



Kent Academic Repository

Hawkins, Emma (2017) *The Effects of Multiple Exemplar Instruction on the Induction of Naming in Older Children and Young Adults Diagnosed with Autism*. Doctor of Philosophy (PhD) thesis, University of Kent,.

Downloaded from

<https://kar.kent.ac.uk/66793/> The University of Kent's Academic Repository KAR

The version of record is available from

This document version

UNSPECIFIED

DOI for this version

Licence for this version

UNSPECIFIED

Additional information

Versions of research works

Versions of Record

If this version is the version of record, it is the same as the published version available on the publisher's web site. Cite as the published version.

Author Accepted Manuscripts

If this document is identified as the Author Accepted Manuscript it is the version after peer review but before type setting, copy editing or publisher branding. Cite as Surname, Initial. (Year) 'Title of article'. To be published in *Title of Journal*, Volume and issue numbers [peer-reviewed accepted version]. Available at: DOI or URL (Accessed: date).

Enquiries

If you have questions about this document contact ResearchSupport@kent.ac.uk. Please include the URL of the record in KAR. If you believe that your, or a third party's rights have been compromised through this document please see our [Take Down policy](https://www.kent.ac.uk/guides/kar-the-kent-academic-repository#policies) (available from <https://www.kent.ac.uk/guides/kar-the-kent-academic-repository#policies>).

Running head: MULTIPLE EXEMPLAR INSTRUCTION AND NAMING

The Effects of Multiple Exemplar Instruction on the Induction of Naming in Older
Children and Young Adults Diagnosed with Autism

Emma Hawkins

Tizard Centre, School of Social Policy, Sociology and Social Research

University of Kent

PhD Applied Psychology

June 2017

Total word count: 83,800

Abstract

The current project included both conceptual and empirical findings in the field of naming. Conceptually, naming appears to be a generic term that describes several sub-components. The current research focused on one of these sub-components, Full Incidental Naming (FIN), defined as the emergence of untaught listener behaviour and untaught speaker behaviour following an incidental language experience or a match-to-sample (MTS) procedure. Empirically, the initial purpose of the current research was to test the effectiveness of Multiple Exemplar Instruction (MEI) to *induce* FIN in older children and young adults diagnosed with autism. Because the results of the initial experiments were not as expected, some variations to the experimental procedures were implemented. An analysis of the results of the initial experiments raised additional questions about the *measurement* of FIN. A series of nine experiments were conducted: six with older children and young adults diagnosed with autism, and three with neuro-typical fully verbal adults. The three experiments with adults focused on the measurement of FIN and the results of these experiments determined the experimental procedure utilised in later experiments. This adaptation to the experimental procedure included conducting an additional MTS session prior to each test for FIN. The results showed that MEI did not reliably induce FIN in older children and young adults diagnosed with autism. Instead, the repetition of the test for FIN, with an additional MTS procedure prior to each test, potentially led to the inducement of FIN. Recommendations are made for future research based on these findings.

TABLE OF CONTENTS

	Page
LIST OF TABLES.....	i
LIST OF FIGURES.....	v
Chapter 1: Introduction.....	1
Chapter 2: Multiple Exemplar Training/Instruction.....	11
Chapter 3: The Emergence of Untaught Listener and Speaker Behaviour.....	25
Chapter 4: When Speaking & Listening Come Together: Naming.....	43
Chapter 5: Testing for Naming and Procedures for Inducing Naming.....	76
Chapter 6: Testing the Effects of Multiple Exemplar Instruction on the Induction of Full Incidental Naming in Older Children Diagnosed with Autism.....	105
Experiment 1.....	105
Experiment 2.....	120
Chapter 7: Examining the Test for Full Incidental Naming with Neuro- Typical Adults.....	130
Experiment 3.....	130
Experiment 4.....	134
Experiment 5.....	139
Chapter 8: Testing Older Children and Young Adults Diagnosed with Autism for Six Sub-Components of Naming.....	146
Experiment 6.....	146
Chapter 9: Using Multiple Exemplar Instruction to Induce Full Incidental Naming or Full Bidirectional Naming in Older Children and Young Adults Diagnosed with Autism.....	158
Experiment 7.....	158
Experiment 8.....	170
Experiment 9.....	179
Chapter 10: Case Studies.....	192

Chapter 11: General Discussion.....	221
Chapter 12: Limitations of the Current Research.....	262
Chapter 13: Recommendations for Future Research.....	268
References	300
Appendices	315
Appendix A: Glossary of Terms.....	315
Appendix B: Participant Information Sheets and Consent Forms...	327
Appendix C: P-Level and National Curriculum Level Descriptors..	330
Appendix D: Speech and Language Therapy Tests.....	333
Appendix E: Examples of Stimuli.....	335
Appendix F: Raw Data and Updated Scores for Participants B and C.....	337

LIST OF TABLES

		Page
1.	A summary of the research demonstrating the emergence or non-emergence of untaught verbal behaviour.....	38
2.	The different components of naming and corresponding conceptual researchers	48
3.	Overview of some of the behavioural cusps, protocols/procedures and research base that is included in the VBDT Pre-Reader Pyramid.....	55
4.	The different components of naming and corresponding conceptual and experimental researchers.....	64
5.	Six suggested sub-components of naming with corresponding descriptions, examples and relevant researchers.....	72
6.	Example of a MEI sequence for a training set.....	82
7.	A summary of the scores for each test for Full Incidental Naming (FIN) in the experiment by Greer et al. (2005b)	85
8.	A summary of the scores for the Test for Listener Bidirectional Naming pre- and post-MEI for each participant in the study by Fiorile and Greer (2007)	87
9.	A summary of the scores for each test for Full Incidental Naming (FIN) for the MEI experimental group in the experiment by Greer et al. (2007)	89
10.	A summary of the scores for each test for Full Incidental Naming (FIN) for the SEI control group in the study by Greer et al. (2007)	90
11.	A summary of the scores for each test for Full Incidental Naming (FIN) for the SEI control group (post-MEI) in the study by Greer et al. (2007)	90
12.	A summary of the scores for each test for Full Incidental Naming in the experiment by Gilic and Greer (2011)	91
13.	A summary of the scores for each test for Full Incidental Naming in the experiment by Greer et al. (2011a)	92
14.	Summary of the variations in procedures used in the studies demonstrating that MEI induces naming.....	93
15.	Summary of the studies showing a functional relationship between MEI and naming.....	95
16.	A summary of all the research on naming with a re-defined dependent variable according to the suggested six sub-components of naming.....	100

17. Prerequisite behavioural cusps for testing for and inducing FIN, according to the VBDT	106
18. Participants' Characteristics.....	107
19. Speech and Language Therapy Test Scores.....	107
20. Example of a MEI sequence for a training set.....	112
21. Number of learn units presented during MEI procedure and duration of procedure for each participant.....	118
22. Participants' Characteristics.....	121
23. Speech and Language Therapy Test Scores.....	121
24. Number of learn units presented during MEI procedure and duration of procedure for each participant.....	126
25. Summary Scores for Participants in Experiments 3, 4 and 5.....	144
26. Participants' Characteristics.....	148
27. Speech and Language Therapy Test Scores.....	149
28. Participant Scores for each Test for Naming.....	154
29. Updated Participant Scores for each Test for Naming.....	156
30. Participants' Characteristics.....	160
31. Speech and Language Therapy Test Scores.....	160
32. Number of learn units presented during MEI procedure and duration of procedure for each participant.....	167
33. Participants' Characteristics.....	171
34. Speech and Language Therapy Test Scores.....	171
35. Number of learn units presented during MEI procedure and duration of procedure for each participant.....	178
36. Participants' Characteristics.....	181
37. Speech and Language Therapy Test Scores.....	181
38. Number of learn units presented during MEI procedure and duration of procedure for each participant.....	187
39. Updated Participant Scores for each Test for Naming.....	190

40.	Participant A’s Characteristics.....	193
41.	Speech and Language Therapy Test Scores for Participant A.....	193
42.	Participant D’s Characteristics.....	195
43.	Speech and Language Therapy Test Scores for Participant D.....	195
44.	Participant E’s Characteristics.....	197
45.	Speech and Language Therapy Test Scores for Participant E.....	197
46.	Participant B’s Characteristics.....	200
47.	Speech and Language Therapy Test Scores for Participant B.....	200
48.	Participant C’s Characteristics.....	202
49.	Speech and Language Therapy Test Scores for Participant C.....	202
50.	Participant F’s Characteristics.....	204
51.	Participant J’s Characteristics.....	205
52.	Speech and Language Therapy Test Scores for Participant J.....	206
53.	Participant G’s Characteristics.....	208
54.	Speech and Language Therapy Test Scores for Participant G.....	208
55.	Participant H’s Characteristics.....	209
56.	Speech and Language Therapy Test Scores for Participant H.....	210
57.	Participant I’s Characteristics.....	211
58.	Speech and Language Therapy Test Scores for Participant I.....	211
59.	Participant K’s Characteristics.....	213
60.	Speech and Language Therapy Test Scores for Participant K.....	213
61.	Participant M’s Characteristics.....	215
62.	Summary of participants who met criteria for FIN and the experimental procedures they were exposed to.....	218
63.	Summary of participants who were exposed to multiple tests preceded by MTS.....	219
64.	Characteristics of each experiment in the experimental sequence (IV = Independent Variable; DV = Dependent Variable; MTS = Match-to-	

Sample).....	224
65. Characteristics of Experiments 2 and 7 (IV = Independent Variable; DV = Dependent Variable; MTS = Match-to-Sample).....	239
66. Summary of the variations in procedures used in the studies on MEI and naming.....	253
67. The P-Level Descriptors for English (Speaking) and English (Listening)....	330
68. The National Curriculum Level Descriptors for English (Speaking and Listening).....	332
69. Test of Abstract Language Comprehension typical pattern of development..	334
70. The sets of five stimuli used throughout the thesis.....	335
71. Original test scores and updated test scores for Participant B's initial test for Speaker Bidirectional Naming (SBN) in Experiment 6.....	337
72. Original test scores and updated test scores for Participant C's initial test for Speaker Incidental Naming (SIN) in Experiment 6.....	338

LIST OF FIGURES

		Page
1.	A schematic representation of the stimulus equivalence paradigm.....	50
2.	The VBBDT pre-reader pyramid (Greer & Ross, 2008)	53
3.	A schematic representation of the two research tracks on naming	63
4.	A schematic representation of bidirectional naming	66
5.	A schematic representation of incidental naming	67
6.	A schematic representation of the complete account of naming	70
7.	A schematic representation of the complete account of naming including terminology currently in use.....	71
8.	A diagram of the procedure for inducing Full Incidental Naming	81
9.	Experimental procedure for Experiment 1	109
10.	Results for Experiment 1: Number of correct responses for each of the untaught listener and speaker behaviours	116
11.	The results for the MEI procedure for each participant	118
12.	Experimental procedure for Experiment 2	122
13.	Results for Experiment 2: Number of correct responses for each of the untaught listener and speaker behaviours. Note Participant 4 did not receive MEI.....	124
14.	The results for the MEI procedure for Participants 1-3	126
15.	Procedure for Experiment 3	131
16.	Results for Experiment 3 showing the number of correct responses for the untaught behaviours	133
17.	Procedure for Experiment 4	135
18.	Results for Experiment 4: Number of correct responses for each of the untaught behaviours	137
19.	Procedure for Experiment 5	140
20.	Results for Experiment 5: Number of correct responses for each of the untaught behaviours	142

21.	Procedure for the Test for Listener Bidirectional Naming (LBN)	150
22.	Procedure for the Test for Speaker Bidirectional Naming (SBN)	151
23.	Procedure for the Test for Full Incidental Naming (FIN)	152
24.	Experimental procedure for Experiment 7	162
25.	Results for Experiment 7: Number of correct responses for the untaught listener and speaker behaviour	165
26.	The results for the MEI procedure for Participants H, E and G	168
27.	Experimental procedure for Experiment 8	173
28.	Results for Experiment 8: Number of correct responses for untaught speaker behaviour	176
29.	The results for the MEI procedure for Participants I and L	178
30.	Experimental procedure for Experiment 9	183
31.	Results for Experiment 9: Number of correct responses for the untaught listener and speaker behaviour	184
32.	The results for the MEI procedure for Participants I, M and K.....	186
33.	The number of participants who met the criteria for each of the sub-components of naming on the first test compared to the final test	188
34.	An overview of the results for thirteen participants	189
35.	Results for Participant A: Number of correct responses for untaught listener behaviour (point to) and speaker behaviour (impure tacts and tacts)	194
36.	Results for Participant D: Number of correct responses for untaught listener and speaker behaviour	196
37.	Results for Participant E: Number of correct responses for untaught listener and speaker behaviour	198
38.	Results for Participant B: Number of correct responses for untaught listener and speaker behaviour (tests for FIN only)	201
39.	Results for Participant C: Number of correct responses for untaught listener and speaker behaviour	203
40.	Results for Participant F: Number of correct responses for untaught listener and speaker behaviour	205

41.	Results for Participant J: Number of correct responses for untaught listener and speaker behaviour	206
42.	Results for Participant G: Number of correct responses for untaught listener and speaker behaviour	209
43.	Results for Participant H: Number of correct responses for untaught listener and speaker behaviour	210
44.	Results for Participant I: Number of correct responses for untaught listener and speaker behaviour	212
45.	Results for Participant K: Number of correct responses for untaught listener and speaker behaviour	214
46.	Results for Participant M: Number of correct responses for untaught listener and speaker behaviour	215
47.	An overview of the results for all twenty participants. The letters denote each of the participants	217
48.	Experimental procedure for Experiment 1	226
49.	Experimental procedure for Experiment 2	229
50.	Procedure for Experiment 3	231
51.	Procedure for Experiment 4	233
52.	Procedure for Experiment 5	235
53.	Procedure for Experiment 6 (Test for Listener Bidirectional Naming) ...	236
54.	Procedure for Experiment 6 (Test for Speaker Bidirectional Naming) ...	236
55.	Procedure for Experiment 6 (Test for Full Incidental Naming)	236
56.	Experimental procedure for Experiment 7	239
57.	Experimental procedure for Experiment 8	241
58.	Experimental procedure for Experiment 9	243
59.	An experimental procedure for testing the effect of MEI on FIN with an additional post-MEI test for FIN with a novel set of stimuli (Set 3)	258
60.	The VBDT pre-reader pyramid (Greer & Ross, 2008)	272
61.	An updated section of the VBDT pre-reader pyramid of behavioural cusps	282

62.	Reinforcement and motivating operations for the speaker behavioural cusps as illustrated by Greer and Du (2015)	284
63.	Experimental procedure utilised in the study by Greer et al. (2011a)	285
64.	The recommended procedure for all future research on MEI and naming	286
65.	Experimental design for isolating whether additional testing or MTS sessions prior to each test for FIN impact test scores	290

Chapter 1

Introduction

Children and young people diagnosed with autism need specific and intensive types of teaching procedures to learn to communicate effectively, acquire life skills and develop adequate academic skills (Howard, Sparkman, Cohen, Green, & Stanislaw, 2005). Neuro-typical children seemingly develop these basic skills incidentally, without intensive interventions. In addition neuro-typical children acquire more skills than they are apparently taught. An account for the precise source of this emergent behaviour remains largely limited within the applied behavioural literature yet theoretical explanations abound regarding its origin (for example Abstraction (Skinner, 1957), Adduction (Andronis, Layng, & Goldiamond, 1997; Johnson & Layng, 1992; Catania, 1998), Stimulus Equivalence (Sidman, 1971, 1977), Relational Frame Theory (Hayes, Barnes-Holmes, & Roche, 2001) and Naming Theory (Horne & Lowe, 1996)). Nonetheless, the designing of teaching experiences resulting in emergent behaviour may be the touchstone of sound instructional practices.

The development of effective and efficient teaching procedures is a goal for many educational specialists (Alessi, 1987). Effective and efficient teaching procedures include those that potentially produce greater skill acquisition than what was directly taught. For example, if $2+1=3$ is directly taught then $1+2=3$ will probably emerge without further direct teaching. Furthermore, for some individuals the operations of $3-2=1$ and $3-1=2$ will also emerge after directly teaching $2+1=3$. Efficient teaching procedures can be described as encouraging or evoking the same type of emergent behaviour often seen with neuro-typical children. The emergence of untaught behaviour is arguably a critical feature in designing superior instruction. However, educational professionals are continually challenged in this area because so little is known about how to design instruction specifically that yields emergent behaviour (Greer, 2002). For

teachers who work with children and young people diagnosed with disabling conditions such as autism, the challenge for those individuals to learn new things without direct teaching is even more daunting.

The quest to locate the source of the emergence of untaught behaviour and to design instruction to achieve this has driven many of the author's experimental undertakings while working as a Behaviour Analyst for the last 17 years at a school for children and young adults diagnosed with autism. The pupils who currently attend the school are aged 4-19 years and all have dual diagnoses of autism and a severe to moderate learning disability. Most of the pupils also emit challenging behaviours. Teaching appropriate communication skills to children diagnosed with autism decreases challenging behaviour (e.g. Carr & Durand, 1985; Durand & Carr, 1991; Miranda, 1997; Sigafos, 2000). Verbal behaviour is therefore a priority curriculum emphasis for a school for children diagnosed with autism. This combination of emergent behaviour and verbal behaviour generates a higher order skill of emergent verbal behaviour. Designing instruction to produce emergent verbal behaviour is the core of this investigative work.

Many schools specialising in educating pupils diagnosed with autism select from a variety of service delivery models, for example TEACCH (Schopler, 1994), DIRFloortime (Greenspan & Wieder, 1997), the Early Start Denver Model (Rogers & Dawson, 2009) and Daily Life Therapy (Quill, Gurry, & Larkin, 1989). Some behaviour analytic schools follow the CABAS (Comprehensive Application of Behaviour Analysis to Schooling) model which is a systems approach to education drawing from all of the scientifically-validated tactics and applying them to all parts of the system (Selinske, Greer, & Lodhi, 1992). Firstly, CABAS is predicated on the principles of behaviour analysis focusing on positive reinforcement and individualised curricula. Additionally, emphasis is placed on developing teachers as strategic scientists of instruction and

designing effective and efficient curricular programming. Data generated from pupil responses drive all aspects of the system and yield robust research opportunities. This process allows for a self-correcting system and results in systemic change based on research findings.

