU REVERSAL & HERE-THERE REVERSAL**						
TRAIN		I-YOU	Red	White	I/Y	1.1		
		HERE-THERE	"	"	I/Y	1.1		
		HERE-THERE	"	"	Y/I	1.1		
		I-YOU	"	"	I/Y	1.1		
		HERE-THERE	"	"	Y/I	1.1		
		I-YOU	"	"	Y/I	1.1		**6**
BLOCK 11		**I-YOU REVERSAL & HERE-THERE REVERSAL**						
TEST		I-YOU	Red	White	I/Y	1.1		
		HERE-THERE	"	"	I/Y	1.1		
		HERE-THERE	"	"	Y/I	1.1		
		I-YOU	"	"	I/Y	1.1		
		HERE-THERE	"	"	Y/I	1.1		
		I-YOU	"	"	Y/I	1.1	**6**	Pass
BLOCK 12		**I-YOU REVERSAL & HERE-THERE REVERSAL - C.S.L.**						
TEST		I-YOU	Red	White	I/Y	1.1		
		HERE-THERE	White	Red	I/Y	1.1		
		HERE-THERE	White	Red	Y/I	1.1		
		I-YOU	Red	White	I/Y	1.1		
		HERE-THERE	White	Red	Y/I	1.1		
		I-YOU	White	Red	Y/I	1.1	**6**	Pass
BLOCK 13		**I-YOU REVERSAL, HERE-THERE REVERSAL,**						

TEST		**& I-YOU/HERE-THERE DOUBLE REVERSAL**						
		I-YOU	Red	White	I/Y	1.1		
		HERE-THERE	"	"	I/Y	1.1		
		I-YOU/HERE-THERE	"	"	Y/I	0.0		
		HERE-THERE	"	"	Y/I	1.1		
		I-YOU/HERE-THERE	"	"	Y/I	0.0		
		I-YOU	"	"	I/Y	1.1		
		I-YOU/HERE-THERE	"	"	I/Y	0.0		
		HERE-THERE	"	"	I/Y	1.1		
		I-YOU	"	"	Y/I	1.1		
		I-YOU/HERE-THERE	"	"	Y/I	0.0		
		I-YOU	"	"	Y/I	1.1		
		HERE-THERE	"	"	I/Y	1.1	**8**	Fail
TRAIN		**I-YOU/HERE-THERE DOUBLE REVERSAL ONLY**						
TASK 6	18	I-YOU/HERE-THERE	Red	White	Y/I	0.0		
			"	"	Y/I	0.0		
			"	"	I/Y	0.0		
			"	"	Y/I	0.0		
			"	"	I/Y	0.0		
			"	"	I/Y	0.0		
			"	"	Y/I	1.1		
			"	"	Y/I	0.0		
			"	"	I/Y	1.1		
			"	"	Y/I	0.0		
			"	"	I/Y	1.1		
			"	"	I/Y	1.1		
	19		"	"	Y/I	0.0		
			"	"	Y/I	0.0		
			"	"	I/Y	1.1		
			"	"	Y/I	0.0		
			"	"	I/Y	1.1		
			"	"	I/Y	1.1		
			"	"	Y/I	0.0		
			"	"	Y/I	1.1		
			"	"	I/Y	1.1		
			"	"	Y/I	1.1		
			"	"	I/Y	1.1		
			"	"	I/Y	1.1		
			"	"	Y/I	1.1		**25**
TEST		**I-YOU/HERE-THERE DOUBLE REVERSAL ONLY**						
TASK 6		I-YOU/HERE-THERE	Red	White	Y/I	1.1		
			"	"	Y/I	1.1		
			"	"	I/Y	1.1		
			"	"	Y/I	1.1		
			"	"	I/Y	1.1		
			"	"	I/Y	1.1	**6**	Pass
BLOCK 13		**I-YOU REVERSAL, HERE-THERE REVERSAL,**						
TEST		**& I-YOU/HERE-THERE DOUBLE REVERSAL**						
	20	I-YOU	Red	White	I/Y	0.0		
		HERE-THERE	"	"	I/Y	1.1		

		I-YOU/HERE-THERE	"	"	Y/I	1.1		
		HERE-THERE	"	"	Y/I	0.0		
		I-YOU/HERE-THERE	"	"	Y/I	0.0		
		I-YOU	"	"	I/Y	1.1		
		I-YOU/HERE-THERE	"	"	I/Y	0.0		
		HERE-THERE	"	"	I/Y	1.1		
		I-YOU	"	"	Y/I	1.1		
		I-YOU/HERE-THERE	"	"	Y/I	0.0		
		I-YOU	"	"	Y/I	1.1		
		HERE-THERE	"	"	I/Y	1.1	7	Fail
BLOCK 13		**I-YOU REVERSAL, HERE-THERE REVERSAL,**						
TRAIN		**& I-YOU/HERE-THERE DOUBLE REVERSAL**						
	21	I-YOU	Red	White	I/Y	1.1		
		HERE-THERE	"	"	I/Y	1.1		
		I-YOU/HERE-THERE	"	"	Y/I	1.1		
		HERE-THERE	"	"	Y/I	1.1		
		I-YOU/HERE-THERE	"	"	Y/I	0.0		
		I-YOU	"	"	I/Y	0.0		
		I-YOU/HERE-THERE	"	"	I/Y	1.1		
		HERE-THERE	"	"	I/Y	0.0		
		I-YOU	"	"	Y/I	1.1		
		I-YOU/HERE-THERE	"	"	Y/I	1.1		
		I-YOU	"	"	Y/I	0.0		
		HERE-THERE	"	"	I/Y	0.0		
	22	I-YOU	"	"	I/Y	0.0		
		HERE-THERE	"	"	I/Y	1.1		
		I-YOU/HERE-THERE	"	"	Y/I	0.0		
		HERE-THERE	"	"	Y/I	0.0		
		I-YOU/HERE-THERE	"	"	Y/I	0.0		
		I-YOU	"	"	I/Y	0.0		
		I-YOU/HERE-THERE	"	"	I/Y	0.0		
		HERE-THERE	"	"	I/Y	1.1		
		I-YOU	"	"	Y/I	1.1		
		I-YOU/HERE-THERE	"	"	Y/I	0.0		
		I-YOU	"	"	Y/I	0.0		
		HERE-THERE	"	"	I/Y	1.1		24*
		Child was failing completely to attend.						
		Added new reinforers-4 beads@ 1 sweet, remove for incorrect.						
		Attempted to re-establish previous performances						
TRAIN		**I-YOU REVERSAL ONLY IN SIMPLE HERE-THERE - C.S.L.**						
TASK 4	23	Reversal	Red	White	I/Y	1.1		
			White	Red	Y/I	1.1		
			Red	White	Y/I	1.1		
			Red	White	I/Y	1.1		
			White	Red	I/Y	1.1		
			White	Red	Y/I	1.1	6	Pass
TEST		**I-YOU REVERSAL ONLY IN SIMPLE HERE-THERE - C.S.L.**						
TASK 4		Reversal	Red	White	I/Y	1.1		
			White	Red	Y/I	1.1		
			Red	White	Y/I	1.1		

			Red	White	I/Y	1.1		
			White	Red	I/Y	1.1		
			White	Red	Y/I	1.1	**6**	Pass
TRAIN		**SIMPLE I-YOU IN HERE-THERE REVERSAL ONLY - C.S.L.**						
TASK 5		Reversal	Red	White	I/Y	1.1		
			White	Red	Y/I	1.1		
			Red	White	Y/I	1.1		
			Red	White	I/Y	1.1		
			White	Red	I/Y	1.1		
			White	Red	Y/I	1.1	**6**	Pass
TEST		**SIMPLE I-YOU IN HERE-THERE REVERSAL ONLY - C.S.L.**						
TASK 5		Reversal	Red	White	I/Y	1.1		
			White	Red	Y/I	1.1		
			Red	White	Y/I	1.1		
			Red	White	I/Y	1.1		
			White	Red	I/Y	1.1		
			White	Red	Y/I	1.1	**6**	Pass
BLOCK 12		**I-YOU REVERSAL & HERE-THERE REVERSAL - C.S.L.**						
TRAIN	24	I-YOU	Red	White	I/Y	0.0		
		HERE-THERE	White	Red	I/Y	1.1		
		HERE-THERE	White	Red	Y/I	1.1		
		I-YOU	Red	White	I/Y	1.1		
		HERE-THERE	White	Red	Y/I	1.1		
		I-YOU	White	Red	Y/I	1.1		
		I-YOU	Red	White	I/Y	1.1		7
BLOCK 12		**I-YOU REVERSAL & HERE-THERE REVERSAL - C.S.L.**						
TEST		I-YOU	Red	White	I/Y	1.1		
		HERE-THERE	White	Red	I/Y	1.1		
		HERE-THERE	White	Red	Y/I	1.1		
		I-YOU	Red	White	I/Y	1.1		
		HERE-THERE	White	Red	Y/I	1.1		
		I-YOU	White	Red	Y/I	1.1	**6**	Pass
TRAIN		**I-YOU/HERE-THERE DOUBLE REVERSAL ONLY - C.S.L.**						
TASK 6	25	I-YOU/HERE-THERE	Red	White	Y/I	0.0		
			White	Red	Y/I	1.1		
			Red	White	I/Y	0.0		
			Red	White	Y/I	1.1		
			White	Red	I/Y	1.1		
			White	Red	I/Y	1.1		
			Red	White	Y/I	1.1		
			White	Red	Y/I	0.0		
			Red	White	I/Y	1.1		
			Red	White	Y/I	1.1		
			White	Red	I/Y	1.1		
			White	Red	I/Y	1.1		
			Red	White	Y/I	1.1		
			White	Red	Y/I	1.1		14
TEST		**I-YOU/HERE-THERE DOUBLE REVERSAL ONLY - C.S.L.**						
TASK 6		I-YOU/HERE-THERE	Red	White	Y/I	1.1		
			White	Red	Y/I	1.1		

			Red	White	I/Y	1.1		
			Red	White	Y/I	0.0		
			White	Red	I/Y	1.1		
			White	Red	I/Y	1.1	**5**	Fail
TRAIN		**I-YOU/HERE-THERE DOUBLE REVERSAL ONLY - C.S.L.**						
TASK 6	26	I-YOU/HERE-THERE	Red	White	Y/I	0.0		
			White	Red	Y/I	1.1		
			Red	White	I/Y	1.1		
			Red	White	Y/I	1.1		
			White	Red	I/Y	1.1		
			White	Red	I/Y	1.1		
			Red	White	Y/I	1.1		7
TEST		**I-YOU/HERE-THERE DOUBLE REVERSAL ONLY - C.S.L.**						
TASK 6		I-YOU/HERE-THERE	Red	White	Y/I	1.1		
			White	Red	Y/I	1.1		
			Red	White	I/Y	1.1		
			Red	White	Y/I	1.1		
			White	Red	I/Y	1.1		
			White	Red	I/Y	1.1	**6**	Pass
BLOCK 13		**I-YOU REVERSAL, HERE-THERE REVERSAL,**						
TRAIN		**& I-YOU/HERE-THERE DOUBLE REVERSAL**						
	27	I-YOU	Red	White	I/Y	1.1		
		HERE-THERE	"	"	I/Y	1.1		
		I-YOU/HERE-THERE	"	"	Y/I	0.0		
		HERE-THERE	"	"	Y/I	0.0		
		I-YOU/HERE-THERE	"	"	Y/I	1.1		
		I-YOU	"	"	I/Y	0.0		
		I-YOU/HERE-THERE	"	"	I/Y	1.1		
		HERE-THERE	"	"	I/Y	0.0		
		I-YOU	"	"	Y/I	0.0		
		I-YOU/HERE-THERE	"	"	Y/I	0.0		
		I-YOU	"	"	Y/I	1.1		
		Changed reinforcers.						
		HERE-THERE	"	"	I/Y	1.1		
	28	I-YOU	"	"	I/Y	0.0		
		HERE-THERE	"	"	I/Y	1.1		
		I-YOU/HERE-THERE	"	"	Y/I	0.0		
		HERE-THERE	"	"	Y/I	1.1		
		I-YOU/HERE-THERE	"	"	Y/I	0.0		
		I-YOU	"	"	I/Y	0.0		
		I-YOU/HERE-THERE	"	"	I/Y	1.1		
		HERE-THERE	"	"	I/Y	0.0		
		I-YOU	"	"	Y/I	1.1		
		I-YOU/HERE-THERE	"	"	Y/I	1.1		
		I-YOU	"	"	I/Y	1.1		
		HERE-THERE	"	"	I/Y	0.0		
		I-YOU	"	"	Y/I	0.0		
		HERE-THERE	"	"	Y/I	0.0		
		I-YOU/HERE-THERE	"	"	Y/I	0.0		
		HERE-THERE	"	"	I/Y	0.0		