Some of the most recent systemic changes have resulted in a focus on research related to emergent verbal behaviour. Examples of emergent verbal behaviour include acquiring some basic verbal behaviour components such as naming items, categorising items or forming novel sentences, but without direct teaching, from incidental experience or through the observation of others. A specific example of emergent verbal behaviour occurs when a child names an item as a “green apple” after having been taught names for a selection of colours, a selection of food items and a 2-word phrase such as “yellow banana.” The label “green apple” is not directly taught, but emerges following the previous teaching.

There is a growing body of research within the behaviour analytic field on various aspects of emergent verbal behaviour (e.g. Greer, Stolfi, Chavez-Brown, & Rivera-Valdes, 2005b; Lechago, Carr, Kisamore, & Grow, 2015; Miguel, Petursdottir, & Carr, 2005; Nuzzolo-Gomez & Greer, 2004; Pérez-González, Cereijo-Blanco, & Carnerero, 2014; Rosales, Rehfeldt, & Lovett, 2011; Rosales & Rehfeldt, 2007). This increase in interest for studying and developing emergent verbal behaviour in individuals diagnosed with autism has led to additional extensive and complex investigations. From these investigations an increasingly large body of applied research related to emergent verbal behaviour has taken shape. Some researchers have stated that, in light of new findings related to emergent verbal behaviour, new theories need to be developed and continual research should be conducted (e.g. Barnes-Holmes, Barnes-Holmes, & Cullinan, 2000; Greer & Ross, 2008; Sautter & LeBlanc, 2006).

The Verbal Behaviour Development Theory (VBDT)

The Verbal Behaviour Development Theory (VBDT; Greer & Keohane, 2005; Greer & Ross, 2008; Greer & Speckman, 2009) purports to draw from existing translational research findings in behaviour analytic (e.g. Barnes-Holmes et al., 2000; Horne & Lowe, 1996; Sidman, 1986) and developmental literature (e.g. Crystal, 2006; Meltzoff & Moore, 1983; Pinker, 1998). The theory delineates 18 “behavioural cusps” in pyramidal fashion and suggests a sequential order in which they may occur. The VBDT identifies behavioural cusps as behaviours that open up pathways to a number of other developments such as learning more effectively and opening up parts of the environment that were inaccessible before. For example, generalised imitation is one such behavioural cusp. Once a child has acquired generalised imitation they can learn more effectively than they could before, via imitation rather than via different levels of prompting.

The VBDT provides procedures on how to test for each of these behavioural cusps as well as how to induce them if they are not present. At its core the theory attempts to provide a mechanism for identifying any missing behavioural cusps and then, rather than implementing numerous tactics to address the subsequent deficits, describes procedures for inducing the behavioural cusp. The development of the new behavioural cusp then makes it possible for the emergence of new skills without direct teaching. Because the individual demonstrates emergent responding they can now learn in different ways and these result in more effective and efficient teaching practice and optimal learning outcomes.

A traditional ABA programme includes a number of different learning targets, and data are collected on the responses and level of prompting required to emit a correct response to those learning targets. Prompts are put in place if targets are not met. This type of approach could be viewed as a micro approach in terms of attempting to rectify

every problem with the data when the pupil is not making the expected progress. The VBDT entails a macro approach, taking into account the bigger picture and ascertaining where the true learning problem lies. For example, if a pupil's data do not show progress on all listener programmes (e.g. following instructions from a teacher), rather than continuing with the programme using multiple layers of prompting, the teacher devotes instructional time to a 'listener emersion' protocol to induce the behavioural cusp of listener literacy. Listener literacy is one of the behavioural cusps from the VBDT and is depicted as one of the levels on the pre-reader pyramid described in more detail later in the paper. Once listener literacy is induced and the pupil follows teacher directions reliably, an increase in correct responses to various listener programmes is observed. This perspective replaces the typical micro level approach which focuses on implementing multiple unrelated tactics to each seemingly unrelated learning problem.

Naming

One behavioural cusp heavily emphasised in the VBDT is naming (Horne & Lowe, 1996). Naming is a phenomenon that occurs when an individual uses the names of items without direct teaching and uses them in multiple ways. This happens when the fusion of listener and speaker behaviour occurs. Listener behaviour (hear-do) involves hearing the name of an item and pointing to or finding that item, for example "Get me my shoes," "point to the duck" or "show me the tree." No speech needs to be produced, but the individual is required to discriminate between the words 'shoes,' 'duck' and 'tree' in order to respond correctly. Speaker behaviour (see-do) is actually saying the name of the items "shoes," "duck" and "tree." Research has shown that speaker and listener responses are probably initially independent of each other (e.g. Eikeseth & Smith, 1992; Guess, 1969; Guess & Baer, 1973; Horne, Lowe, & Randle, 2004; Tu, 2006) meaning that if one behaviour is directly taught the other behaviour does not automatically emerge. This is true of neuro-typical children's behaviour as well as those diagnosed

with autism (Horne et al., 2004). Several researchers have shown the effectiveness of specific protocols which do appear to promote the fusion of speaker and listener responses (e.g. Greer et al., 2005b; Rosales et al., 2011; Pérez-González et al., 2014).

Multiple Exemplar Training/Instruction (MET/MEI)

One of those protocols Multiple Exemplar Training/Instruction (MET/MEI)¹ has been found to be effective in inducing naming as a behavioural cusp which allows the individual to acquire new information incidentally without direct teaching (Gilic & Greer, 2011; Greer, Corwin, & Buttigieg, 2011a; Greer et al., 2005b; Greer, Stolfi, & Pistoljevic, 2007). Based on research findings, individuals who have acquired naming may subsequently develop new skills in ways they could not prior to implementation of the protocol. Because of the overarching importance of developing this behavioural cusp it is highly valuable to explore the published research on MET/MEI and naming.

A review of the literature on MET/MEI to induce naming reveals two critical areas that warrant further investigation if the MET/MEI protocol is to have relevance for older children and young people diagnosed with autism. Firstly, the procedure has been carried out with a limited number of young children, between the ages 2-6 years, with and without an autism diagnosis. Secondly, the naming described in one group of research articles (e.g. Lowe, Horne, Harris, & Randle, 2002; Sprinkle & Miguel, 2012) is defined differently from the naming behavioural cusp described in other research studies seemingly investigating the same phenomenon (e.g. Greer et al., 2007; Gilic & Greer, 2011). Upon further analysis, what one may extract from the published research on naming is that there appears to be different components of naming and that a distinction between components is not always clearly made. Thus, without

¹ It is important to note that the terms Multiple Exemplar Training (MET) and Multiple Exemplar Instruction (MEI) are often used interchangeably, but they appear to have some valid distinction. This will be discussed in more detail in the chapter on Multiple Exemplar Training.

differentiating or identifying the various aspects of naming, an analysis of the research findings is somewhat difficult.

Based on these discrepancies and the potential value of findings to older children and young people diagnosed with autism, it is clear that various aspects of the VBDT require further testing. Specifically, the research centred on the efficacy of MET/MEI and its effects on the naming behavioural cusp needs to be replicated with participants of different age bands and diagnoses. Two papers have been published testing various protocols and procedures from the VBDT with older children diagnosed with autism, but they have only focused on case studies (Hawkins, Charnock, & Gautreaux, 2007; Hawkins, Kingsdorf, Charnock, Szabo, & Gautreaux, 2009). Hawkins et al. (2007) implemented four protocols where behavioural cusps were only induced in one case, but gains were made by each participant. Hawkins et al. (2009) focused on the use of MET/MEI to induce naming (this procedure will be described in detail later in this paper). Three case studies were summarised and all participants needed individualised modifications to the procedure in order to meet the experimental criterion for the acquisition of naming. With that said it is not uncommon in the field of behaviour analysis and with the autism population to individualise procedures in order to obtain optimal outcomes for the individual (e.g. Matson, Hattier, & Belva, 2012; Shipley-Benamou, Lutzker, & Taubman, 2002; Walker, 2008). However, it is important to isolate those variables which may contribute to making such modifications necessary.

The findings by Hawkins et al. (2007) and Hawkins et al. (2009) warrant further investigation and additional experiments to isolate potentially crucial variables. One major weakness in these two studies was the lack of a sound single subject experimental design. In summary, the research already conducted in relation to MET/MEI and naming with older children and young adults diagnosed with autism has produced outcomes similar to the other published research, but contains some methodological

concerns that established the need for additional research. It is important to note that in an attempt to directly replicate published findings two extraneous variables have surfaced which may have implications regarding the generality of the procedure. The two extraneous variables are the age of the participants (due to differences in instructional histories) and the ambiguity of defining the naming phenomenon itself.

Because of the potential benefits to older children and young adults diagnosed with autism, the initial purpose of the work reported here was to design a series of scientifically sound and well controlled systematic studies with an older group of children and young adults having dual diagnoses of autism and moderate to severe learning disability. This would help to ascertain whether the protocols and procedures described in the VBDT can be used to induce missing behavioural cusps for older children and young adults diagnosed with autism. In order to answer this question in a systematic fashion the literature on naming has been reviewed and there has been an attempt to distinguish the different components of naming. Furthermore, some possible variables have been analysed which may account for the differences in the research findings across the applied literature base. At a minimum, the results will help to determine whether additional and unidentified prerequisites are required or whether further components need to be added to the sequential framework of the VBDT.

Aim of Current Work

One aim of this work was to offer clearer guidelines to practitioners teaching similar populations. It is questionable if time and effort should be spent on protocols that may not produce the same results as the studies used as the basis of the VBDT. The focus of teaching practices should not only be effectiveness, but also efficiency. It is extremely efficient to enable a child to acquire naming, but conversely inefficient to spend days, if not weeks, aiming to induce a behavioural cusp that a child does not have the prerequisites to acquire. If the same results are demonstrated as the published

research in the area of MET/MEI and naming then recommendations can be made to encourage others to replicate the procedure. If the results are not replicated it raises the question whether additional prerequisites are required. Irrespective of the findings, this work will contribute to this area of research by providing guidance on how published procedures may need to be adapted to reach more children and young adults.

Structure of Thesis

Structurally this work consists of thirteen chapters. First, literature on Multiple Exemplar Training/Instruction (MET/MEI) is reviewed. Following this chapter, the reader is introduced to the concept of emergent verbal behaviour. Chapter 4 describes the phenomenon of naming where a description of naming is provided and the naming literature is reviewed. The VBDT is described in detail within this chapter. A review of this literature highlights the notion that there are different components of naming and these are described within Chapter 4. The fifth chapter revisits MET/MEI and reviews the literature that used MET/MEI to induce naming. Chapter 6 includes the first two experiments on MET/MEI and naming. Following this chapter there are seven further experiments (Chapters 7-9) on MET/MEI and naming with various modifications involving both older children with a diagnosis of autism and fully verbal neuro-typical adults as participants. Chapter 10 provides a summary of the experiments with the children with a diagnosis of autism and reviews the data case by case. There are three discussion chapters. The first discussion chapter, Chapter 11, provides a general discussion of all experiments and summarises the major findings of the current body of work. The final two chapters describe the limitation of the thesis (Chapter 12) and recommendations for future research (Chapter 13). The Appendices include a Glossary of Terms (Appendix A). All technical terms are defined within the thesis, but the Glossary of Terms provides the reader with an opportunity to re-visit key terms and

definitions of these terms. The technical terms included in the Glossary of Terms are underlined within the thesis when they are first utilised from Chapter 2 to Chapter 5.

Chapter 2

Multiple Exemplar Training/Instruction

Identifying procedures that contribute to the development of complex skills is an ongoing field of investigation for many researchers (e.g. Green, 2001; Greer & Ross, 2008; Strain & Schwartz, 2001; Sundberg, 1991). For the purpose of designing effective and efficient teaching protocols, it is important to ascertain how skills develop and generalise, and how stimulus classes (concepts) come to control behaviour. Of particular interest is the identification of procedures that might contribute to the emergence of skills without the need for direct teaching. Once identified, teaching protocols incorporating such procedures may be used to effectively bring about generalisation and promote the emergence of untaught behaviours. Several areas of research in Applied Behaviour Analysis have contributed substantially to the search for procedures effective in the development and generalisation of new skills, the emergence of behaviours not directly taught, and the development of control by stimulus classes. These areas include research on Generalisation, General Case Analysis and Multiple Exemplar Training/ Instruction.

Structurally this chapter consists of four sections. In the first section Generalisation is defined and its importance explained. Next, Multiple Exemplar Training and General Case Analysis are described and are linked to Generalisation. In the third section the research related to Multiple Exemplar Training is reviewed. This third section includes four sub-sections where the research is described according to different themes: Multiple Exemplar Training compared to teaching using a single exemplar; Multiple Exemplar Training as part of a broader treatment package; the addition of Multiple Exemplar Training to a treatment to promote generalisation; Multiple Exemplar Training/Instruction to fuse previously independent classes of

behaviour. Finally a summary of this chapter and focus for the following chapter is provided.

Generalisation

Teachers teach many new skills to pupils, but the usefulness of these new skills is limited if they only occur in the classroom in which they were taught but not in other settings. Generalisation occurs when previously taught behaviour is emitted at new times or in new places without having to be taught again in those new times or places (Stimulus Generalisation), or if functionally-related behaviours occur that were not directly taught (Response Generalisation; Cooper, Heron, & Heward, 2007). This is the ultimate aim of all teaching, ensuring the skill is demonstrated again outside the classroom and is functional. Baer, Wolf, and Risley (1968) included ‘generality of behaviour change’ as one of the defining characteristics of Applied Behaviour Analysis. They stated that ‘a behaviour change may be said to have generality if it proves durable over time, if it appears in a wide variety of possible environments, or if it spreads to a wide variety of related behaviours’ (p. 96). A behaviour change is therefore only effective if it is generalised. Generalisation is considered in the context of either Stimulus Generalisation or Response Generalisation.

Stimulus Generalisation is a process that accounts for skills occurring across different stimuli, environments or settings. For example, a child is taught to call the family pet a “cat;” they then either call the same cat in a different environment a “cat,” or seeing a different cat say it is a “cat.” The response is not directly taught in the novel setting or with the novel stimulus, but when a child responds in a similar way to different stimuli or to the same stimuli across different settings then Stimulus Generalisation has occurred. The child correctly responds to the concept or stimulus class “cat.”

Response Generalisation accounts for the occurrence of untrained behaviours that are functionally equivalent to directly trained target behaviours. For example, a child is taught to eat using a spoon and then eats a bowl of spaghetti with a fork. Eating with a fork has not been directly taught but is functionally equivalent to eating with a spoon. Thus, Response Generalisation is related to functionally equivalent responding and Stimulus Generalisation is related to responding to a stimulus across new environments or a similar stimulus in the same environment. It is important to note that it is not possible to teach Generalisation as an outcome, but through the careful planning of the teaching environment it can be occasioned.

Stokes and Baer (1977) emphasised the importance of planning for Generalisation rather than teaching and hoping for Generalisation to occur. They posited that a behaviour change is ineffective if Generalisation does not occur and suggested several strategies to promote it. The strategies centred around ensuring sufficient exemplars are taught, using stimuli found in generalisation settings, providing opportunities for the target behaviour to be shaped by natural maintaining contingencies (for example teaching a pre-school child to say “hello” or “will you play with me?” to a peer), training loosely by designing the teaching environment to be as unpredictable as possible, moving towards a variable schedule of reinforcement for correct responding, mediating generalisation by applying self-recording and self-reinforcement techniques wherever possible and reinforcing all occurrences of generalised responding. In order to make generalisation more possible, researchers and practitioners have developed tactics which incorporate several of these strategies (e.g. Anderson-Inman, 1981; Campbell & Stremel-Campbell, 1982; Rhode, Morgan, & Young, 1983; Schwarz & Hawkins, 1970; Stokes, Fowler, & Baer, 1978).

Multiple Exemplar Training and General Case Analysis

Multiple Exemplar Training (MET) is a tactic that draws from the strategies suggested by Stokes and Baer (1977) to promote Generalisation. It directly links to the strategy of ensuring sufficient exemplars are taught, meaning multiple examples of the target stimuli are used when teaching a new skill. MET is designed to provide practice with a range of essential elements of the stimuli and response variations used in the instruction (Cooper et al., 2007; Marzullo-Kerth, Reeve, Reeve, & Townsend, 2011). For example, if teaching the stimulus class ‘chairs,’ a teacher might include all the different variations of chairs within the teaching set. However, this is not as simple as it seems. When considering the identification of essential factors for selecting a teaching set for chairs, an analysis of several features, such as size, shape, colour or material composition, is critical. In order to determine whether the range of exemplars for a target set of stimuli is sufficient a thoroughgoing analysis is required. This process illustrates General Case Analysis (Engelmann & Carnine, 1982; Tiemann & Markle, 1985).

This General Case Analysis is the core of designing effective MET and is defined by Cooper et al. (2007) as a systematic method for selecting teaching examples that represent the full range of stimulus variations and response requirements in the generalisation setting. The General Case Analysis is the initial step in designing a MET procedure. Returning to the ‘chair’ example provided above, a General Case Analysis identifies a complete breadth and depth of the exemplars required to teach the stimulus class ‘chairs.’ For example the ‘chair’ teaching set might include a red office chair on wheels, a throne, a wooden dining room chair, a metal garden chair and a leather armchair. The MET teaching set includes an adequate range of the breadth and depth of exemplars possible to increase the likelihood of stimulus class formation. Thus, the MET procedure is a function of the completeness of the General Case Analysis. The

analysis across different stimulus classes will result in differences between the irrelevant and relevant features of each stimulus class. For example, the use of MET to teach the stimulus class ‘chairs’ results in a different set of important features of chairs (e.g. legs, seat, back) compared to the results of an analysis to teach the stimulus class ‘kettles’ (e.g. handle, spout, container). When teaching a stimulus class, the relevant physical features of that stimulus class are isolated and rotated with the irrelevant features of that stimulus class. These different applications contribute to the flexibility of MET and the utility of the procedure as an effective strategy to promote generalisation. A review of the literature clearly demonstrates there are both procedural and instructional variations to implementing MET.