	I-YOU/HERE-THERE	"	"	I/Y	0.0	
	I-YOU	"	"	Y/I	1.1	
	I-YOU/HERE-THERE	"	"	Y/I	0.0	
	HERE-THERE	"	"	I/Y	1.1	32*
	"Listen very carefully" used before the double reversals only.					
	Alternating single and double reversals.					
29	I-YOU	Red	White	I/Y	0.0	
	I-YOU/HERE-THERE	"	"	Y/I	0.0	
	HERE-THERE	"	"	I/Y	0.0	
	I-YOU/HERE-THERE	"	"	Y/I	0.0	
	HERE-THERE	"	"	Y/I	0.0	
	I-YOU/HERE-THERE	"	"	I/Y	0.0	
	HERE-THERE	"	"	I/Y	1.1	
	I-YOU/HERE-THERE	"	"	Y/I	0.0	
	I-YOU	"	"	Y/I	0.0	
	I-YOU/HERE-THERE	"	"	Y/I	0.0	
	I-YOU	"	"	I/Y	1.1	
	I-YOU/HERE-THERE	"	"	I/Y	1.1	
30	I-YOU	"	"	I/Y	0.0	
	I-YOU/HERE-THERE	"	"	Y/I	1.1	
	HERE-THERE	"	"	I/Y	1.1	
	I-YOU/HERE-THERE	"	"	Y/I	0.0	
	HERE-THERE	"	"	Y/I	0.0	
	I-YOU/HERE-THERE	"	"	I/Y	1.1	
	HERE-THERE	"	"	I/Y	0.0	
	I-YOU/HERE-THERE	"	"	Y/I	0.0	
	I-YOU	"	"	Y/I	1.1	
	I-YOU/HERE-THERE	"	"	Y/I	0.0	
	I-YOU	"	"	I/Y	0.0	
	I-YOU/HERE-THERE	"	"	I/Y	0.0	
31	I-YOU	"	"	I/Y	0.0	
	I-YOU/HERE-THERE	"	"	Y/I	0.0	
	HERE-THERE	"	"	I/Y	1.1	
	I-YOU/HERE-THERE	"	"	Y/I	0.0	
	HERE-THERE	"	"	Y/I	0.0	
	I-YOU/HERE-THERE	"	"	I/Y	0.0	
	HERE-THERE	"	"	I/Y	0.0	
	I-YOU/HERE-THERE	"	"	Y/I	0.0	
	I-YOU	"	"	Y/I	1.1	
	I-YOU/HERE-THERE	"	"	Y/I	0.0	
	I-YOU	"	"	I/Y	0.0	
	I-YOU/HERE-THERE	"	"	I/Y	1.1	
	Changed reinforcers.					
32	I-YOU	"	"	I/Y	0.0	
	I-YOU/HERE-THERE	"	"	Y/I	1.1	
	HERE-THERE	"	"	I/Y	1.1	
	I-YOU/HERE-THERE	"	"	Y/I	0.0	
	HERE-THERE	"	"	Y/I	0.0	
	I-YOU/HERE-THERE	"	"	I/Y	1.1	
	HERE-THERE	"	"	I/Y	1.1	

		I-YOU/HERE-THERE	"	"	Y/I	0.0	
		I-YOU	"	"	Y/I	0.0	
		I-YOU/HERE-THERE	"	"	Y/I	0.0	
		I-YOU	"	"	I/Y	0.0	
		I-YOU/HERE-THERE	"	"	I/Y	1.1	
		I-YOU	"	"	I/Y	xx	xx
		I-YOU/HERE-THERE	"	"	Y/I	xx	"Don't know"
		HERE-THERE	"	"	I/Y	xx	
		I-YOU/HERE-THERE	"	"	Y/I	xx	
		HERE-THERE	"	"	Y/I	xx	
		I-YOU/HERE-THERE	"	"	I/Y	1.1	
		HERE-THERE	"	"	I/Y	xx	
		I-YOU/HERE-THERE	"	"	Y/I	xx	
		I-YOU	"	"	Y/I	xx	
		I-YOU/HERE-THERE	"	"	Y/I	0.0	
		I-YOU	"	"	I/Y	xx	
		I-YOU/HERE-THERE	"	"	I/Y	xx	60*
							92*
		INTRODUCE SHAPING PROCEDURE					
		Train to 6CCR's - C.S.L.					
TRAIN		**I-YOU**					
I-YOU	33	Simple	Red	White	I/Y	1.1	
BLOCK 8		Reversal	White	Red	Y/I	1.1	
		Reversal	Red	White	I/Y	1.1	
		Simple	Red	White	I/Y	1.1	
		Simple	White	Red	Y/I	1.1	
		Reversal	White	Red	Y/I	0.0	
		Simple	Red	White	I/Y	1.1	
		Reversal	White	Red	Y/I	1.1	
		Reversal	Red	White	I/Y	0.0	
		Simple	Red	White	I/Y	1.1	
		Simple	White	Red	Y/I	1.1	
		Reversal	White	Red	Y/I	1.1	
		Simple	Red	White	I/Y	1.1	
		Reversal	White	Red	Y/I	1.1	
		Reversal	Red	White	I/Y	1.1	15
TRAIN		**HERE-THERE**					
HERE-		Simple	Red	White	I/Y	1.1	
THERE		Reversal	Red	White	I/Y	0.0	
BLOCK 10		Simple	White	Red	Y/I	1.1	
		Reversal	Red	White	Y/I	1.1	
		Reversal	White	Red	Y/I	0.0	
		Simple	White	Red	I/Y	1.1	
		Simple	Red	White	I/Y	0.0	
		Reversal	Red	White	I/Y	1.1	
		Simple	White	Red	Y/I	1.1	
		Reversal	Red	White	Y/I	0.0	
		Reversal	White	Red	Y/I	0.0	
		Simple	White	Red	I/Y	1.1	
	34	Simple	Red	White	I/Y	1.1	

		Reversal	Red	White	I/Y	0.0	
		Simple	White	Red	Y/I	1.1	
		Reversal	Red	White	Y/I	1.1	
		Reversal	White	Red	Y/I	0.0	
		Simple	White	Red	I/Y	1.1	
		Simple	Red	White	I/Y	1.1	
		Reversal	Red	White	I/Y	1.1	
		Simple	White	Red	Y/I	1.1	
		Reversal	Red	White	Y/I	0.0	
		Reversal	White	Red	Y/I	1.1	
		Simple	White	Red	I/Y	1.1	
		Simple	Red	White	I/Y	1.1	
		Reversal	Red	White	I/Y	1.1	
		Simple	White	Red	Y/I	1.1	
		Reversal	Red	White	Y/I	1.1	28
		I-YOU/HERE-THERE					
TRAIN	35	"	Red	White	Y/I	0.0	
DOUBLE		"	White	Red	Y/I	1.1	
REVERSAL		"	Red	White	I/Y	1.1	
TASK 6		"	Red	White	Y/I	1.1	
		"	White	Red	I/Y	1.1	
		"	White	Red	I/Y	1.1	
		"	Red	White	Y/I	1.1	7
		Train to 4CCR's - C.S.L.					
TRAIN		**I-YOU**					
I-YOU		Simple	Red	White	I/Y	1.1	
BLOCK 8		Reversal	White	Red	Y/I	1.1	
		Reversal	Red	White	I/Y	1.1	
		Simple	Red	White	Y/I	1.1	4
TRAIN		**HERE-THERE**					
HERE-		Simple	Red	White	I/Y	1.1	
THERE		Reversal	Red	White	I/Y	1.1	
BLOCK 10		Simple	White	Red	Y/I	1.1	
		Reversal	Red	White	Y/I	0.0	
	36	Simple	Red	White	I/Y	1.1	
		Reversal	Red	White	I/Y	1.1	
		Simple	White	Red	Y/I	1.1	
		Reversal	Red	White	Y/I	1.1	8
		I-YOU/HERE-THERE					
TRAIN		"	Red	White	I/Y	0.0	
DOUBLE		"	White	Red	Y/I	0.0	
REVERSAL		"	Red	White	I/Y	1.1	
TASK 6		"	Red	White	Y/I	1.1	
		"	Red	White	I/Y	1.1	
		"	White	Red	Y/I	1.1	6
		Train to 2CCR's - C.S.L.					
TRAIN		**I-YOU**					
I-YOU		Simple	Red	White	I/Y	0.0	

BLOCK 8		Reversal	White	Red	Y/I	1.1	
		Simple	Red	White	I/Y	1.1	3
TRAIN		HERE-THERE					
HERE-		Simple	White	Red	I/Y	1.1	
THERE		Reversal	Red	White	Y/I	1.1	2
BLOCK 10							
TRAIN		I-YOU/HERE-THERE					
DOUBLE		"	Red	White	I/Y	0.0	
REVERSAL		"	White	Red	Y/I	1.1	
TASK 6		"	Red	White	I/Y	1.1	3
		Train to ICCR - C.S.L.					
TRAIN		I-YOU					
I-YOU		Simple	Red	White	I/Y	1.1	1
BLOCK 8							
TRAIN		HERE-THERE					
HERE-		Simple	White	Red	I/Y	0.0	
THERE		Reversal	Red	White	Y/I	1.1	2
BLOCK 10							
TRAIN		I-YOU/HERE-THERE					
DOUBLE		"	Red	White	I/Y	0.0	
REVERSAL		"	White	Red	Y/I	1.1	2
TASK 6							
BLOCK 13	37	I-YOU REVERSAL, HERE-THERE REVERSAL,					
TRAIN		& I-YOU/HERE-THERE DOUBLE REVERSAL					
		I-YOU	Red	White	I/Y	1.1	
		HERE-THERE	"	"	I/Y	1.1	
		I-YOU/HERE-THERE	"	"	Y/I	1.1	
		HERE-THERE	"	"	Y/I	1.1	
		I-YOU/HERE-THERE	"	"	Y/I	1.1	
		I-YOU	"	"	I/Y	1.1	
		I-YOU/HERE-THERE	"	"	I/Y	0.0	
		HERE-THERE	"	"	I/Y	0.0	
		I-YOU	"	"	Y/I	1.1	
		I-YOU/HERE-THERE	"	"	Y/I	1.1	
		I-YOU	"	"	Y/I	1.1	
		HERE-THERE	"	"	I/Y	0.0	
		I-YOU	"	"	I/Y	0.0	
		HERE-THERE	"	"	I/Y	1.1	
		I-YOU/HERE-THERE	"	"	Y/I	1.1	
		HERE-THERE	"	"	Y/I	1.1	
		I-YOU/HERE-THERE	"	"	Y/I	1.1	
		I-YOU	"	"	I/Y	1.1	
		I-YOU/HERE-THERE	"	"	I/Y	1.1	
		HERE-THERE	"	"	I/Y	1.1	
		I-YOU	"	"	Y/I	1.1	
		I-YOU/HERE-THERE	"	"	Y/I	1.1	
		I-YOU	"	"	Y/I	1.1	
		HERE-THERE	"	"	I/Y	1.1	
		I-YOU	"	"	I/Y	1.1	25