Research on Multiple Exemplar Training/Instruction

There is a wealth of research demonstrating the effectiveness of MET/MEI² to teach many skills to individuals with and without learning disabilities (e.g. Garcia-Albea, Reeve, Brothers, & Reeve, 2014; Gena, Krantz, McClannahan, & Poulson, 1996; Greer, Yuan, & Gautreaux, 2005c; Hughes, Harmer, Killian, & Niarhos, 1995; Hughes & Rusch, 1989; Marzullo-Kerth et al., 2011; Nuzzolo-Gomez & Greer, 2004; Reeve, Reeve, Townsend, & Poulson, 2007; Rosales, Rehfeldt, & Lovett, 2011; Sprague & Horner, 1984). The earlier research demonstrated the importance of using a General Case Analysis to devise MET and showed the effectiveness of MET over single exemplars and more than one exemplar (e.g. Sprague & Horner, 1984). Several studies have used MET as part of a broader treatment package to teach a variety of skills, such as appropriate affect (Gena et al., 1996), generalised sharing repertoire (Marzullo-Kerth et al., 2011) and helping behaviour (Reeve et al., 2007). Some studies have extended previous research by adding MET to promote generalisation to increase vocal

² As a reminder to the reader and, as mentioned in Chapter 1, it is important to note that the terms Multiple Exemplar Training (MET) and Multiple Exemplar Instruction (MEI) are often used interchangeably, but they appear to have some valid distinction. This distinction will be addressed later in this chapter.

interactions (Garcia-Albea et al., 2014), to increase independent performance in vocational settings (Hughes & Rusch, 1989) and to increase conversational skills (Hughes et al., 1995). A further area of research is the use of MET/MEI to fuse previously independent classes of behaviour (e.g. Greer et al., 2005c; Nuzzolo-Gomez & Greer, 2004; Rosales et al., 2011). This research is described in more detail in the next sub-sections with a focus on the four previously described themes.

MET versus single exemplars. Researchers have emphasised the requirement to use multiple exemplars to promote generalisation (e.g. Becker, Engelmann, & Thomas, 1975; Engelmann & Carnine, 1982), but also asserted that simply teaching with more exemplars (multiple instance training) will not in itself reliably produce generalised responding. Sprague and Horner (1984) provided a clear demonstration that MET is superior to multiple instance training to promote Generalisation. They compared three strategies for teaching generalised use of vending machines with six males diagnosed with moderate to severe learning disabilities aged 16-19 years. The three strategies were:

1. Training with a single vending machine (single instance training).
2. Training with three similar vending machines (multiple instance training).
3. Training with three machines that included the range of stimulus and response variation in a defined class of vending machines (MET).

The third strategy included a General Case Analysis of vending machine use where the full range of exemplars representing all the stimulus variations and response requirements of different vending machines were used. The results showed that the third strategy was the most effective for promoting generalised use of vending machines.

By comparing these three different strategies it was shown that MET was the most effective treatment. Not only does this research show that MET was more effective than teaching using multiple instance training, but it demonstrated that a General Case

Analysis was also required to establish the range of stimulus and response variation in the defined class of vending machines. Sprague and Horner (1984) provided the empirical evidence to dispel the notion that simply teaching more exemplars will lead to Generalisation. Furthermore, in some instances MET alone may not be sufficient to achieve Generalisation in other important areas.

MET as part of a broader treatment package. Some researchers have incorporated MET into a broader treatment package (Gena et al., 1996; Marzullo-Kerth et al., 2011; Reeve et al., 2007). For example, Gena et al. (1996) demonstrated the effectiveness of a treatment package that included MET, different prompting procedures, modeling and reinforcement to teach appropriate affect to four young people (aged 11-18 years) diagnosed with autism. Appropriate affect, including showing sympathy or appreciation, was measured via eye contact, appropriate verbal responses and facial expression. Prior to the implementation of the treatment the researchers carried out a General Case Analysis and developed multiple scenarios to address a variety of affective behaviour responses. For example, participants were taught how to respond when someone talked to them about their favourite things, to show sympathy, to show appreciation, to indicate dislike and to respond appropriately to absurdities. Each participant was taught appropriate affect across multiple response classes. The range of these responses constituted the MET. The participants were also provided with tokens contingent upon showing appropriate affect and an error correction procedure was used if they did not. The treatment package increased appropriate affect across all four participants and this generalised to novel stimuli.

MET, as part of a broader treatment package, has also been used to teach helping behaviour to young children diagnosed with autism. Reeve et al. (2007) defined several categories of helping behaviour (e.g. locating objects, putting items away, and setting up an activity). The MET aspect of the procedure involved teaching these behaviours in

different settings with different stimuli and with different experimenters. This package was implemented in conjunction with video models, prompting and reinforcement and was shown to be successful in teaching generalised helping behaviour.

Further positive results were shown by Marzullo-Kerth et al. (2011) who used a MET procedure similar to that used by Reeve et al. (2007) to establish a generalised sharing repertoire in young children diagnosed with autism. A General Case Analysis of sharing was conducted prior to the implementation of the procedure and MET was used to teach sharing of multiple classes of materials (art materials, snack foods, toys, and gym materials). Generalisation was demonstrated by children offering to share materials outside of the training session.

While it is likely that MET was the operative variable in each of the interventions, they were packaged with other tactics and implemented as a whole, making it difficult to analyse the effects of any one component of the package. The common link across the three studies is the use of MET in each of the treatment packages to establish generalised behaviour. One way to aid in identifying the operative variable in a treatment package is to add the variable of interest to the package independently.

Adding MET to a treatment to promote generalisation. Some researchers have extended previous research studies by adding MET to their treatment procedure in order to promote Generalisation. For example, Hughes and Rusch (1989) extended a study by Agran, Salzberg, and Stowitschek (1987) by adding MET to the initial treatment procedure. Agran et al. (1987) investigated the effectiveness of self-instruction to increase independent performance of individuals diagnosed with severe learning disabilities in vocational settings. They found that the participants did learn to seek assistance, but they did not verbalise self-instructions in either the training or generalised setting. Hughes and Rusch (1989) taught two individuals diagnosed with

severe learning disabilities to solve work-related problems by using self-instruction in combination with MET. The individuals were required to solve a variety of work-related problems with a range of self-instructions. Adding the MET component resulted in generalisation of the skills to untrained work-related problems.

Garcia-Albea et al. (2014) used audio script fading and MET to increase vocal interactions in children diagnosed with autism. Previous research showed that scripts and script fading helped children diagnosed with autism to initiate conversations with others, but the conversational skills had not actually generalised (e.g. Krantz & McClannahan, 1993). Garcia-Albea et al. (2014) incorporated MET and script-fading in order to ensure generalisation occurred. The procedure involved teaching three different scripts related to toy play across six different categories. Use of the combined strategy resulted in generalisation of the conversational skills to novel stimuli.

Hughes et al. (1995) extended the research on self-instruction and MET (e.g. Hughes & Rusch, 1989) and the research on promoting conversational skills (e.g. Krantz & McClannahan, 1993) to demonstrate the effectiveness of self-instruction and MET to increase generalised conversational skills among four students diagnosed with severe learning disabilities. The MET component of the model consisted of several neuro-typical peers teaching self-instructional social skills across a variety of examples of conversational interactions. Again, the combined strategy resulted in generalisation of conversational skills across familiar and unfamiliar peers with and without disabilities. The focus of the Garcia-Albea et al. (2014) study was to evoke more unprompted conversations about different stimuli, but without an emphasis on measuring conversations across people. However, the focus of the Hughes et al. (1995) study was to promote more conversations across different people, because a variety of neuro-typical peers was an essential part of the MET component.

As in the previous sub-section (MET as part of a broader treatment package), MET cannot be isolated as the variable that led to generalisation. All studies, however, have replicated previous research where MET was not included and generalisation did not occur. There is therefore a stronger case for the MET being the key variable that promoted the generalisation of the target behaviours.

The common element in all the studies reviewed within this work thus far is the emphasis on MET as a tactic to programme for generalisation. There are other studies which focus on fusing previously independent classes of behaviour.

MET/MEI to fuse previously independent classes of behaviour. MET/MEI has been used to evoke the emergence of derived relations (e.g. Rosales et al., 2011), fuse previously independent verbal operants (e.g. mands and tacts; Nuzzolo-Gomez & Greer, 2004) and integrate previously functionally independent behaviours (e.g. speaker and writer behaviours; Greer et al., 2005c).

Rosales et al. (2011) used MET to induce the emergence of derived relations. Four neuro-typical 3-year-old children participated in this study. They were taught the names of items in a foreign language as a listener, e.g. “point to (name of item)” and were tested whether they named the same item as a speaker. If participants failed the test, MET was implemented where speaker and listener instruction were provided using multiple exemplars of each item. This continued until the participants were taught a novel name as a listener and subsequently tested for the corresponding speaker form. Results showed marked improvements in the derived speaker tests following MET.

It is important to note that Rosales et al. (2011) and other previously reviewed studies utilising MET procedures (e.g. Garcia-Albea et al., 2014; Gena et al., 1996; Hughes et al., 1995; Hughes & Rusch, 1989; Marzullo-Kerth et al., 2011; Reeve et al., 2007; Sprague & Horner, 1984) did not include the random rotation of antecedent presentations within each of the intervention teaching sessions. For example, Rosales et

al. (2011) did not indicate that an intervention session consisted of listener and speaker behaviours taught through random rotation within one session. It appears as though the listener programmes were run to criterion and then the speaker programmes were run, as opposed to one programme which included both listener and speaker behaviours randomly rotated within.

Random rotation is an element of MET that has been addressed in some of the published applied literature. In fact, including a random rotation across multiple behaviours has become a defining feature of researchers (e.g. Greer & Ross, 2008) who refer to MET as Multiple Exemplar Instruction (MEI). Although this distinction might appear to be innocuous, it may bear further consideration as more research is conducted in this burgeoning area. To clarify, researchers using MET appeared to focus on using multiple exemplars of stimuli when teaching under a single type of responding behaviour (e.g. speaking or listening, reading or writing) whereas MEI researchers focused on multiple exemplars of stimuli *and* types of responding behaviour. Thus, with MEI the teacher's delivery is multiple exemplar in nature. For example, the teacher delivers antecedents that require multiple types of responding (e.g. speaker, listener, reader, and writer) all randomly rotated within one instructional session.

The effectiveness of MEI in fusing emergent responses between mands and tacts was demonstrated by Nuzzolo-Gomez and Greer (2004). A mand is defined as "a verbal operant in which the response is reinforced by a characteristic consequence and is therefore under the control of relevant conditions of deprivation or aversive stimulation" (Skinner, 1957, pp.35-36). A mand is reinforced by receiving the item specified by a speaker. For example, an individual who is thirsty (the condition of deprivation) will mand for a drink by saying "drink," signing "drink" or pointing to a picture of a drink. A listener will then provide the speaker with a drink. A tact is defined by Skinner (1957) as "a verbal operant in which a response of a given form is evoked (or at least

strengthened) by a particular object or event or the property of an object or event” (pp. 81-82). The tact is reinforced “with many different reinforcers or with a generalised reinforcer” (p. 83). For example, a tact occurs if an individual says “it’s raining” in the presence of rain and a listener responds with a nod, “yes” or “I hope it clears up soon.” Any word can function as both a mand or tact depending on the context in which it is used. For example, “jump” functions as a mand if the speaker is asking for a turn on the trampoline or is asking someone to jump with them; this mand is subsequently reinforced by a listener ensuring the speaker has the opportunity to jump. “Jump” functions as a tact if the speaker is making conversation with a listener and the listener responds with “Yes, he looks like he is jumping.”

In the study by Nuzzolo-Gomez and Greer (2004), young children (6-9 years of age) with diagnoses of autism and developmental disabilities were directly taught a variety of mands and tacts. Subsequently Nuzzolo-Gomez and Greer (2004) tested for the emergence of the untaught function. Words directly taught as a mand were tested to determine if they subsequently occurred as tacts, and words directly taught as a tact were tested to determine if they subsequently occurred as mands. In line with prior research (e.g. Lamarre & Holland, 1985; Twyman, 1996), the untaught mands or tacts did not emerge without further instruction. Nuzzolo-Gomez and Greer (2004) subsequently implemented MEI involving direct teaching of mands and tacts in a carefully planned, rotated form. Following the direct teaching of mands and tacts, words taught as mands emerged as tacts, and those taught as tacts emerged as mands suggesting that MEI is an effective procedure for fusing these two previously independent classes of behaviour (mands and tacts).

Behaviours that were established as being functionally independent were also brought under the same stimulus control via MEI in a study by Greer et al. (2005c). Rather than mands and tacts, the focus of their study was speaking and writing. Again,

these are functionally independent behaviours. When an individual is taught to write a word (e.g. to write the word “cat” following the instruction, “Write cat,”) the vocal spelling of the same word does not simply emerge without additional experiences (e.g. vocally say the letters “c,” “a,” “t” following the instruction “spell cat”), and vice versa. In the study by Greer et al. (2005c), children were taught to write words to determine if subsequently they vocally spelled the same words, and vice versa. The initial stage of the study demonstrated the functional independence of these two behaviours (speaker behaviour and writer behaviour). Following the use of MEI, which in this case included randomly rotated written and speaker behaviours (e.g. “write cat” and “spell cat”), the fusing of these previously independent classes of behaviour was induced. As a result, children were taught to write a new word and, without further direct teaching, vocally spelled that same word.

Further research by Lechago, Carr, Kisamore, and Grow (2015) used MEI to induce emergent listener and intraverbal categorisation behaviours in six neuro-typical pre-school children. An intraverbal is one of Skinner’s (1957) verbal operants and is speaker behaviour evoked by speaker behaviour. An example of an intraverbal includes, “What day is it?” with the response of “Monday” or “Let’s count down 5, 4, 3...” with the correct response of “2, 1.” The participants were taught a listener behaviour such as “point to the vehicle” when presented with pictures of a car and a dog. They were then tested for the emergent intraverbal categorisation behaviour where the teacher antecedent was “A car is a...” and the correct vocal response was “vehicle.” If emergent behaviour did not occur then the MEI procedure was implemented. The MEI procedure involved alternating behaviours as a listener and as an intraverbal. The procedure closely aligned to the procedure used by Nuzzolo-Gomez and Greer (2004) for inducing the integration of mands and tacts in the sense that the two targets were alternated throughout the procedure. Once criterion was met on the MEI procedure the participants

were tested again for emergent intraverbal categorisation behaviour. Two participants showed some evidence of emergent intraverbal behaviour and four participants showed no emergent behaviour. Lechago et al. (2015) stated that their research extends the literature on MEI by showing that it is not reliably effective in producing emergent behaviour between listener and intraverbal categorisation behaviours. They speculated whether MEI failed to induce emergent behaviour in their study due to the more complex nature of the behaviours involved (categorisation and intraverbals).

Lechago et al. (2015) suggested that there may have been potentially confounding variables in place for both the Nuzzolo-Gomez and Greer (2004) study and the Greer et al. (2005c) study. They noted that participants were tested only once during baseline before the MEI procedure was implemented which means that practice effects could be a confounding variable. They recommended that multiple tests were conducted during baseline conditions to help control for practice effects. Despite these comments Lechago et al. (2015) stated that this line of research did provide evidence that MEI may produce functional emergent behaviour between verbal operants or behaviours.

Summary

This chapter has introduced and described MET and MEI as procedures to promote generalisation and fuse previously independent classes of behaviour and the corresponding research has been summarised. One area in the literature that has been omitted from this review is the research associated with the use of MEI to induce naming. Before analysing this area of research, however, it is necessary to discuss the emergence of listener and speaker behaviour (Chapter 3) and relate this account of emergent behaviour through a detailed and thorough description of naming (Chapter 4). Subsequently, Chapter 5 explains the importance of naming as a dependent variable in the applied research and an analysis is provided of the research that demonstrates the effectiveness of MEI to induce naming.

Chapter 3

The Emergence of Untaught Listener and Speaker Behaviour

The importance of Generalisation, MET/MEI and General Case Analysis were emphasised in the previous chapter. It is necessary that teachers plan for generalisation to ensure that skills taught are used outside of the training setting (Stokes & Baer, 1977). The research on MET/MEI was described, apart from the research on MEI and naming. Before the research on MEI and naming can be summarised, the research on the emergence of untaught listener and speaker behaviour needs to be reviewed. This is the purpose of this chapter.

Structurally this chapter consists of five sections. The first section addresses the functional independence of speaking and listening (where speaker skills are acquired and listener skills may not emerge, and vice versa) and the research demonstrating this independence of speaking and listening is discussed. In the next section a review is provided of experiments that have shown once speaker behaviour is taught then corresponding untaught listener behaviour emerges. The third section provides an overview of the research demonstrating that when listener behaviour is taught then corresponding untaught speaker behaviour does not emerge. Next, discrepancies in these experimental findings are presented along with some suggested explanations for these variations. Finally, a summary of this chapter isolating some of the potentiating variables in the research is provided.

The Functional Independence of Speaking and Listening

For an individual to be truly verbal, it is claimed that both listener behaviour and speaker behaviour must be present (Greer & Ross, 2008). Listener behaviour involves listening to a speaker and subsequently responding to what the speaker has said. Speaker behaviour involves speaking to a listener. If on the playground a teacher asks a child to, "Pass the ball," and the child locates the ball and passes it then the child has

demonstrated listener behaviour. However, if the child wants the ball returned, they may not have the corresponding speaker behaviour to request it. Put simply, the presence of listener behaviour may not predict the presence of speaker behaviour. A child may not produce the word “ball” (speaker behaviour) even though they locate the ball when asked to (listener behaviour). It cannot be assumed that if an individual has listener behaviour they will automatically use those words as a speaker and vice versa (Skinner, 1957). To emphasise this, Skinner (1957) stated that “in acquiring a verbal repertoire the speaker does not necessarily become a listener, and in acquiring the behaviour characteristic of a listener he does not spontaneously become a speaker” (p. 195).

Guess and Baer (1973) carried out a study to test for the emergence of untaught speaker behaviour following corresponding listener training and the emergence of untaught listener behaviour following corresponding speaker training and found that emergence of untaught behaviour did not take place for three out of four participants diagnosed with a learning disability. To illustrate this, participants who were taught a selection-based listener response (e.g. “Point to the bus,” when presented with a bus and other items) did not automatically emit the corresponding production-based speaker response (e.g. tacting a “bus”). Conversely, those who were taught the production-based speaker response did not automatically emit the corresponding selection-based listener response. This study demonstrated the functional independence of listener and speaker behaviour (neither behaviour emerged following the teaching of the alternative behaviour for most participants). One possible limitation to this study was related to the use of non-contrived stimuli that the participants may have experienced within their instructional history. This instructional history may have served as a confounding variable in the findings although it is uncertain exactly how the findings would have been impacted by this variable.