BLOCK 13 TEST		**I-YOU REVERSAL, HERE-THERE REVERSAL, & I-YOU/HERE-THERE DOUBLE REVERSAL**						
	38	I-YOU	Red	White	I/Y	1.1		
		HERE-THERE	"	"	I/Y	1.1		
		I-YOU/HERE-THERE	"	"	Y/I	1.1		
		HERE-THERE	"	"	Y/I	1.1		
		I-YOU/HERE-THERE	"	"	Y/I	1.1		
		I-YOU	"	"	I/Y	1.1		
		I-YOU/HERE-THERE	"	"	I/Y	1.1		
		HERE-THERE	"	"	I/Y	1.1		
		I-YOU	"	"	Y/I	1.1		
		I-YOU/HERE-THERE	"	"	Y/I	1.1		
		I-YOU	"	"	Y/I	1.1		
		HERE-THERE	"	"	I/Y	1.1	**12**	Pass
		INTRODUCE FOILS						
BLOCK 13 TEST FOILS		**I-YOU REVERSAL, HERE-THERE REVERSAL, & I-YOU/HERE-THERE DOUBLE REVERSAL**						
	39	I-YOU	Red	White	I/Y	1.1		
		PROBE-I-YOU	"	"	I/Y	1.1		
		HERE-THERE	"	"	I/Y	1.1		
		PROBE-HERE-THERE	"	"	I/Y	1.1		
		I-YOU/HERE-THERE	"	"	Y/I	1.1		
		PROBE-I-U/H-T	"	"	Y/I	1.1		
		HERE-THERE	"	"	Y/I	1.1		
		I-YOU/HERE-THERE	"	"	Y/I	1.1		
		I-YOU	"	"	I/Y	1.1		
		PROBE-HERE-THERE	"	"	Y/I	1.1		
		I-YOU/HERE-THERE	"	"	I/Y	1.1		
		PROBE-I-YOU	"	"	Y/I	1.1		
		HERE-THERE	"	"	I/Y	1.1		
		I-YOU	"	"	Y/I	1.1		
		I-YOU/HERE-THERE	"	"	Y/I	1.1		
		I-YOU	"	"	Y/I	1.1		
		HERE-THERE	"	"	I/Y	1.1		
		PROBE-I-U/H-T	"	"	I/Y	1.1	**18**	Pass
BLOCK 14 TEST		**I-YOU REVERSAL, HERE-THERE REVERSAL, & I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.**						
	40	I-YOU	Red	White	I/Y	1.1		
		HERE-THERE	White	Red	I/Y	1.1		
		I-YOU/HERE-THERE	Red	White	Y/I	1.1		
		HERE-THERE	Red	White	Y/I	1.1		
		I-YOU/HERE-THERE	White	Red	Y/I	1.1		
		I-YOU	Red	White	I/Y	1.1		
		I-YOU/HERE-THERE	Red	White	I/Y	1.1		
		HERE-THERE	White	Red	Y/I	1.1		
		I-YOU	White	Red	Y/I	1.1		
		I-YOU/HERE-THERE	White	Red	I/Y	1.1		
		I-YOU	Red	White	Y/I	1.1		

		HERE-THERE	Red	White	I/Y	1.1	12	Pass
BLOCK 14		**I-YOU REVERSAL, HERE-THERE REVERSAL,**						
TEST		**& I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.**						
FOILS	41	I-YOU	Red	White	I/Y	1.1		
		PROBE-I-YOU	White	Red	I/Y	1.1		
		HERE-THERE	White	Red	I/Y	1.1		
		PROBE-HERE-THERE	Red	White	I/Y	1.1		
		I-YOU/HERE-THERE	Red	White	Y/I	1.1		
		PROBE-I-U/H-T	White	Red	I/Y	1.1		
		HERE-THERE	Red	White	Y/I	1.1		
		I-YOU/HERE-THERE	White	Red	Y/I	1.1		
		I-YOU	Red	White	I/Y	1.1		
		PROBE-HERE-THERE	Red	White	Y/I	1.1		
		I-YOU/HERE-THERE	Red	White	I/Y	1.1		
		PROBE-I-YOU	Red	White	Y/I	1.1		
		HERE-THERE	White	Red	Y/I	1.1		
		I-YOU	White	Red	Y/I	1.1		
		I-YOU/HERE-THERE	White	Red	I/Y	1.1		
		I-YOU	Red	White	Y/I	1.1		
		HERE-THERE	Red	White	I/Y	1.1		
		PROBE-I-U/H-T	Red	White	Y/I	1.1	18	Pass
BLOCK 15		**GEN. I-YOU REVERSAL, HERE-THERE REVERSAL,**						
TEST		**& I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.**						
	42	I-YOU	Yellow	Brown	I/Y	1.1		STANDING
		HERE-THERE	Brown	Yellow	I/Y	1.1		YELLOW/
		I-YOU/HERE-THERE	Yellow	Brown	Y/I	1.1		BROWN
		HERE-THERE	Yellow	Brown	Y/I	1.1		DOORS
		I-YOU/HERE-THERE	Brown	Yellow	Y/I	1.1		
		I-YOU	Yellow	Brown	I/Y	1.1		
		I-YOU/HERE-THERE	Yellow	Brown	I/Y	1.1		
		HERE-THERE	Brown	Yellow	Y/I	1.1		
		I-YOU	Brown	Yellow	Y/I	1.1		
		I-YOU/HERE-THERE	Brown	Yellow	I/Y	1.1		
		I-YOU	Yellow	Brown	Y/I	1.1		
		HERE-THERE	Yellow	Brown	I/Y	1.1	12	Pass
BLOCK 15		**GEN. I-YOU REVERSAL, HERE-THERE REVERSAL,**						
TEST		**& I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.**						
FOILS	43	I-YOU	Yellow	Brown	I/Y	1.1		
		PROBE-I-YOU	Brown	Yellow	I/Y	1.1		
		HERE-THERE	Brown	Yellow	I/Y	1.1		
		PROBE-HERE-THERE	Yellow	Brown	I/Y	1.1		
		I-YOU/HERE-THERE	Yellow	Brown	Y/I	1.1		
		PROBE-I-U/H-T	Brown	Yellow	I/Y	1.1		
		HERE-THERE	Yellow	Brown	Y/I	1.1		
		I-YOU/HERE-THERE	Brown	Yellow	Y/I	1.1		
		I-YOU	Yellow	Brown	I/Y	1.1		
		PROBE-HERE-THERE	Yellow	Brown	Y/I	1.1		
		I-YOU/HERE-THERE	Yellow	Brown	I/Y	1.1		
		PROBE-I-YOU	Yellow	Brown	Y/I	1.1		
		HERE-THERE	Brown	Yellow	Y/I	1.1		