Studies that have attempted to address this confound by using contrived stimuli have not tested for both untaught listener behaviour as well as untaught speaker behaviour (e.g. Eikeseth & Smith, 1992; Horne, Lowe, & Randle, 2004; Lowe, Horne, Harris, & Randle, 2002; Lowe, Horne, & Hughes, 2005; Tu, 2006) or have not consistently found the two behaviours to be independent (e.g. Pérez-González, García-Conde, & Carnerero, 2011; Pérez-González, Cereijo-Blanco, & Carnerero, 2014; Sprinkle & Miguel, 2012). In the research studies by Pérez-González et al. (2011) and Sprinkle and Miguel (2012), participants demonstrated emergent untaught listener behaviour following corresponding speaker training. The study by Pérez-González et al. (2011) included neuro-typical participants, whereas the study by Sprinkle and Miguel (2012) included participants diagnosed with autism. In the research study by Pérez-González et al. (2014), some participants demonstrated emergent untaught listener behaviour following corresponding speaker training and some did not. Furthermore, some participants demonstrated emergent untaught speaker behaviour following corresponding listener training and some did not. The participants in this study were neuro-typical. To summarise, only Guess and Baer (1973) demonstrated the initial functional independence of speaking and listening across most participants and supported the notion that the two are acquired independently. Multiple studies have been carried out to test for untaught listener or speaker behaviour and different results were generated (e.g. Cuvo & Riva, 1980; Delfs, Conine, Frampton, Shillingsburg, & Robinson, 2014; Eikeseth & Smith, 1992; Guess, 1969; Horne, Hughes, & Lowe, 2006; Horne et al., 2004; Keller & Bucher, 1979; Lee, 1981; Lowe et al., 2002; Lowe et al., 2005; Miguel & Kobari-Wright, 2013; Pérez-González et al., 2011; Sprinkle & Miguel, 2012; Tu, 2006). These studies will be discussed in more detail in the next three sub-sections.

Does Teaching Speaker Behaviour Ensure the Emergence of Listener Behaviour?

A number of studies have demonstrated the emergence of untaught listener behaviour following the teaching of corresponding speaker behaviour (e.g. Cuvo & Riva, 1980; Delfs et al., 2014; Keller & Bucher, 1979; Lee, 1981; Lowe et al., 2002; Lowe et al., 2005; Miguel & Kobari-Wright, 2013; Pérez-González et al., 2011; Sprinkle & Miguel, 2012). In these studies the acquisition of untaught listener behaviour was the dependent variable. An example of this is to teach a child the names of five different cars (speaker behaviour) and without further teaching the child points to pictures of those cars when shown a car magazine (listener behaviour) and asked to, “Point to Ferrari.” In this example, only the speaker behaviour is taught and the corresponding listener behaviour emerges without further teaching. This example is in contrast to the research by Guess and Baer (1973) demonstrating the functional independence of speaking and listening. If speaking and listening are independent the child in the previous example would not have pointed to the correct cars in the magazine (demonstrating listener behaviour) following being taught the names of those cars (speaker behaviour).

Keller and Bucher (1979) taught six children diagnosed with language delays a set of speaker responses (production). They taught the children noun labels for pictured objects (speaker behaviour) and tested whether the corresponding untaught listener behaviour emerged. They found that untaught listener behaviour emerged when speaker behaviours were taught; no further teaching was required in order for the listener behaviour to emerge. Similar results occurred in an experiment by Lee (1981) demonstrating the emergence of untaught listener behaviour (prepositions) following direct teaching of speaker behaviour in two young children diagnosed with a learning disability. For example, Lee (1981) taught participants to vocally answer the question, “Where is the cup?” by responding, “To the left of the book.” Once these responses and

variations of these responses were mastered (speaker behaviour), participants were tested for the corresponding listener behaviour, for example to point to the cup to the left of the book.

While these two studies (Keller & Bucher, 1979; Lee, 1981) focused on children diagnosed with a disability, Cuvo and Riva (1980) compared children who were neuro-typical to children diagnosed with learning disabilities to test whether taught listener behaviour transferred to speaker behaviour without further training and vice versa. This section of the chapter is only focusing on the emergence of untaught listener behaviour following speaker training, thus the results of the test for untaught speaker behaviour following listener training will be discussed in a later section. This study used coin labels as the stimuli. The experimenters found that all participants (those with and without a diagnosis of a learning disability) demonstrated that once taught speaker behaviour they responded to the coins with corresponding listener behaviour. They located different coins (listener behaviour) once they had been taught to label those coins (speaker behaviour).

More recently, Miguel and Kobari-Wright (2013) tested whether speaker training (teaching non-contrived facts) led to the emergence of untaught listener behaviour without direct teaching. Two boys diagnosed with autism, aged 5 and 6 years, participated in the study. Once the participants met criterion on speaker training they were tested for untaught listener behaviour and both scored 100%. Research by Delfs et al. (2014) tested whether speaker training led to the emergence of corresponding listener behaviour. Four participants, aged 3-8 years, all with a diagnosis of autism took part in the study. Results showed that speaker training (teaching facts) produced untaught listener behaviour for all four participants. Their results were consistent with all previous research on teaching speaker behaviour initially followed by a test for the

corresponding untaught listener behaviour, with the exception of Guess and Baer (1973).

Similar to Guess and Baer (1973), one possible limitation to these studies (Cuvo & Riva, 1980; Delfs et al., 2014; Keller & Bucher, 1979; Lee, 1981; Miguel & Kobari-Wright, 2013) was related to the use of non-contrived stimuli that the participants may have contacted within their instructional history. This instructional history may have served as a confounding variable in the findings.

Lowe et al. (2002) and Lowe et al. (2005) controlled for this possible limitation by demonstrating the emergence of untaught listener behaviour following the teaching of corresponding speaker behaviour using contrived stimuli. These two studies showed that neuro-typical children, aged 1 year to 4 years 3 months, demonstrated listener behaviour without further direct teaching after being taught corresponding speaker behaviour. In these experiments, contrived stimuli were used to control for instructional history. Participants were presented with a contrived symbol and taught to tact the symbol as “vek” or “zog.” The children who met criterion on tact training (speaker behaviour) were tested for corresponding listener behaviour. “Zog” and “vek” symbols were presented to each participant and they were asked to, “Point to zog,” or, “Point to vek.” All participants who had met criterion on tact training passed this subsequent listener test. It may be concluded from these studies that when neuro-typical 1- to 4-year-old children are directly taught speaker behaviour, listener behaviour emerges. Pérez-González et al. (2011) replicated these results with 6-year-old neuro-typical children. They also demonstrated the emergence of untaught listener behaviour following corresponding speaker training with contrived stimuli. The participants in all three of these studies were neuro-typical. A more recent study by Sprinkle and Miguel (2012) focused on children diagnosed with autism.

Sprinkle and Miguel (2012) tested whether speaker training (teaching contrived and non-contrived tacts) led to the emergence of untaught listener behaviour. Four boys diagnosed with autism, aged 5-7 years, participated in the study. The study showed that listener behaviour emerged following speaker training for both contrived and non-contrived stimuli.

In summary, there appears to be an established research base demonstrating the emergence of untaught listener behaviour following the teaching of corresponding speaker behaviour with neuro-typical children and children diagnosed with disabilities including those with autism. These findings contradict the previously described research demonstrating the functional independence of speaking and listening (Guess & Baer, 1973) and the mixed results produced by Pérez-González et al. (2014). In addition, these findings apparently contradict Skinner's (1957) claim that speaking and listening are functionally independent of one another. As mentioned earlier, Skinner (1957) stated that "in acquiring a verbal repertoire the speaker does not necessarily become a listener, and in acquiring the behaviour characteristic of a listener he does not spontaneously become a speaker" (p. 195). Instead, research appears to show that for *most* individuals (in these studies) in acquiring a verbal repertoire the speaker *does* become a listener (speaker behaviour was taught and corresponding listener behaviour emerged). It is noted, however, that this is not the case for all individuals. For some untaught listener behaviour does not emerge following speaker training.

It is unclear why untaught listener behaviour emerges for some individuals and not others and is an area that requires further research. It is possible that the instructional histories and behavioural cusps of the individuals who served as participants in the previously described studies played a role in whether the untaught behaviour emerged or not. This unanswered question does warrant further investigation. It is clearer, however, that it may be more efficient to teach one behaviour initially

(speaker behaviour) in order to generate the corresponding untaught behaviour (listener behaviour). Therefore, it is crucial that researchers understand why this occurs and what potential prerequisites need to be in place necessary for this emergence to occur. It may be that speaker and listener behaviour are *initially* independent of one another and at some point untaught listener behaviour emerges following speaker training. This leads to the consideration whether the converse also occurs, the emergence of untaught speaker behaviour following the teaching of corresponding listener behaviour.

Does Teaching Listener Behaviour Ensure the Emergence of Speaker Behaviour?

A number of studies have tested for untaught speaker behaviour following the teaching of listener behaviour and have shown that untaught speaker behaviour has not emerged (e.g. Delfs et al., 2014; Guess, 1969; Guess & Baer, 1973; Horne et al., 2004; Keller & Bucher, 1979; Lee, 1981; Pérez-González et al., 2011; Sprinkle & Miguel, 2012). In these studies the acquisition of untaught speaker behaviour was the dependent variable.

Guess (1969) carried out a study to specifically determine whether untaught speaker behaviour emerged if listener behaviour was taught. Guess (1969) taught individuals diagnosed with a learning disability to select different plural forms of words. They were taught listener discriminations and tested for corresponding speaker behaviour. For example, to teach listener behaviour, the participants were presented with a picture of one bus and a picture of several buses and required to select “bus” or “buses” (when either direction was given to them) until they met the pre-determined criterion (with hats, cars, boxes and further regular plural forms). They were subsequently tested for untaught speaker behaviour by ascertaining if they tacted the pictures of buses, cars, hats and so on. Although the participants accurately selected the correct picture in the presence of the spoken word (listener behaviour), they did not

subsequently tact the pictures (speaker behaviour). Thus, the listener behaviour did not lead to the emergence of speaker behaviour without further direct teaching.

Similar to the study by Guess and Baer (1973), a number of studies tested for untaught speaker behaviour following corresponding listener training as well as testing for untaught listener behaviour following corresponding speaker training (Delfs et al., 2014; Keller & Bucher, 1979; Lee, 1981). As previously stated, untaught listener behaviour did emerge in all three of these studies. These studies also addressed the converse transfer and tested whether untaught speaker behaviour emerged following corresponding listener training. Keller and Bucher (1979) taught six children diagnosed with language delays a set of listener responses (selection) using sets of noun labels for pictured objects and tested whether the corresponding untaught speaker behaviour emerged for each set. They found that untaught speaker behaviour did not emerge when listener responses were taught. An additional study showing similar results was conducted by Lee (1981). She demonstrated that children diagnosed with learning disabilities could be taught speaker behaviour (prepositions) and untaught listener behaviour emerged, but untaught speaker behaviour did not emerge following listener training. Delfs et al. (2014) also tested for both untaught speaker behaviour following corresponding listener training and untaught listener behaviour following corresponding speaker training. Their results also showed that untaught speaker behaviour did not emerge following corresponding listener training. These studies also shared similar limitations to other studies previously discussed in this chapter which tested the same variables (e.g. Cuvo & Riva, 1980; Keller & Bucher, 1979; Lee, 1981; Miguel & Kobari-Wright, 2013). One possible limitation of these studies was related to the use of non-contrived stimuli that the participants may have contacted within their instructional history. This instructional history of the participants may have served as a confounding variable in the findings.

There appears to be two studies that controlled for this possible limitation by using contrived stimuli (Horne et al., 2004; Pérez-González et al., 2011). Horne et al. (2004) provided listener training to nine neuro-typical children aged 1 year 4 months to 4 years. Seven children failed a subsequent test of corresponding untaught speaker behaviour (tact test). Pérez-González et al. (2011) provided listener training to five neuro-typical children aged 6 years. Two children failed the subsequent tact test. Their combined results showed that 1- to 6-year-old children can be taught listener behaviour, but without the emergence of corresponding speaker behaviour. Additionally, Sprinkle and Miguel (2012) used contrived and non-contrived stimuli in their study. Their participants made gains with the untaught speaker behaviour following corresponding listener training, but not to criterion level. Untaught speaker behaviour therefore did not fully emerge which is consistent with previous results.

In review, there appears to be an established research base demonstrating that untaught speaker behaviour does not emerge following the teaching of corresponding listener behaviour with neuro-typical children and children diagnosed with disabilities including those with autism. These findings support the consideration that some children may benefit from speaker behaviour being taught prior to listener behaviour. This is potentially the most efficient practice to promote the emergence of corresponding listener behaviour.

While teaching speaker behaviour first may be the more efficient practice, it might not always be possible to capitalise on language opportunities by waiting for speaker behaviour to occur first. For example, at a zoo when people are looking at a variety of animals someone in the group (a speaker) mentions, “Look at that orangutan,” and someone in the group (a listener) has to determine which one is the orangutan (acting as a listener) before having the opportunity to tact the “orangutan” (acting as a speaker). In this example, “orangutan” is a new word for the listener/speaker. They have

acquired this novel name by listening first. It is therefore not always possible to capitalise on the teaching of speaker behaviour first. In addition, in order to acquire speaker behaviour the individual does have to emit certain listener behaviours, e.g. they need to echo and they have to respond to the reinforcement or correction process. The discrepancy between why some individuals demonstrate emergent speaker behaviour following corresponding listener training and why some do not has not been determined. At this point there are only two studies that have shown the emergence of untaught speaker behaviour following corresponding listener training (Cuvo & Riva, 1980; Horne et al., 2006). Thus, an experimental question for future research is why this is the case for some individuals and not others. Furthermore, research needs to provide an account of what makes teaching speaker behaviour first more efficient. What may be the most vital aspect of this discussion is determining how to achieve the integration of speaker and listener behaviour where teaching either behaviour results in the emergence of the untaught behaviour.

Discrepancies between Research Studies

The first discrepancy to be addressed is the different results between Guess and Baer (1973) and those produced by Cuvo and Riva (1980), Delfs et al. (2014), Keller and Bucher (1979), Lee (1981), Lowe et al. (2002), Lowe et al. (2005), Miguel and Kobari-Wright (2013), Pérez-González et al. (2011) and Sprinkle and Miguel (2012). Guess and Baer's (1973) research confirms Skinner's (1957) hypothesis that speaking and listening are functionally independent of one another, but these eight other studies contradict their findings by showing untaught listener behaviour emerged following corresponding speaker training.

There are three studies that do support the results of Guess and Baer (1973). Eikeseth and Smith (1992), Tu (2006) and Fiorile and Greer (2007) have also shown that listener behaviour did not emerge following speaker training. In the study by

Eikeseth and Smith (1992), children diagnosed with autism were taught to tact (speaker behaviour) a contrived symbol. Subsequently, their listener behaviour was tested to determine whether it emerged without further teaching. The experimenters did this by asking the participants to select the correct contrived symbol when presented alongside another contrived symbol (i.e. to follow the direction, "Give me the (contrived stimulus)," when this symbol was presented alongside another contrived symbol). Results showed that corresponding listener behaviour did not automatically emerge. These findings were replicated by Tu (2006) and also Fiorile and Greer (2007). In both of these studies, children diagnosed with autism were also taught to tact contrived stimuli. Subsequently, the children did not demonstrate corresponding emergent listener behaviour. It would be interesting to know whether untaught speaker behaviour emerged following listener training with the participants in these three studies, but this was not tested.

The research described in the previous section showed that untaught speaker behaviour did not emerge following listener training (Delfs et al., 2014; Guess, 1969; Horne et al., 2004; Keller & Bucher, 1979; Lee, 1981; Pérez-González et al., 2011; Sprinkle & Miguel, 2012). Two studies have contradicted these results and have demonstrated the emergence of untaught speaker behaviour following listener training (Cuvo & Riva, 1980; Horne et al., 2006). Horne et al. (2006) investigated whether speaker behaviour emerged if listener behaviour is taught. Fourteen neuro-typical children aged 1-4 years participated in the study. They showed that listener training did establish untaught speaker behaviour in 10 of the children. Horne et al. (2006) showed that most (but not all) participants acquired untaught speaker behaviour. These mixed results indicated that this phenomenon occurs for some individuals, but not all. Apparently, these reported contradictions warrant further investigation to determine why this phenomenon occurs for some individuals and not others. To illustrate this,

Cuvo and Riva (1980) compared neuro-typical children to those diagnosed with learning disabilities to test whether taught listener behaviour resulted in the emergence of untaught speaker behaviour and vice versa. Using coin labels as the stimuli, the researchers found that all participants (those with and without a diagnosis of a learning disability) demonstrated the acquisition of untaught speaker behaviour after they were taught the corresponding listener behaviour. They accurately tacted different coins (speaker behaviour) once they had been taught to point to those coins (listener behaviour).

Closer inspection of the results by Pérez-González et al. (2011) actually showed that the results were mixed for the emergence of untaught speaker behaviour following corresponding listener training. Untaught speaker behaviour emerged for three out of the five participants and it did not for the remaining two participants. These mixed results were replicated in a further study by Pérez-González et al. (2014).

This section illustrated four discrepancies between research studies which have focused on testing for emergent verbal behaviour. First, there is the discrepancy between Guess and Baer (1973) demonstrating the functional independence of speaking and listening and the research studies demonstrating that untaught listener behaviour emerges following corresponding speaker training (Cuvo & Riva, 1980; Delfs et al., 2014; Keller & Bucher, 1979; Lee, 1981; Lowe et al., 2002; Lowe et al., 2005; Miguel & Kobari-Wright, 2013; Pérez-González et al., 2011; Sprinkle & Miguel, 2012). The second discrepancy was related to the three further research studies (Eikeseth & Smith, 1992; Fiorile & Greer, 2007; Tu, 2006) confirming Guess and Baer's (1973) findings that untaught listener behaviour did not emerge following speaker training, but these studies did not test for untaught speaker behaviour following listener training. Furthermore, there have been two research studies (Cuvo & Riva, 1980; Horne et al., 2006) demonstrating that untaught speaker behaviour does emerge following

corresponding listener training which contradicts the previously reported findings.

Finally, two research studies have produced mixed results for the emergence of untaught speaker behaviour following corresponding listener training showing that this untaught behaviour emerges for some, but not for others (Pérez-González et al., 2011, 2014).

Summary

The research summarised thus far has focused on whether listener and speaker behaviour are independent of one another, whether untaught listener behaviour emerges following the direct teaching of speaker behaviour or whether untaught speaker behaviour emerges following direct listener teaching. The corresponding research is summarised in Table 1.

Table 1

A summary of the research demonstrating the emergence or non-emergence of untaught verbal behaviour

Authors & Date of Study	Number of Participants & Diagnosis	Type of Stimuli Used	Taught Behaviour	Tested Untaught Behaviour	Demonstration of the Emergence of Untaught Behaviour
Guess & Baer (1973)	4 Learning Disability	Non-contrived	Speaker Behaviour	Listener Behaviour	No
			Listener Behaviour	Speaker Behaviour	No
Pérez-González et al. (2014)	7 Neuro-typical	Contrived	Speaker Behaviour	Listener Behaviour	No*
			Listener Behaviour	Speaker Behaviour	No*
Eikeseth & Smith (1992)	4 Autism	Contrived	Speaker Behaviour	Listener Behaviour	No
Tu (2006)	4 Autism	Contrived	Speaker Behaviour	Listener Behaviour	No

Fiorile & Greer (2007)	4 Autism	Contrived	Speaker Behaviour	Listener Behaviour	No
Lowe et al. (2002)	9 Neuro-typical	Contrived	Speaker Behaviour	Listener Behaviour	Yes
Lowe et al. (2005)	9 Neuro-typical	Contrived	Speaker Behaviour	Listener Behaviour	Yes
Miguel & Kobari-Wright (2013)	2 Autism	Non-contrived	Speaker Behaviour	Listener Behaviour	Yes
Keller & Bucher (1979)	6 Language delay	Non-contrived	Speaker Behaviour Listener Behaviour	Listener Behaviour Speaker Behaviour	Yes No
Lee (1981)	2 Learning disability	Non-contrived	Speaker Behaviour Listener Behaviour	Listener Behaviour Speaker Behaviour	Yes No
Delfs et al. (2014)	4 Autism	Non-contrived	Speaker Behaviour Listener Behaviour	Listener Behaviour Speaker Behaviour	Yes No
Pérez-González et al. (2011)	5 Neuro-typical	Contrived	Speaker Behaviour Listener Behaviour	Listener Behaviour Speaker Behaviour	Yes* No*
Sprinkle & Miguel (2012)	4 Autism	Contrived & non-contrived	Speaker Behaviour Listener Behaviour	Listener Behaviour Speaker Behaviour	Yes No
Guess (1969)	2 Learning disability	Non-contrived	Listener Behaviour	Speaker Behaviour	No
Horne et al. (2004)	9 Neuro-typical	Contrived	Listener Behaviour	Speaker Behaviour	No

Horne et al. (2006)	14 Neuro-typical	Contrived	Listener Behaviour	Speaker Behaviour	Yes
Cuvo & Riva (1980)	20 Neuro-typical & learning disability	Non-contrived	Speaker Behaviour Listener Behaviour	Listener Behaviour Speaker Behaviour	Yes Yes

*Results were mixed for this study. The functional independence of speaking and listening was not shown as some participants demonstrated untaught behaviour and some did not.

Table 1 shows that one study has demonstrated that speaker and listener behaviour are independent of one another (Guess & Baer, 1973). This study showed that if speaker or listener behaviour was taught then the converse behaviour did not emerge. Nine studies have consistently shown that untaught listener behaviour emerges following corresponding speaker instruction: Cuvo and Riva (1980), Delfs et al. (2014), Keller and Bucher (1979), Lee (1981), Lowe et al. (2002), Lowe et al. (2005), Miguel and Kobari-Wright (2013), Pérez-González et al. (2011) and Sprinkle and Miguel (2012). Three further studies have produced contradictory results showing that untaught listener behaviour does not emerge following corresponding speaker training: Eikeseth and Smith (1992), Fiorile and Greer (2007) and Tu (2006). With regard to untaught speaker behaviour emerging following listener training, there have been two studies showing success in this area: Cuvo and Riva (1980) and Horne et al. (2006). Six additional studies have been unsuccessful in showing untaught speaker behaviour consistently emerges following listener training: Delfs et al. (2014), Guess (1969), Horne et al. (2004), Keller and Bucher (1979), Lee (1981), Pérez-González et al. (2011), Pérez-González et al. (2014) and Sprinkle and Miguel (2012).

The weight of the evidence from the research summarised within this chapter suggests that the presence of listener behaviour may not predict the presence of

corresponding speaker behaviour, but the presence of speaker behaviour may predict the presence of corresponding listener behaviour.

One common missing element across all studies discussed is specific information regarding the participants' levels of verbal behaviour, arrangement of the teaching environment, teaching procedures and behavioural cusps. Without this information it is difficult to identify whether these variables had an impact on the differences in the findings. Isolating one or more of these variables may provide a correlate with the emergence of untaught listener and speaker behaviour. In turn, this discovery could position future researchers to identify specific experiences that are necessary to induce emergent verbal behaviour.

Most of the studies reviewed thus far have reported results in which participants demonstrated emergent verbal behaviour, but some did not. The question remains, for those participants who did not demonstrate emergent verbal behaviour, whether specific emergent verbal behaviour can be induced. Thus, the missing element across all of the previously reviewed studies was that the authors did not address potential interventions for the individuals who did not demonstrate emergent verbal behaviour. Apart from Fiorile and Greer (2007), these studies did not implement procedures to induce emergent verbal behaviour if it was not present. The study demonstrating the functional independence of speaking and listening (Guess & Baer, 1973) did not attempt to induce emergent listener behaviour or emergent speaker behaviour. Similarly the studies that showed speaker behaviour did not emerge following listener training did not attempt to induce emergent speaker behaviour (Delfs et al., 2014; Horne et al., 2004; Keller & Bucher, 1979; Lee, 1981; Sprinkle & Miguel, 2012). Greer and Ross (2008) state, that for an individual to be truly verbal, both listener behaviour and speaker behaviour must be present. They argue that the point at which speaker and listener behaviours fuse, when they are no longer functionally independent of each other, is the point at which an

individual can be described as verbal. Thus, understanding how to bring about this integration for *all* individuals is crucial to the development of verbal behaviour. The fusion of speaking and listening is often referred to as 'naming' and will be described in more detail in Chapter 4. Once the phenomenon of 'naming' is completely described then studies that used MEI as a procedure to induce naming will be described in Chapter 5.

Chapter 4

When Speaking and Listening Come Together: Naming

Chapter 3 summarised the research on the emergence of untaught listener and speaker behaviour. Greer and Ross (2008) have suggested that once listener and speaker behaviour are integrated then an individual is truly verbal. This fusion of speaker and listener behaviour is known as 'naming' and naming theory provides an account of how new verbal behaviour occurs without direct teaching. Different components of naming are described in this chapter. Greer and Ross (2008) identified one of these components as 'full naming' and incorporated its description into a theory known as the Verbal Behaviour Development Theory (VBDT; Greer & Keohane, 2005; Greer & Ross, 2008; Greer & Speckman, 2009). Their theory provides a research-based and detailed account of the acquisition of verbal behaviour and, according to Greer and Speckman (2009), the theory builds upon and complements research related to naming (Horne & Lowe, 1996), stimulus equivalence (Sidman, 1986; Sidman, 1994) and relational frame theory (Hayes, Barnes-Holmes, & Roche, 2001). The theory also provides procedures for inducing behavioural cusps including naming.

Structurally this chapter consists of seven sections. In the first section, a description of naming, as defined by Horne and Lowe (1996), is presented and linked to research summarised in Chapter 3. The second section describes definitions of naming provided by other researchers, e.g. Greer and Ross (2008), and describes how naming is incorporated into the VBDT. The third section provides a brief overview of other theories that are relevant to the VBDT, specifically stimulus equivalence and relational frame theory. The VBDT is described in more detail in the fourth section of this chapter. The fifth section emphasises the importance of naming. A synthesis of the research allowing for a more in-depth analysis and the identification of potentially

different components of naming is discussed in the penultimate section. Finally, a summary of this chapter is provided.

Naming as Defined by Horne and Lowe (1996)

Horne and Lowe (1996) identified naming as “the basic unit of verbal behaviour” (p. 185) and defined naming as “a higher order bidirectional behavioural relation that combines conventional speaker and listener functions so that the presence of either one presupposes the other” (p. 207). Horne and Lowe (1996) suggested that “higher order” in this instance refers to behaviour that produces generalised, emergent or novel behaviour. This viewpoint and terminology are supported by work from Catania (1998). Generalised imitation is an example of higher order behaviour. Generalised imitation occurs when an individual imitates novel behaviour. Untaught speaker behaviour and untaught listener behaviour, as described in Chapter 3, are also examples of higher order behaviours. Once naming is established for an individual, directly taught listener behaviour results in the emergence of corresponding untaught speaker behaviour. Likewise, directly taught speaker behaviour results in the emergence of corresponding untaught listener behaviour. For example, naming is present if a tact, such as “frog” (speaker behaviour), is directly taught and, without subsequent or simultaneous training, a picture of a frog is selected following the instruction, “Find frog,” in the presence of other stimuli (listener behaviour). Conversely, after being taught to select a picture of a frog following the instruction, “Find frog,” when presented with other stimuli (listener behaviour), the tact “frog” (speaker behaviour) can be produced without further training. Thus, naming is the integration of speaker and listener behaviour in which one behaviour is taught and, without further teaching, the other behaviour emerges. The naming theory attempts to account for how untaught verbal behaviour emerges.

There are apparent overlapping elements between the explanation of naming described in this chapter and the explanation of the emergence of untaught verbal behaviour described in Chapter 3. Chapter 3 focused on research where untaught listener behaviour and/or untaught speaker behaviour was the dependent variable. For some participants untaught verbal behaviour emerged (Cuvo & Riva, 1980; Horne, Hughes, & Lowe, 2006; Keller & Bucher, 1979; Lee, 1981; Lowe, Horne, Harris, & Randle, 2002; Lowe, Horne, & Hughes, 2005; Miguel & Kobari-Wright, 2013; Sprinkle & Miguel, 2012) whereas other studies failed to show such emergent behaviour (Eikeseth & Smith, 1992; Fiorile & Greer, 2007; Guess, 1969; Guess & Baer, 1973; Horne, Lowe, & Randle, 2004; Tu, 2006). Some researchers used the term ‘naming’ to describe the dependent variable in their studies (e.g. Fiorile & Greer, 2007; Horne et al., 2006; Lowe et al., 2002; Lowe et al., 2005) while others used a variety of terminology (Cuvo & Riva, 1980; Keller & Bucher, 1979; Lee, 1981). It appears the research published prior to Horne and Lowe’s (1996) landmark publication used terminology such as ‘generalisation and transfer between comprehension and production’ (Cuvo & Riva, 1980) or ‘transfer between receptive and productive language’ (Keller & Bucher, 1979), whereas research conducted since the publication of Horne and Lowe (1996) predominantly used the term ‘naming’ as the dependent variable (Fiorile & Greer, 2007; Horne et al., 2006; Lowe et al., 2002; Lowe et al., 2005). Interestingly, Sprinkle and Miguel (2012) and Miguel and Kobari-Wright (2014) cited ‘naming’ in their literature review and referenced Horne and Lowe (1996), but used the terminology ‘the emergence of listener/speaker skills’ when describing the dependent variable. Thus, all of these studies potentially tested for naming as defined by Horne and Lowe (1996).

In addition to the bidirectional emergence of untaught speaker/listener behaviour, Horne and Lowe (1996) included a second component of naming where names of items are acquired without direct teaching. They referred to research by

Nelson and Bonvillian (1973) where children 18 months and older could name new objects after an adult named the objects in their presence only once or twice. The direct teaching of either listener or speaker behaviour was not required to establish naming. It was established solely by making contact with the new name in the presence of the stimulus.

A third component of naming, as described by Horne and Lowe (1996), is related to the categorisation of objects and events. To clarify, names not only refer to individual stimuli, they also categorise or describe classes of items. For example, “cat” refers to a class of felines as well as to an individual picture of a cat or to a specific cat. According to this third component of naming theory, novel items are included in categories without formal teaching; for example, responding to a novel picture of a cat as belonging to a class of “cats.”

To summarise, Horne and Lowe (1996) presented a definition of naming and suggested three distinct components. The first component, where untaught listener behaviour emerges following speaker training and untaught speaker behaviour emerges following listener training, is closely linked to the research summarised in Chapter 3. The incidental acquisition of language is the focus of the second component where individuals acquire the names of novel items having made contact with those items (seeing them and saying their names) without direct teaching of the names of these items. The final component involved the categorisation of objects and events. Furthermore, Horne and Lowe (1996) provided an explanation as to how naming might be acquired based on individuals overtly or covertly saying the names of items while seeing them.

Naming as Defined by Others

Catania (1998) provided a definition of naming that closely aligned with the definition of the first component of naming provided by Horne and Lowe (1996). He

also defined it as a higher order class and also in terms of a bidirectional relationship between listener and speaker behaviour. Catania (1998) also described another feature³ of naming explaining how individuals acquire the names of new items after listening to someone else say the name of that item while referencing that item. He provided an example of a child being shown a glove for the first time. The child is told, “This is a glove,” and the child repeats “glove” and points to it. Catania (1998) emphasised that naming is demonstrated if the child later points to a glove if directed to, “Find the glove,” or says “glove” when the child sees one. This additional feature of naming aligns with Horne and Lowe’s (1996) second component of naming where they described how names of items can be acquired without direct reinforcement.

Others have expanded on previous definitions of naming and have conducted research with naming as an explicit dependent variable. Consistent with Horne and Lowe’s (1996) second component of naming and Catania’s (1998) second feature of naming (acquiring both untaught listener behaviour and untaught speaker behaviour without direct teaching), Greer and Ross (2008) described naming as “the capacity to acquire a tact (pure or impure) and a listener response by simply hearing another person tact a stimulus” (p. 149). Pure tacts are those that occur under non-verbal antecedent control whereas impure tacts are those that occur under both verbal and non-verbal control. Greer and Ross (2008) provided an example of naming as someone pointing to a bird and saying, “That’s a blue bunting,” and a child who heard this statement and simultaneously saw the bird to later:

- Say, “Blue bunting,” (demonstrating untaught speaker behaviour as a pure tact).
- Say, “Blue bunting,” if asked, “What bird is that?” (demonstrating untaught speaker behaviour as an impure tact).

³ For clarification, Horne and Lowe (1996) used the term ‘component’ to discriminate between different levels of naming and Catania (1998) used the term ‘feature.’ The same terms will be used respectively. This should provide an easier understanding of the distinction and similarities between Horne and Lowe’s and Catania’s definitions.

- Point to a blue bunting when someone else says, “Blue bunting,” (demonstrating untaught listener behaviour).

To clarify, Table 2 summarises the three components of naming as described by Horne and Lowe (1996) and shows where they link with other conceptual researchers.

Table 2

The different components of naming and corresponding conceptual researchers

Components	Descriptions	Conceptual Researchers
Component 1 Feature 1	Bidirectional relationship; emergence of untaught speaker/listener behaviour following listener/speaker teaching	Horne & Lowe (1996) Catania (1998)
Component 2 Feature 2 'Full naming'	Acquiring new names without direct teaching	Horne & Lowe (1996) Catania (1998) Greer & Ross (2008)
Component 3	Categorisation	Horne & Lowe (1996)

Thus, Greer and Ross (2008, p. 149-150) drew from these previously identified components and features to describe what they termed ‘full naming.’ Greer and Ross (2008) used the term ‘full naming’ to identify the acquisition of novel listener and speaker behaviour without direct teaching. It does appear appropriate that a different term (‘full naming’) is adopted for this aspect of naming because it is more complex than the first component and first feature of naming as described by Horne & Lowe (1996) and Catania (1998). It is more complex because the names of novel items are acquired without direct teaching and this appears to be an important distinction.

Subsequently, research emanating from the concept posited by Greer and Ross (2008) used the term ‘full naming’ to describe the dependent variable in their studies (e.g. Gilic & Greer, 2011; Greer, Corwin, & Buttigieg, 2011a; Greer, Stolfi, Chavez-Brown, & Rivera-Valdes, 2005b; Greer, Stolfi, & Pistoljevic, 2007). ‘Full naming’ is one of

several components of the framework that is used to establish Greer and Ross's (2008) comprehensive theory of verbal behaviour development (described below).

The focus of the current work is Components 1 and 2 of naming as described by Horne and Lowe (1996) and their relation to 'full naming' as described by Greer and Ross (2008). One aim of this thesis is to establish whether there are foundational components necessary for the development of 'full naming.' Subsequently, Component 3, categorisation, is not reviewed and will not be described further in this thesis. Component 2, Feature 2 or 'Full Naming' is described in more detail by Greer and Ross (2008) as part of their Verbal Behaviour Development Theory (VBDT). As stated earlier, the VBDT builds upon and complements research related to naming, stimulus equivalence and relational frame theory.

Stimulus Equivalence and Relational Frame Theory

Sidman (1971) was the first to demonstrate the stimulus equivalence paradigm, illustrated in Figure 1. The bold lines within the figure show direct teaching and the dotted lines show emergent behaviour. In his study, the participants were taught to match dictated words to corresponding pictures (A to B) and to match the pictures to the printed words (B to C) then, without further instruction, they tacted the pictures (B to A), read the words (C to A), matched words to pictures (C to B) and pointed to the words (A to C). This original study was conducted with individuals with developmental disorders and limited language skills. This demonstration of emergent behaviour has been replicated by many researchers across different behaviours and with individuals of different ages and abilities (e.g. Cowley, Green, & Braunling-McMorrow, 1992; Hanna, de Souza, de Rose, & Foncesca, 2004; Kennedy, Itkonen, & Lindquist, 1994; LeBlanc, Miguel, Cummings, Goldsmith, & Carr, 2003; Lynch & Cuvo, 1995; Rosales & Rehfeldt, 2007; Sidman & Tailby, 1982).