		I-YOU	Brown	Yellow	Y/I	1.1		
		I-YOU/HERE-THERE	Brown	Yellow	I/Y	1.1		
		I-YOU	Yellow	Brown	Y/I	1.1		
		HERE-THERE	Yellow	Brown	I/Y	1.1		
		PROBE-I-U/H-T	Yellow	Brown	Y/I	1.1	**18**	Pass
BLOCK 15		**GEN. I-YOU REVERSAL, HERE-THERE REVERSAL,**						
TEST		**& I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.**						
FOILS	44	I-YOU	Blue	Black	I/Y	1.1		
		PROBE-I-YOU	Black	Blue	I/Y	1.1		
		HERE-THERE	Black	Blue	I/Y	1.1		
		PROBE-HERE-THERE	Blue	Black	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	Y/I	1.1		
		PROBE-I-U/H-T	Black	Blue	I/Y	1.1		
		HERE-THERE	Blue	Black	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Blue	Black	I/Y	1.1		
		PROBE-HERE-THERE	Blue	Black	Y/I	1.1		
		I-YOU/HERE-THERE	Blue	Black	I/Y	1.1		
		PROBE-I-YOU	Blue	Black	Y/I	1.1		
		HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Black	Blue	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	I/Y	1.1		
		I-YOU	Blue	Black	Y/I	1.1		
		HERE-THERE	Blue	Black	I/Y	1.1		
		PROBE-I-U/H-T	Blue	Black	Y/I	1.1	**18**	Pass
		REVERSAL 1						
LEVEL 1			**EXP.**	**CHILD**	**Order**	**Correct**	**Total**	**Perf.**
BLOCK 4		**I-YOU SIMPLE & REVERSAL - C.S.L.**						
TEST	45	Simple	Green	Red	I/Y	0.0		
		Reversal	Green	Red	I/Y	0.0		
		Simple	Red	Green	Y/I	0.0		
		Reversal	Green	Red	Y/I	0.0		
		Reversal	Red	Green	Y/I	0.0		
		Simple	Red	Green	I/Y	0.0	0	Fail
BLOCK 4		**I-YOU SIMPLE & REVERSAL - C.S.L.**						
TRAIN		Simple	Green	Red	I/Y	0.0		
		Reversal	Green	Red	I/Y	0.0		
		Simple	Red	Green	Y/I	0.0		
		Reversal	Green	Red	Y/I	0.0		
		Reversal	Red	Green	Y/I	1.1		
		Simple	Red	Green	I/Y	0.0		
		Simple	Green	Red	I/Y	1.1		
		Reversal	Green	Red	I/Y	0.0		
		Simple	Red	Green	Y/I	0.0		
		Reversal	Green	Red	Y/I	0.0		
		Reversal	Red	Green	Y/I	1.1		
		Simple	Red	Green	I/Y	1.1		
		Simple	Green	Red	I/Y	1.1		

		Reversal	Green	Red	I/Y	0.0		
		Simple	Red	Green	Y/I	1.1		
		Reversal	Green	Red	Y/I	1.1		
		Reversal	Red	Green	Y/I	1.1		
		Simple	Red	Green	I/Y	1.1		
		Simple	Green	Red	I/Y	1.1		
		Reversal	Green	Red	I/Y	1.1		**20**
BLOCK 4		**I-YOU SIMPLE & REVERSAL - C.S.L.**						
TEST	46	Simple	Green	Red	I/Y	1.1		
		Reversal	Green	Red	I/Y	1.1		
		Simple	Red	Green	Y/I	1.1		
		Reversal	Green	Red	Y/I	1.1		
		Reversal	Red	Green	Y/I	1.1		
		Simple	Red	Green	I/Y	1.1	**6**	Pass
LEVEL 2		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
BLOCK 10		Simple	Red	White	I/Y	1.1		
TEST		Reversal	Red	White	I/Y	0.0		
		Simple	White	Red	Y/I	0.0		
		Reversal	Red	White	Y/I	0.0		
		Reversal	White	Red	Y/I	1.1		
		Simple	White	Red	I/Y	0.0	**2**	Fail
BLOCK 10		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
TRAIN	47	Simple	Red	White	I/Y	0.0		
		Reversal	Red	White	I/Y	0.0		
		Simple	White	Red	Y/I	1.1		
		Reversal	Red	White	Y/I	1.1		
		Reversal	White	Red	Y/I	1.1		
		Simple	White	Red	I/Y	0.0		
		Simple	Red	White	I/Y	1.1		
		Reversal	Red	White	I/Y	1.1		
		Simple	White	Red	Y/I	1.1		
		Reversal	Red	White	Y/I	1.1		
		Reversal	White	Red	Y/I	1.1		
		Simple	White	Red	I/Y	1.1		**12**
BLOCK 10		**SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.**						
TEST		Simple	Red	White	I/Y	1.1		
		Reversal	Red	White	I/Y	1.1		
		Simple	White	Red	Y/I	1.1		
		Reversal	Red	White	Y/I	1.1		
		Reversal	White	Red	Y/I	1.1		
		Simple	White	Red	I/Y	1.1	**6**	Pass
BLOCK 12		**I-YOU REVERSAL & HERE-THERE REVERSAL - C.S.L.**						
TEST		I-YOU	Red	White	I/Y	1.1		
		HERE-THERE	White	Red	I/Y	0.0		
		HERE-THERE	White	Red	Y/I	0.0		
		I-YOU	Red	White	I/Y	0.0		
		HERE-THERE	White	Red	Y/I	1.1		
		I-YOU	White	Red	Y/I	0.0	**2**	Fail
BLOCK 12		**I-YOU REVERSAL & HERE-THERE REVERSAL - C.S.L.**						
TRAIN	48	I-YOU	Red	White	I/Y	0.0		