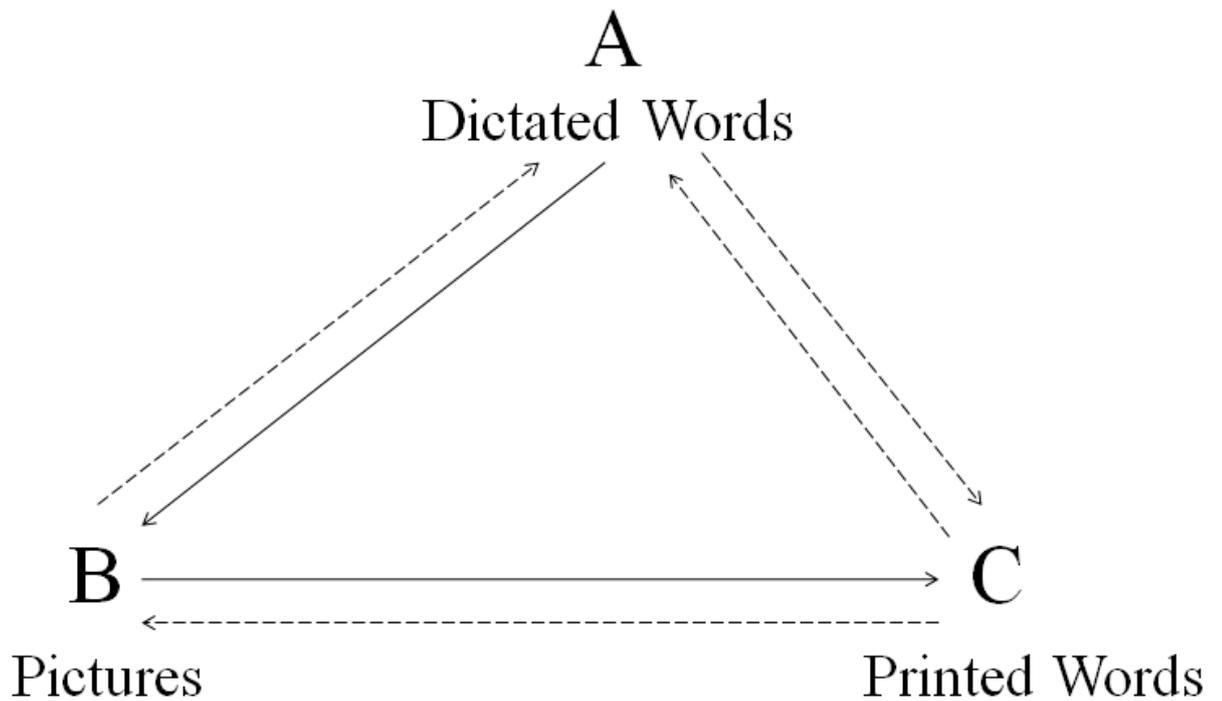


Figure 1: A schematic representation of the stimulus equivalence paradigm.

This description of stimulus equivalence relates to Component 1 of naming as it specifies a bidirectional relationship between speaking and listening (e.g. the emergence of untaught speaker/listener behaviour following listener/speaker teaching). To clarify, if A is the vocal word “shoe” and B is a picture of a shoe and an individual is taught speaker behaviour (when a picture of a shoe is presented then the tact “shoe” is emitted (B to A)) then the A to B relation (listener behaviour) will emerge (when the vocal word “shoe” is heard then the picture of the shoe is pointed to). This is an example of a symmetrical relation; if A is equivalent to B then B is equivalent to A.

Relational Frame Theory (Hayes, Barnes-Holmes, & Roche, 2001) states that responses are related to each, rather than solely equivalent to each other, and is based on a similar paradigm to stimulus equivalence. Instead of A being equivalent to B (therefore B is equivalent to A), however, A is *related* to B (therefore B is related to A). Language develops via relational frames (e.g. if A is bigger than B and B is bigger than C then it can be derived that B is smaller than A, C is smaller than B, A is bigger than C

and C is smaller than B). Responding within each of these frames requires “deriving” information about one stimulus or event based on information given about its relation to another stimulus or event which, according to RFT, is established through “an appropriate history of multiple-exemplar training” (Barnes-Holmes, Barnes-Holmes, & Cullinan, 2000, p.70). Relational frame theorists thus view multiple exemplar training as a building block for language development.

This description of relational frame theory also links to Component 1 of naming as it identifies a bidirectional relationship between A and B or speaking and listening. RFT encompasses vocabulary specific to the phenomena identified within the theory. Thus, the relationship between A and B is considered mutual entailment. The term mutual entailment not only encompasses the stimulus equivalence term ‘symmetry,’ but also the derived relation between stimuli related to one another: “Mutual entailment describes the fundamental bidirectionality of relational responding, even when such bidirectionality is not symmetrical” (Hayes et al., 2001, p. 29).

The Verbal Behaviour Development Theory

The Verbal Behaviour Development Theory (VBDT) evolved from research findings reviewed by Greer and Keohane (2005), Greer and Ross (2008) and Greer and Speckman (2009). It appears that these three published articles described critical features of the VBDT despite not formally stating the phrase ‘Verbal Behaviour Development Theory.’ The phrase was used seminally in an article by Singer-Dudek, Speckman, and Nuzzolo (2010) citing Greer and Keohane (2005) as their primary source for the VBDT. Greer and Speckman (2009) referred to a ‘theory of verbal development,’ but did not clearly specify a ‘Verbal Behaviour Development Theory.’ Subsequently several experimental studies have cited the VBDT as a critical framework for their research (e.g. Du, Broto, & Greer, 2015; Greer, Pistoljevic, Cahill, & Du, 2011b; Singer-Dudek, Choi, & Lyons, 2013).

The VBDT is an empirically-based updated account of Skinner's (1957) analysis of verbal behaviour. The VBDT is based on experimental findings from research conducted with children with and without language delays (Greer & Ross, 2008). The VBDT focuses on the identification of behavioural cusps related to verbal behaviour:

A cusp is a change that (1) is often difficult, tedious, subtle, or otherwise problematic to accomplish, yet (2) if not made, means little or no further development is possible in its realm (and perhaps in several realms); but (3) once it is made, a significant set of subsequent developments suddenly become easy or otherwise highly probable which (4) brings the developing organism into contact with other cusps crucial to further, more complex, or more refined development in a thereby steadily expanding, steadily more interactive realm (Rosales-Ruiz & Baer, 1996, p. 166).

Walking is a behavioural cusp in the sense that further behaviours are enabled such as exploratory behaviour, new kinds of play and improved accessibility to the environment. Accurate and fluent speaking and reading are behavioural cusps. Both behaviours open up pathways to a number of other developments such as learning more effectively and opening up parts of the environment that were inaccessible before.

The two pyramids of behavioural cusps described in the VBDT are the pre-reader pyramid and the reader/writer pyramid. 'Full naming' is a component of the VBDT pre-reader pyramid shown in Figure 2. Both VBDT pyramids distinguish levels of behavioural cusps and suggest a developmental sequence for those cusps. The theory operates from a starting point at which individuals are tested to determine whether or not certain behavioural cusps are present. Subsequently, if a behavioural cusp is not present then specific protocols and procedures could be implemented to induce that cusp (Greer & Ross, 2008; Greer & Speckman, 2009).

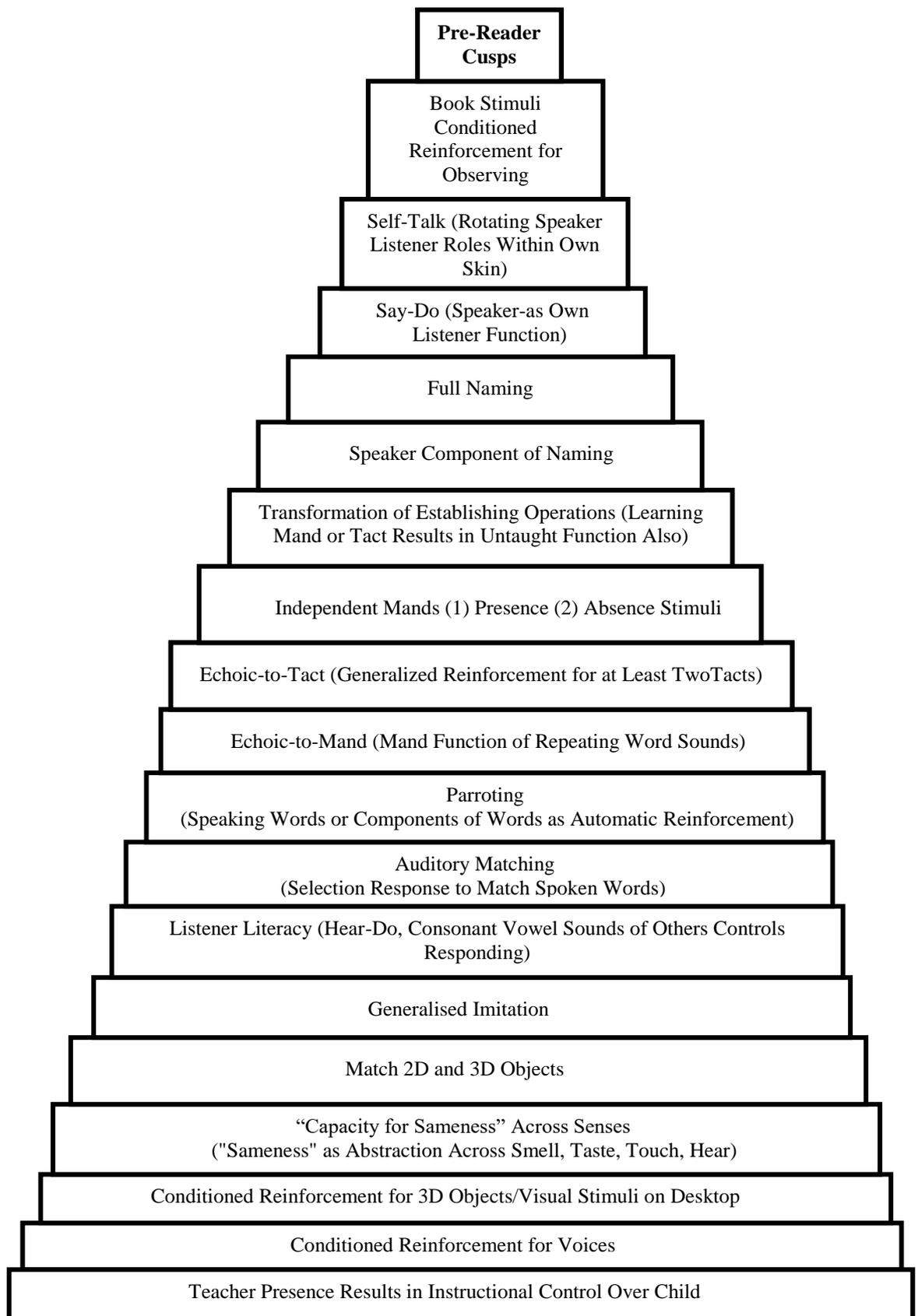


Figure 2: The VBDT pre-reader pyramid (Greer & Ross, 2008).

For example, if an individual does not attend to visual stimuli, needs frequently to be redirected to stimuli and/or multiple tactics are required to occasion a response to the stimuli, then it is determined that the cusp ‘conditioned reinforcement for three-dimensional objects/visual stimuli on the desktop’ is not present.

As a result, a specific protocol using a stimulus-stimulus pairing procedure to condition three-dimensional stimuli is implemented which is designed to induce the missing behavioural cusp. When individuals have acquired a behavioural cusp within the VBDT pyramid they are ready to access the procedures that allow them to reach the next level in terms of competence. Thus, the behavioural cusp that is newly acquired becomes the prerequisite for the next behavioural cusp on the VBDT pyramid. An overview of some of the research that provides the empirical base to the VBDT is shown in Table 3.

Each of the behavioural cusps described in the VBDT pre-reader pyramid (Figure 2) is important to advancing verbal behaviour and more complex behavioural cusps. Descriptions of each of the behavioural cusps described in the VBDT pre-reader pyramid are provided below.

Teacher presence results in instructional control over child. For individuals to learn new skills, they must respond consistently to the presence of a teacher or a person of authority. Greer and Ross (2008) described five programmes designed to establish instructional control: sitting, sitting still, providing eye contact, imitation skills and generalised imitation skills. These skills do not require listening skills. Instead, the presence of the teacher and a chair may evoke sitting or the teacher looking at the child may evoke eye contact from the child. Once an individual has demonstrated these prerequisite skills to criteria level they are described as having met the behavioural cusp of ‘teacher presence results in instructional control over child.’

Table 3

Overview of some of the behavioural cusps, protocols/procedures and research base that is included in the VBDDT Pre-Reader Pyramid

Behavioural Cusp	Protocol/Procedure for Inducing Behavioural Cusp	Research Base
Conditioned Reinforcement for Voices	Conditioning Voices	Greer, Pistoljevic, Cahill, & Du (2011b)
Conditioned Reinforcement for 3D Objects/Visual Stimuli on Desktop	Visual Tracking	Delgado, Greer, Speckman, & Goswami (2009)
“Capacity for Sameness” across senses (abstraction across smell, taste, touch, hear)	Sensory Matching	Greer, Keohane, Ackerman, O’Sullivan, Park, Longano Kracher, & Wiehe (2006).
Generalised Imitation	Mirror Protocol	Du & Greer (2014)
Listener Literacy	Listener Emersion Protocol	Greer, Chavez-Brown, Nirgudkar, Stolfi, & Rivera-Valdes (2005a)
Auditory Matching	Auditory Matching Protocol	Chavez-Brown (2005) Choi, Greer, & Keohane (2015)
Echoic-to-Mand	Rapid Motor Imitation	Ross & Greer (2003)
Transformation of Establishing Operations (learning mand or tact results in untaught function also)	Multiple Exemplar Instruction	Nuzzolo-Gomez & Greer (2004)
Full Naming	Multiple Exemplar Instruction	Greer, Stolfi, & Pistoljevic (2007)

Conditioned reinforcement for voices. Greer and Ross (2008) stated that neuro-typical children will rapidly orient to both familiar and unfamiliar voices, demonstrating that adult voices are conditioned reinforcers for observing. Conditioned reinforcement for voices is a foundation skill for listening. Children are tested to determine whether they will choose to listen to recordings of adult voices. A conditioning voices protocol is implemented if the behavioural cusp is absent which involves pairing a conditioned reinforcer with the adult voice until the child chooses to

listen to the recording of the adult voice without the presence of the conditioned reinforcer (Greer et al., 2011b).

Conditioned reinforcement for three-dimensional objects/visual stimuli on desktop. This behavioural cusp is measured by observing whether children move their eyes to follow the movement of three-dimensional objects/visual stimuli on the desktop. If the cusp is not present then a visual tracking protocol is implemented (Delgado et al., 2009) to induce conditioned reinforcement for three-dimensional objects. This protocol involves pairing a conditioned reinforcer with the tracking of an item on the desktop.

“Capacity for sameness” across senses. Engelmann and Carnine (1982) stated that the capacity for sameness is a prerequisite for stimulus discrimination. Greer and Ross (2008) suggested teaching the capacity for sameness across visual, auditory, gustatory, olfactory and tactile stimuli by using a match-to-sample procedure. To illustrate, to test for gustatory sameness, two visually-identical stimuli are presented (for example, a bottle of water and a bottle of flavoured water). The child is provided with the opportunity to taste both samples of water. Another matching stimulus (for example, a third bottle of water) is presented along with the vocal antecedent, “Match.” The child tastes this sample of water and matches it with one of the stimuli presented. Reinforcement is provided for correctly matching the bottles of water. Trials are randomly rotated across the senses so a gustatory matching trial may be followed by an auditory matching trial and then an olfactory matching trial (Greer et al., 2006).

Match two-dimensional and three-dimensional objects. Testing for this behavioural cusp consists of matching two-dimensional pictures to identical three-dimensional objects by using a match-to-sample procedure. To illustrate, objects are presented (one being a spoon) and a picture of a spoon is also presented along with the vocal antecedent, “Match.” Reinforcement is provided for correctly matching the picture of the spoon with the three-dimensional spoon.

Generalised imitation. For individuals to have a reliable generalised imitation behavioural cusp they must do what a teacher (or model) does, even if imitation of a particular action has not been taught. Greer and Ross (2008) stated that the presence of generalised imitation indicates that children have a see-do behavioural cusp as a response class. Greer and Ross (2008) suggested that this see-do cusp is a key stage in the acquisition of observational learning because individuals are beginning to learn by watching others. If the cusp is not present then a mirror protocol (Du & Greer, 2014) is implemented to induce generalised imitation.

Listener literacy. This behavioural cusp refers to responding fluently and discriminatively to the auditory properties of speech. An individual demonstrates listener literacy when directions are followed without the use of additional cues or prompts. Discriminative responding demonstrates that the listener's responses are controlled by speaker responses (Greer & Ross, 2008). If listener literacy is not present then the listener immersion protocol (Greer et al., 2005a) is implemented to induce this behavioural cusp.

Auditory matching. For individuals to demonstrate a reliable auditory matching behavioural cusp they must consistently discriminate between auditory sounds. This is tested using a match-to-sample procedure where two visually-identical sound-producing apparatus are presented. The child is provided with the opportunity to listen to the two different sounds. Another sound-producing apparatus is presented and the child listens to the sound from this stimulus along with the vocal antecedent from the teacher, "Match." Reinforcement is provided for correctly matching the auditory sounds. Greer and Ross (2008) described auditory matching as a probable prerequisite skill to listener and speaker behaviour, particularly parroting or echoic responses, since speakers must match the components of what is heard to what they say. If auditory matching is not

present an auditory matching protocol (Choi, Greer, & Keohane, 2015) is implemented to induce this behavioural cusp.

Parroting. Parroting (a term used by Skinner, 1957) is described as a point-to-point vocal response in which individuals emit a vocal sound or word under the control of automatic reinforcement. For example, a child says “car” in response to a parent saying “car” and the correspondence of the sounds emitted by the parent and the child serves to reinforce this behaviour.

Echoic-to-mand (mand function of repeating word sounds). As stated in Chapter 2, a mand is defined as “a verbal operant in which the response is reinforced by a characteristic consequence and is therefore under the control of relevant conditions of deprivation or aversive stimulation” (Skinner, 1957, pp.35-36). A mand is reinforced by receiving the item specified by a listener. For example, an individual who is thirsty (the condition of deprivation) will mand for a drink by saying “drink,” signing “drink” or pointing to a picture of a drink. A listener will then provide the speaker with a drink. The language model (the echoic) is provided by a speaker to introduce the mand. The echoic model evokes production of the corresponding word. The echoic model is then faded and the individual produces the correct mand independently. Thus, antecedent control is shifted from verbal to non-verbal. If an individual does not have an echoic-to-mand repertoire then the rapid motor imitation protocol (Greer & Ross, 2003) is implemented to induce this behavioural cusp.

Echoic-to-tact (generalised reinforcement for at least two tacts). As stated in Chapter 2, a tact is defined by Skinner (1957) as “a verbal operant in which a response of a given form is evoked (or at least strengthened) by a particular object or event or the property of an object or event” (pp. 81-82). The tact is reinforced “with many different reinforcers or with a generalised reinforcer” (p. 83). For example, a tact occurs if an individual says “it’s raining” in the presence of rain and a listener responds with a nod,

"yes" or "I hope it clears up soon." The language model (the echoic) is provided by a speaker to introduce the tact. The echoic model evokes production of the corresponding word. The echoic model is faded until the correct tact occurs independently. Again, antecedent control is shifted from verbal to non-verbal. This tact acquisition cusp is considered present when the individual produces at least two new tacts reliably under generalised reinforcement conditions.

Independent mands: (1) presence of stimuli, (2) absence of stimuli. In order for individuals to have a reliable independent mand behavioural cusp they must mand consistently without prompting (e.g. echoic vocal prompt, picture prompt or text prompt) and under conditions where the target stimuli are either present or absent.

Transformation of establishing operations across mands and tacts. The behavioural cusp 'transformation of establishing operations across mands and tacts' involves learning a new mand and using that same word as a tact (or vice versa) without further direct teaching. This is the first identified behavioural cusp in the VBBDT pre-reader pyramid related to emergent verbal behaviour. If transformation of establishing operations across mands and tacts is not present then Multiple Exemplar Instruction (MEI) is implemented to induce this behavioural cusp (Nuzzolo-Gomez & Greer, 2004).

Speaker component of naming. For individuals to demonstrate the speaker component of naming, the production of novel names of items emerges without direct teaching of those novel names. To illustrate, following an incidental experience where the name of a novel item is provided, but without direct teaching, the tact for the novel item is produced without further instruction.

Full naming. For individuals to demonstrate 'full naming,' the selection and production of novel names of items occurs without direct teaching of those novel names. To illustrate, following an incidental experience where the name of a novel item is provided, but without direct teaching, the novel name can be selected from a choice

of items and the tact for the novel name is produced without further instruction; the novel name emerges as listener behaviour and speaker behaviour. This description relates to the previous example referencing a blue bunting (see page 47). If ‘full naming’ is not present then Multiple Exemplar Instruction (MEI) is implemented to induce this behavioural cusp (Greer et al., 2007).

Say-do. This behavioural cusp is the relation between the verbal and non-verbal behaviour of an individual (Greer & Ross, 2008). An individual who follows the directions of another or oneself has say-do correspondence. This individual emits an instance of verbal behaviour that indicates the individual’s future behaviour (say) and then they perform the behaviour (do).

Self-talk. This behavioural cusp is described by Greer and Ross (2008) as an important ‘developmental milestone’ in which individuals behave as both speaker and listener (for example, through playing with toys). This cusp is present if a speaker first speaks, then listens, and then responds as a speaker to oneself.

Book stimuli conditioned reinforcement for observing. This behavioural cusp is an early reader cusp and is the link between the VBDT pre-reader pyramid and the VBDT reader/writer pyramid. It is present if an individual reliably selects to look at books when books are available alongside other items of interest.

Specific to this body of work, the VBDT pre-reader pyramid includes two behavioural cusps related to naming: the ‘speaker component of naming’ and ‘full naming.’ These cusps are identified as the 14th and 15th steps within the VBDT pre-reader pyramid (see Figure 2) with 13 behavioural cusps prerequisite to the presence or the induction of ‘full naming.’ The VBDT, therefore, describes the developmental sequence by which initially independent listener and speaker behaviour fuses and, as stated earlier, allows an individual to become truly verbal.

In summary, naming is represented on the VBDT pre-reader pyramid, but only in relation to Component 2 or Feature 2 of naming (see Table 2). Component 1 or Feature 1 of naming was not represented on this VBDT pre-reader pyramid. This point is addressed again later in this chapter as part of an analysis of the different components of naming. First, the importance of naming is explained. As naming is near the top of the VBDT pre-reader pyramid, it is potentially an integral part of the development of sophisticated verbal behaviour.

Importance of Naming

As stated earlier in this chapter, naming comprises several components (see Table 2). Component 1 involves the emergence of speaker behaviour following listener teaching and the emergence of listener behaviour following speaker teaching (bidirectional naming). Component 2 involves the emergence of both untaught listener and untaught speaker behaviour without direct teaching (incidental naming).

It appears that for neuro-typical individuals, naming emerges in response to the cumulative effects of an individual's acquisition of language and contact with language used across numerous environmental experiences, without the need for additional tactics or intervention (Greer & Ross, 2008; Horne & Lowe, 1996). In fact, researchers have argued that naming accounts for most incidental language acquisition (Greer & Longano, 2010). However, this phenomenon may not be the case for individuals with limited verbal behaviour, such as those diagnosed with autism or related disorders (Greer & Ross, 2008). The research summarised in Chapter 3 clarified that most individuals demonstrate untaught listener behaviour following the teaching of the corresponding speaker behaviour, but not necessarily the converse relation. There are, however, individuals within the reported research who did not demonstrate any emergent verbal behaviour and thus support the notion that speaking and listening may be independent of one another for certain individuals. This contradiction in the research

findings (the disparity in the participant outcomes) may be explained upon further inspection of the participants' behavioural cusps. For example, it may be that those individuals who did not demonstrate the emergence of untaught verbal behaviour were also missing relevant prerequisite behavioural cusps, such as fluent speaker behaviour. It is important to induce these missing prerequisite behavioural cusps and to ultimately induce naming. It is important to identify whether naming is present in order to provide effective programming, or absent in order to implement interventions to induce it.

In regards to this work, an individual without naming would require the deliberate teaching of speaker and listener behaviour across an exponential number of target stimuli. For example, when teaching colours to a child without naming, a teacher implements a 'point to colours' programme to teach listener behaviour and a 'tacts colours' programme to teach speaker behaviour. However, once a child has acquired naming, a more efficient type of teaching can take place. At this point, listener and speaker behaviours need not be taught independently; rather, one can be directly taught (e.g. speaker) and the other (listener) emerges without further teaching. With this initial component of naming established it may only be necessary to teach a 'point to colours' programme or a 'tact colours' programme, not both. Specifically, once 'full naming' is established, following an incidental language experience (hearing someone say 'fuchsia'), the child then discriminates and tacts 'fuchsia' incidentally. Thus, all that is required to respond correctly to a novel name is an environmental experience incorporating both language models about colours and the actual colours. This instructional arrangement is most efficient because neither a 'point to colours' nor a 'tact colours' programme is necessary. Thus, the identification of components which serve to make up the larger phenomenon of naming is important.

An Analysis of the Different Components of Naming

Upon an examination of the current published literature on naming, it appears that there are two applied research tracks on the study of naming. One research track is related to the bidirectional relationship that occurs when listener behaviour is taught to an individual and speaker behaviour emerges for that same individual, and/or vice versa (e.g. Delfs et al., 2014; Horne et al., 2004; Horne et al., 2006; Lowe et al., 2002; Lowe et al., 2006; Miguel & Kobari-Wright, 2013; Sprinkle & Miguel, 2012). This is referred to as bidirectional naming. The other research track is related to the emergence of new listener and speaker behaviour following an incidental language experience without direct teaching. This is referred to as incidental naming (e.g. Gilic & Greer, 2011; Greer et al., 2005b, 2007, 2011a). See Figure 3 for an introductory schematic representation of these two research tracks.

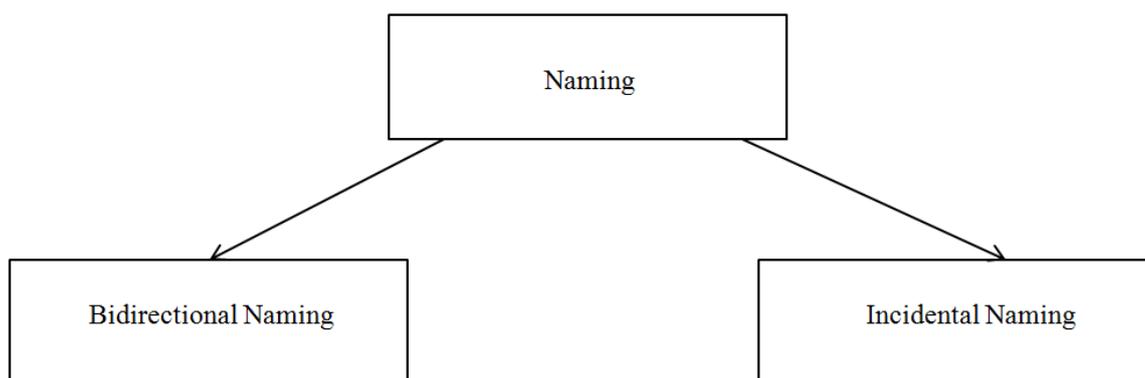


Figure 3: A schematic representation of the two research tracks on naming.

Table 4 illustrates these two research tracks, linking them to the conceptual researchers shown in Table 2.

Table 4

The different components of naming and corresponding conceptual and experimental researchers

Components	Descriptions	Conceptual Researchers	Experimental Researchers
Component 1 Feature 1	Bidirectional naming – emergence of untaught speaker/listener behaviour	Horne & Lowe (1996) Catania (1998)	Delfs et al. (2014) Horne et al. (2004) Horne et al. (2006) Lowe et al. (2002) Lowe et al (2006) Miguel & Kobari-Wright (2013) Sprinkle & Miguel (2012)
Component 2 Feature 2 Full naming	Incidental naming - acquiring new names without direct teaching	Horne & Lowe (1996) Catania (1998) Greer & Ross (2008)	Gilic & Greer (2011) Greer et al. (2005b) Greer et al. (2007) Greer et al. (2011a)

Closer inspection of the studies described thus far suggests further dissection of naming within these two identifiable research tracks. Separate and unique distinctions can be established as the research is further analysed. This additional analysis has provided a case for the identification of possibly six components of the phenomena referred to by researchers as naming.

Distinctions within the bidirectional naming research track. Individual participants in the study by Lowe et al. (2002) pointed to items following direct teaching of speaker behaviour (the emergence of untaught listener behaviour), whereas individual participants in the study by Horne et al. (2006) pointed to items following direct teaching of listener behaviour (the emergence of untaught speaker behaviour). While both studies measured the emergence of untaught behaviour, the function of the behaviour was different (listener or speaker). Each of these studies used different dependent variables, thus the outcomes were different. To clarify, either untaught listener behaviour emerged following speaker training (Lowe et al., 2002) or untaught speaker behaviour emerged following listener training (Horne et al., 2006).

Interestingly, despite these differences, both studies stated that naming was demonstrated if the untaught behaviour emerged. A consideration within the analyses of these experiments is whether this distinction is appreciable enough to refer to them as different sub-components of the larger component referred to as bidirectional naming. The teaching of speaker behaviour to an individual and the emergence of corresponding untaught listener behaviour (e.g. Lowe et al., 2002) may be categorised as Listener Bidirectional Naming. The teaching of listener behaviour to an individual and the emergence of corresponding untaught speaker behaviour (e.g. Horne et al., 2006) may be categorised as Speaker Bidirectional Naming.

It should also be made clear that Listener Bidirectional Naming and Speaker Bidirectional Naming actually only represent a unidirectional component (testing only one of the untaught behaviours, listener or speaker) within the broader scope of testing for a bidirectional relationship. A true test for a bidirectional relationship includes both direct teaching of listener behaviour to an individual followed by a subsequent test for corresponding emergent speaker behaviour *and* direct teaching of speaker behaviour to that same individual followed by a subsequent test for corresponding emergent listener behaviour (e.g. Cuvo & Riva, 1980; Pérez-González, Blanco, & Carnerero, 2014). This third component of bidirectional naming may be termed Full Bidirectional Naming. Thus, an individual who demonstrates both Listener Bidirectional Naming and Speaker Bidirectional Naming shows the requirements are met for Full Bidirectional Naming. See Figure 4 for a schematic representation of the sub-components of bidirectional naming. To be clear, an individual may be described as having Listener Bidirectional Naming, Speaker Bidirectional Naming or Full Bidirectional Naming.

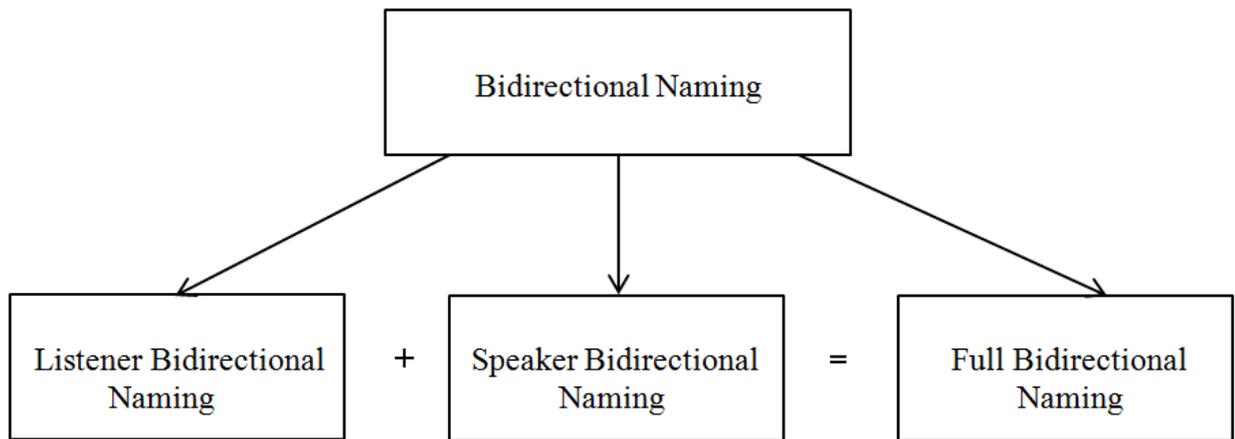


Figure 4: A schematic representation of bidirectional naming.

Distinctions within the incidental naming research track. Thus far, three components of naming have been distinguished. These three components all link to the research track on bidirectional naming described in the opening paragraph of this section. Three additional components of naming are linked to incidental naming which refers to acquiring new names without direct teaching (e.g. Gilic & Greer, 2011; Greer et al., 2005b, 2007, 2011a). These are identified by Greer and Ross (2008) as: ‘listener half of naming’, ‘speaker half of naming’ and ‘full naming.’ These three components of naming all focus on acquiring untaught listener and/or untaught speaker behaviour without any corresponding direct teaching of speaker or listener behaviour. Instead, individuals are exposed to novel names of items and tested to ascertain whether they subsequently use those novel names as a listener (e.g. pointing to the item) or as a speaker (e.g. tacting the item). Individuals who use the names as a listener, but not as a speaker are described by Greer and Ross (2008) as having the ‘listener half of naming.’ Since the use of consistent terminology is paramount when conducting scientifically-validated research, it is necessary to align these terms with the terms introduced in the section on bidirectional naming. Thus, the term Listener Incidental Naming will be used to describe individuals who point to objects following exposure to hearing the names of

those items (no direct teaching), but do not accurately tact those same items. In addition, the term Speaker Incidental Naming will be used to describe individuals who tact items following exposure to hearing the names of those items (no direct teaching), but do not accurately point to those items. The term Full Incidental Naming will be used to describe individuals who meet the criteria for both Listener Incidental Naming and Speaker Incidental Naming. These terms fully align with Greer and Ross (2008) who describe individuals with ‘full naming’ as those who meet the criteria for both the listener half and the speaker half of naming.

In summary, similar to the research track on bidirectional naming, the research track on incidental naming also appears to include three sub-components: 1) Listener Incidental Naming: individuals who demonstrate the emergence of untaught listener behaviour following exposure to the names of novel items (e.g. Greer & Ross, 2008); 2) Speaker Incidental Naming: individuals who demonstrate the emergence of untaught speaker behaviour following exposure to the names of novel items (e.g. Greer & Ross, 2008); 3) Full Incidental Naming: individuals who demonstrate the emergence of both untaught listener behaviour and untaught speaker behaviour following exposure to the names of novel items (e.g. Gilic & Greer, 2011; Greer et al., 2005b, 2007, 2011a). See Figure 5 for a schematic representation of the sub-components of incidental naming.

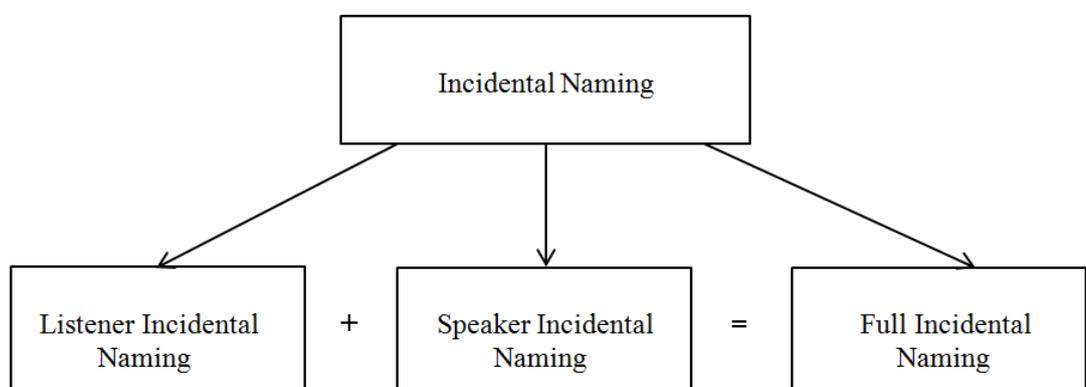


Figure 5: A schematic representation of incidental naming.

Additional variations in terminology within research tracks on naming.