	HERE-THERE	White	Red	I/Y	1.1		
	HERE-THERE	White	Red	Y/I	1.1		
	I-YOU	Red	White	I/Y	1.1		
	HERE-THERE	White	Red	Y/I	1.1		
	I-YOU	White	Red	Y/I	1.1		
	I-YOU	Red	White	I/Y	1.1		7
BLOCK 12 TEST	**I-YOU REVERSAL & HERE-THERE REVERSAL - C.S.L.**						
	I-YOU	Red	White	I/Y	1.1		
	HERE-THERE	White	Red	I/Y	1.1		
	HERE-THERE	White	Red	Y/I	1.1		
	I-YOU	Red	White	I/Y	1.1		
	HERE-THERE	White	Red	Y/I	1.1		
	I-YOU	White	Red	Y/I	1.1	6	Pass
BLOCK 14 TEST	**I-YOU REVERSAL, HERE-THERE REVERSAL, & I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.**						
49	I-YOU	Red	White	I/Y	1.1		
	HERE-THERE	White	Red	I/Y	1.1		
	I-YOU/HERE-THERE	Red	White	Y/I	0.0		
	HERE-THERE	Red	White	Y/I	1.1		
	I-YOU/HERE-THERE	White	Red	Y/I	0.0		
	I-YOU	Red	White	I/Y	1.1		
	I-YOU/HERE-THERE	Red	White	I/Y	0.0		
	HERE-THERE	White	Red	Y/I	1.1		
	I-YOU	White	Red	Y/I	1.1		
	I-YOU/HERE-THERE	White	Red	I/Y	0.0		
	I-YOU	Red	White	Y/I	1.1		
	HERE-THERE	Red	White	I/Y	1.1	8	Fail
BLOCK 14 TRAIN	**I-YOU REVERSAL, HERE-THERE REVERSAL, & I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.**						
	I-YOU	Red	White	I/Y	1.1		
	HERE-THERE	White	Red	I/Y	1.1		
	I-YOU/HERE-THERE	Red	White	Y/I	0.0		
	HERE-THERE	Red	White	Y/I	1.1		
	I-YOU/HERE-THERE	White	Red	Y/I	1.1		
	I-YOU	Red	White	I/Y	1.1		
	I-YOU/HERE-THERE	Red	White	I/Y	1.1		
	HERE-THERE	White	Red	Y/I	1.1		
	I-YOU	White	Red	Y/I	1.1		
	I-YOU/HERE-THERE	White	Red	I/Y	1.1		
	I-YOU	Red	White	Y/I	1.1		
	HERE-THERE	Red	White	I/Y	1.1		
	I-YOU	Red	White	I/Y	1.1		
	HERE-THERE	White	Red	I/Y	1.1		
	I-YOU/HERE-THERE	Red	White	Y/I	1.1		15
BLOCK 14 TEST	**I-YOU REVERSAL, HERE-THERE REVERSAL, & I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.**						
50	I-YOU	Red	White	I/Y	1.1		
	HERE-THERE	White	Red	I/Y	1.1		
	I-YOU/HERE-THERE	Red	White	Y/I	1.1		
	HERE-THERE	Red	White	Y/I	1.1		

		I-YOU/HERE-THERE	White	Red	Y/I	1.1		
		I-YOU	Red	White	I/Y	1.1		
		I-YOU/HERE-THERE	Red	White	I/Y	1.1		
		HERE-THERE	White	Red	Y/I	1.1		
		I-YOU	White	Red	Y/I	1.1		
		I-YOU/HERE-THERE	White	Red	I/Y	1.1		
		I-YOU	Red	White	Y/I	1.1		
		HERE-THERE	Red	White	I/Y	1.1	**12**	Pass
BLOCK 15		**GEN. I-YOU REVERSAL, HERE-THERE REVERSAL,**						
TEST		**& I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.**						
		I-YOU	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	Y/I	1.1		
		HERE-THERE	Blue	Black	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Blue	Black	I/Y	1.1		
		I-YOU/HERE-THERE	Blue	Black	I/Y	1.1		
		HERE-THERE	Black	Blue	Y/I	1.1		
		I-YOU	Black	Blue	Y/I	1.1		
		I-YOU/HERE-THERE	Black	Blue	I/Y	1.1		
		I-YOU	Blue	Black	Y/I	1.1		
		HERE-THERE	Blue	Black	I/Y	1.1	**12**	Pass
		REVERSAL 2						
LEVEL 1			**EXP.**	**CHILD**	**Order**	**Correct**	**Total**	**Perf.**
BLOCK 4		**I-YOU SIMPLE & REVERSAL - C.S.L.**						
TEST	51	Simple	Green	Red	I/Y	0.0		
		Reversal	Green	Red	I/Y	0.0		
		Simple	Red	Green	Y/I	0.0		
		Reversal	Green	Red	Y/I	0.0		
		Reversal	Red	Green	Y/I	0.0		
		Simple	Red	Green	I/Y	0.0	**0**	Fail
BLOCK 4		**I-YOU SIMPLE & REVERSAL - C.S.L.**						
TRAIN		Simple	Green	Red	I/Y	0.0		
		Reversal	Green	Red	I/Y	1.1		
		Simple	Red	Green	Y/I	0.0		
		Reversal	Green	Red	Y/I	1.1		
		Reversal	Red	Green	Y/I	1.1		
		Simple	Red	Green	I/Y	1.1		
		Simple	Green	Red	I/Y	1.1		
		Reversal	Green	Red	I/Y	1.1		
		Simple	Red	Green	Y/I	1.1		9
BLOCK 4		**I-YOU SIMPLE & REVERSAL - C.S.L.**						
TEST		Simple	Green	Red	I/Y	1.1		
		Reversal	Green	Red	I/Y	1.1		
		Simple	Red	Green	Y/I	1.1		
		Reversal	Green	Red	Y/I	1.1		
		Reversal	Red	Green	Y/I	1.1		
		Simple	Red	Green	I/Y	1.1	**6**	Pass

LEVEL 2		SIMPLE I-YOU IN HERE-THERE SIMPLE & REVERSAL - C.S.L.						
BLOCK 10	52	Simple	Red	White	I/Y	1.1		
TEST		Reversal	Red	White	I/Y	1.1		
		Simple	White	Red	Y/I	1.1		
		Reversal	Red	White	Y/I	1.1		
		Reversal	White	Red	Y/I	1.1		
		Simple	White	Red	I/Y	1.1	6	Pass
BLOCK 12		I-YOU REVERSAL & HERE-THERE REVERSAL - C.S.L.						
TEST		I-YOU	Red	White	I/Y	1.1		
		HERE-THERE	White	Red	I/Y	1.1		
		HERE-THERE	White	Red	Y/I	1.1		
		I-YOU	Red	White	I/Y	1.1		
		HERE-THERE	White	Red	Y/I	1.1		
		I-YOU	White	Red	Y/I	1.1	6	Pass
BLOCK 14		I-YOU REVERSAL, HERE-THERE REVERSAL,						
TEST		& I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.						
	53	I-YOU	Red	White	I/Y	1.1		
		HERE-THERE	White	Red	I/Y	1.1		
		I-YOU/HERE-THERE	Red	White	Y/I	0.0		
		HERE-THERE	Red	White	Y/I	1.1		
		I-YOU/HERE-THERE	White	Red	Y/I	1.1		
		I-YOU	Red	White	I/Y	1.1		
		I-YOU/HERE-THERE	Red	White	I/Y	1.1		
		HERE-THERE	White	Red	Y/I	1.1		
		I-YOU	White	Red	Y/I	1.1		
		I-YOU/HERE-THERE	White	Red	I/Y	1.1		
		I-YOU	Red	White	Y/I	1.1		
		HERE-THERE	Red	White	I/Y	1.1	11	Fail
BLOCK 14		I-YOU REVERSAL, HERE-THERE REVERSAL,						
TRAIN		& I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.						
	54	I-YOU	Red	White	I/Y	1.1		
		HERE-THERE	White	Red	I/Y	1.1		
		I-YOU/HERE-THERE	Red	White	Y/I	0.0		
		HERE-THERE	Red	White	Y/I	1.1		
		I-YOU/HERE-THERE	White	Red	Y/I	1.1		
		I-YOU	Red	White	I/Y	1.1		
		I-YOU/HERE-THERE	Red	White	I/Y	1.1		
		HERE-THERE	White	Red	Y/I	1.1		
		I-YOU	White	Red	Y/I	1.1		
		I-YOU/HERE-THERE	White	Red	I/Y	1.1		
		I-YOU	Red	White	Y/I	1.1		
		HERE-THERE	Red	White	I/Y	1.1		
		I-YOU	Red	White	I/Y	1.1		
		HERE-THERE	White	Red	I/Y	1.1		
		I-YOU/HERE-THERE	Red	White	Y/I	1.1		15
BLOCK 14		I-YOU REVERSAL, HERE-THERE REVERSAL,						
TEST		& I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.						
	55	I-YOU	Red	White	I/Y	1.1		
		HERE-THERE	White	Red	I/Y	1.1		
		I-YOU/HERE-THERE	Red	White	Y/I	1.1		

	HERE-THERE	Red	White	Y/I	1.1		
	I-YOU/HERE-THERE	White	Red	Y/I	1.1		
	I-YOU	Red	White	I/Y	1.1		
	I-YOU/HERE-THERE	Red	White	I/Y	1.1		
	HERE-THERE	White	Red	Y/I	1.1		
	I-YOU	White	Red	Y/I	1.1		
	I-YOU/HERE-THERE	White	Red	I/Y	1.1		
	I-YOU	Red	White	Y/I	1.1		
	HERE-THERE	Red	White	I/Y	1.1	**12**	Pass
BLOCK 15 TEST	**GEN. I-YOU REVERSAL, HERE-THERE REVERSAL, & I-YOU/HERE-THERE DOUBLE REVERSAL - C.S.L.**						
	I-YOU	Blue	Black	I/Y	1.1		
	HERE-THERE	Black	Blue	I/Y	1.1		
	I-YOU/HERE-THERE	Blue	Black	Y/I	1.1		
	HERE-THERE	Blue	Black	Y/I	1.1		
	I-YOU/HERE-THERE	Black	Blue	Y/I	1.1		
	I-YOU	Blue	Black	I/Y	1.1		
	I-YOU/HERE-THERE	Blue	Black	I/Y	1.1		
	HERE-THERE	Black	Blue	Y/I	1.1		
	I-YOU	Black	Blue	Y/I	1.1		
	I-YOU/HERE-THERE	Black	Blue	I/Y	1.1		
	I-YOU	Blue	Black	Y/I	1.1		
	HERE-THERE	Blue	Black	I/Y	1.1	**12**	Pass

* Indicates that the subject did not reach the mastery criterion