Pérez-González et al. (2014) also identified different types of naming in their research. The bidirectional component of naming was described, but the terminology differed: the authors labelled this component of naming as ‘tact-selection’ naming. Pérez-González et al. (2014) reported a ‘tact-selection’ procedure for testing for ‘tact-selection’ naming which involved directly teaching listener behaviour and testing for untaught speaker behaviour, and vice versa with the same participants. The procedure is identical to the test for Full Bidirectional Naming where the emergence of both untaught listener behaviour and untaught speaker behaviour are tested for with the same participants. This can be distinguished from the unidirectional components of naming where either untaught listener or speaker behaviour are tested for following corresponding speaker or listener training (Listener Bidirectional Naming and Speaker Bidirectional Naming).

Pérez-González et al. (2014) also use the term ‘full naming’ in their work, citing Greer and Ross (2008), but re-name it ‘pair-test’ naming to distinguish it from ‘tact-selection’ naming described above (a bidirectional test for the emergence of untaught listener behaviour following speaker training and untaught speaker behaviour following listener training). Pérez-González et al. (2014) used a ‘pairing’ procedure to test for ‘pair-test’ naming. Their ‘pairing’ procedure involved presenting an individual with a number of pictures while saying the names of the pictures one at a time without requiring any response from the individual other than attending. The individual was subsequently tested for untaught listener and speaker behaviour (using the same stimuli exposed to in the ‘pairing’ procedure). This description of ‘pair-test’ naming closely aligns with ‘full naming’ (Greer & Ross, 2008) in the sense that no direct teaching was involved, but the names of the items were acquired by hearing the names of the items while attending to them. ‘Pair-test’ naming can therefore also be termed Full Incidental

Naming as both untaught listener and untaught speaker behaviour are tested for following an incidental language experience.

All the research on naming discussed thus far is important, but there are different measurements in place. This disparity within the research track on bidirectional naming and incidental naming establishes a rationale for distinguishing different components of naming.

A synthesis of bidirectional and incidental naming. In summary, the research track on bidirectional naming appears to include three sub-components: 1) Listener Bidirectional Naming: the emergence of untaught listener behaviour following speaker training (e.g. Lowe et al., 2002); 2) Speaker Bidirectional Naming: the emergence of untaught speaker behaviour following listener training (e.g. Horne et al., 2006); 3) Full Bidirectional Naming: the emergence of both untaught listener behaviour and untaught speaker behaviour for the same individual following corresponding speaker and listener training (e.g. Cuvo & Riva, 1980; Pérez-González et al., 2014). The first two sub-components focus on a unidirectional component, whereas the third sub-component demonstrates a bidirectional relationship.

The research track on incidental naming appears to also include three sub-components: 1) Listener Incidental Naming: the emergence of untaught listener behaviour (but not untaught speaker behaviour) following exposure to the names of the items, but without direct teaching (Greer & Ross, 2008); 2) Speaker Incidental Naming: the emergence of untaught speaker behaviour (but not listener behaviour) following exposure to the names of the items, but without direct teaching (Greer & Ross, 2008); 3) Full Incidental Naming: the emergence of both untaught listener behaviour and untaught speaker behaviour for the same individual following exposure to the names of the items, but without direct teaching (e.g. Gilic & Greer, 2011; Greer et al., 2005b, 2007, 2011a;

Pérez-González et al., 2014). See Figure 6 for a schematic representation of the complete account of naming.

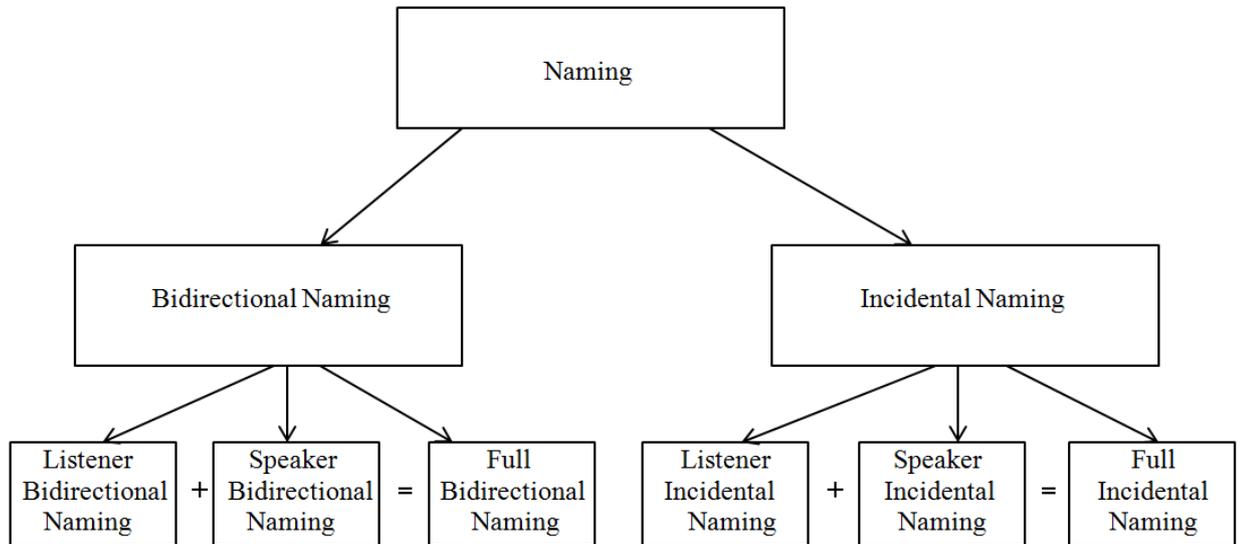


Figure 6: A schematic representation of the complete account of naming.

Figure 7 shows this same schematic representation account for naming, but also includes terminology used by other researchers, specifically Greer and Ross (2008) and Pérez-González et al. (2014), so that comparisons can be made between the new suggested terminology and the current terminology.

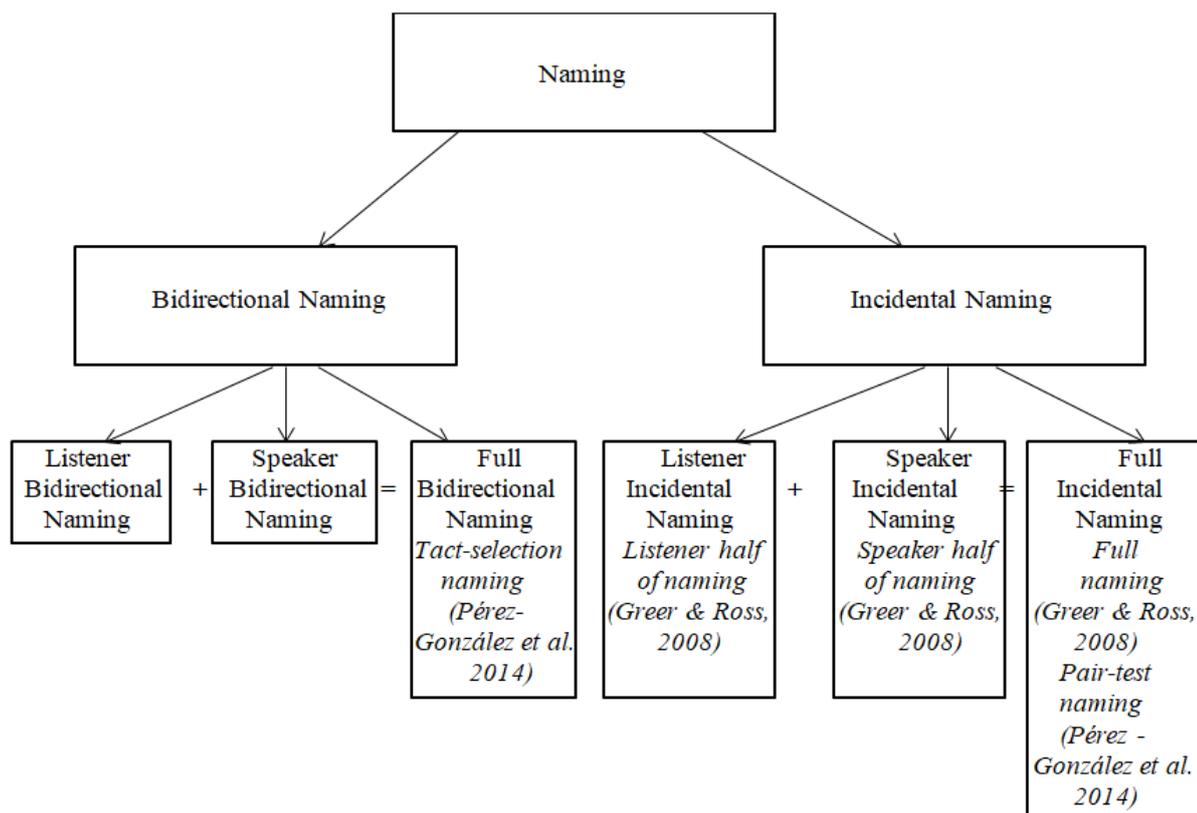


Figure 7: A schematic representation of the complete account of naming including terminology currently in use.

While this body of research on naming has implications for understanding the emergence of untaught verbal behaviour, it is to the benefit of future research to conceptually categorise and organise the prerequisite components making up the composite behaviour known as naming. Clarification of terminology can only be helpful to the furtherance of scientific knowledge of this important aspect of verbal behaviour. The foregoing consideration of research in this area suggests there are six sub-categories of naming. These are presented in Table 5.

Table 5

Six suggested sub-components of naming with corresponding descriptions, examples and relevant researchers

Component of Naming	Description	Example	Researchers
Listener Bidirectional Naming	Speaker behaviour is taught and corresponding untaught listener behaviour emerges.	Using contrived stimuli, the tact "zog" is taught (speaker behaviour) and the selection of the symbol from a choice of symbols emerges (listener behaviour).	Lowe et al. (2002) Lowe et al. (2005) Fiorile & Greer (2007)
Speaker Bidirectional Naming	Listener behaviour is taught and corresponding untaught speaker behaviour emerges.	Using contrived stimuli, the selection of a "zog" from a choice of symbols is taught (listener behaviour) and the tact "zog" emerges (speaker behaviour).	Horne et al. (2006)
Full Bidirectional Naming	Both Listener Bidirectional Naming and Speaker Bidirectional Naming. Speaker behaviour is taught and corresponding untaught listener behaviour emerges and listener behaviour is taught and corresponding untaught speaker behaviour emerges.	Both Listener Bidirectional Naming and Speaker Bidirectional Naming. Using contrived stimuli, the tact "zog" is taught (speaker behaviour) and the selection of the symbol from a choice of symbols emerges (listener behaviour) <i>and</i> using contrived stimuli, the selection of a "vek" from a choice of symbols is taught (listener behaviour) and the tact "vek" emerges (speaker behaviour).	Cuvo & Riva (1980) Delfs et al. (2014) Gilic & Greer (2011) Pérez-González et al. (2014)
Listener Incidental Naming	Following an incidental experience where the name of a novel item is provided, but no direct teaching or direct reinforcement, the novel name can be selected from a choice of items without any further teaching; the novel name emerges as listener behaviour.	Using contrived stimuli, a match-to sample procedure (e.g. "match zog") is presented and listener behaviour emerges without further teaching e.g. a "zog" is selected from a choice of symbols having only heard the name "zog" in the match-to-sample procedure.	Greer & Ross (2008)

Speaker Incidental Naming	Following an incidental experience where the name of a novel item is provided, but no direct teaching or direct reinforcement, the tact for the novel name is produced without any further teaching; the novel name emerges as speaker behaviour.	Using contrived stimuli, a match-to sample procedure (e.g. “match zog”) is presented and speaker behaviour emerges without further instruction e.g. the tact “zog” emerges having only heard the name “zog” in the match-to-sample procedure.	Greer & Ross (2008)
Full Incidental Naming	Both Listener Incidental Naming and Speaker Incidental Naming. Following an incidental experience where the name of a novel item is provided, but no direct teaching or direct reinforcement, the novel name can be selected from a choice of items and the tact for the novel name is produced without any further teaching; the novel name emerges as listener behaviour and speaker behaviour.	Both Listener incidental Naming and Speaker Incidental Naming. Using contrived stimuli, a match-to sample procedure (e.g. “match zog”) is presented and listener and speaker behaviour emerges without further teaching e.g. a “zog” is selected from a choice of symbols and the tact “zog” emerges having only heard the name “zog” in the match-to-sample procedure.	Gilic & Greer (2011) Greer & Ross (2008) Pérez-González et al. (2014)

Similar to the importance of acquiring Full Bidirectional Naming and Full Incidental Naming as behavioural cusps, it is equally important to identify the specific component(s) of naming an individual demonstrates because this may change how the individual acquires new skills. For example, if an individual shows evidence of Listener Bidirectional Naming then listener behaviour will emerge when instructional antecedents are presented in speaker format, e.g. tacts. Conversely if an individual demonstrates Speaker Bidirectional Naming then speaker behaviour will emerge when instructional antecedents are presented in listener format, e.g. ‘point to’ programmes.

Thus, *teaching* using one type of antecedent presentation (listener or speaker format) results in the acquisition of two forms of behaviour (listener and speaker).

Furthermore, if an individual shows evidence of Listener Incidental Naming then the individual only needs to be *exposed* to the names of items for listener behaviour to emerge. Thus, curricular components might be presented more naturally where the teacher talks about the names of new items, but does not necessarily provide direct teaching about these items. From this incidental language experience the individual demonstrating only Listener Incidental Naming will acquire the names of these new items as a listener, i.e. point to them, but will still require direct teaching to acquire them as a speaker, i.e. a tacts programme is necessary. Conversely if an individual demonstrates Speaker Incidental Naming then the individual only needs to be exposed to the names of items for speaker behaviour to emerge. From the incidental language experience the individual demonstrating only Speaker Incidental Naming will acquire the names of new items as a speaker, i.e. tact them, but will still require direct teaching to acquire them as a listener. To clarify, if the component(s) of naming are clearly identified for an individual then curricula are designed more effectively and efficiently.

Summary

This chapter provided an account of how researchers have addressed naming in the applied literature as well as a detailed synthesis of the terminology used within their research. This analysis has provided the necessary elements to unify the research findings so that professionals may effectively identify key components of naming. The identification of these key components aids in determining when an individual may learn in a new and different way, subsequently laying the foundation for more efficient and individualised curricular design.

A full analysis of the published research has provided a case for the isolation of possibly six distinct components of naming (Listener Bidirectional Naming, Speaker

Bidirectional Naming, Full Bidirectional Naming, Listener Incidental Naming, Speaker Incidental Naming and Full Incidental Naming) within two clearly defined research tracks on naming (bidirectional naming and incidental naming). It has also been shown that naming, and inducing naming, is an integral component of the VBDT and its emphasis on a developmental scheme of behavioural cusps (VBDT pre-reader pyramid).

Upon further review of the current published research on naming, it appears the research is also divided between those researchers demonstrating the *presence or absence* of naming (e.g. Delfs et al., 2014; Horne et al., 2004; Horne et al., 2006; Lowe et al., 2002; Lowe et al., 2006; Miguel & Kobari-Wright, 2013; Sprinkle & Miguel, 2012) and those researchers focusing on the use of an intervention, such as Multiple Exemplar Instruction (MEI), to *induce* naming as a behavioural cusp (e.g. Fiorile & Greer, 2007; Gilic & Greer, 2011; Greer et al., 2005b, 2007, 2011a). The MEI procedure for inducing naming will be described along with research demonstrating its effectiveness in Chapter 5.

Chapter 5

Testing for Naming and Procedures for Inducing Naming

Chapter 2 described Multiple Exemplar Training/Instruction (MET/MEI) as a teaching strategy that may lead to the generalisation of skills. Generalisation occurs when, for example, a child is taught to tact multiple pictures of dogs and they subsequently tact a different dog as “dog.” The child correctly responds to the concept or stimulus class of “dog.” MET/MEI was also described as a procedure for integrating previously independent classes of behaviour. For example, mands and tacts are initially independent classes of behaviour (Lamarre & Holland, 1985). MEI was shown to be successful in integrating these two classes of behaviour so if a child is taught to emit “juice” as a mand subsequently “juice” may be emitted as a tact without further direct teaching (Nuzzolo-Gomez & Greer, 2004). Chapter 4 described naming as the fusion of initially independent classes of listener and speaker behaviour. The research summarised in Chapter 3 showed that for most individuals if speaker behaviour is taught then listener behaviour emerged without further direct teaching. Conversely, if listener behaviour is taught then speaker behaviour does not emerge.

Across the corpus of research on emergent verbal behaviour (e.g. untaught listener behaviour or untaught speaker behaviour), there are inconsistencies in the findings. Therefore, when designing instructional programmes for children diagnosed with autism it is recommended that all children are tested for the presence or absence of emergent verbal behaviour. If emergent verbal behaviour is not present, or is only partially present, then procedures should be implemented to induce this fusion of listener and speaker behaviour. Chapter 4 clarified that there are different components of naming and it is important to identify and isolate those components. Full Bidirectional Naming and Full Incidental Naming provide an explanation for how emergent verbal behaviours are acquired beyond a traditional teaching paradigm. While

it appears that most neuro-typical individuals acquire the different components of naming incidentally (developmentally and through cumulative language experiences), other individuals, especially those diagnosed with substantial language deficits and learning disabilities, need intensive intervention for naming to be induced. Some researchers have used MET to induce naming (e.g. Rosales, Rehfeldt, & Lovett, 2011) and some have used MEI to induce naming (e.g. Fiorile & Greer, 2007; Gilic & Greer, 2011; Greer, Corwin, & Buttigieg, 2011a; Greer, Stolfi, Chavez-Brown, & Rivera-Valdes, 2005b; Greer, Stolfi, & Pistoljevic, 2007). As stated in Chapter 2, the defining variation between MET and MEI includes the random rotation of the multiple exemplars across behaviours (e.g. match-to-sample, selection responses and production responses).

There are six parts to this chapter. First, the procedures for testing for different components of naming are described. Second, a description of the MEI procedure for inducing naming is provided. Next, the research demonstrating the use of MEI to induce naming is summarised. This section is followed by descriptions of alternate procedures that can be utilised to induce naming and the research supporting these. Next, an alignment of the research on naming according to the six suggested components of naming is given. Finally, a summary of this chapter is provided.

Testing for the Presence of Naming

Before procedures are implemented with the aim to induce naming, it is important to establish whether naming is present. As suggested in Chapter 4 there are potentially different components of naming and it may be prudent to test for each component separately. One possible component of naming, the presence of untaught listener behaviour following speaker training, was outlined by the research described in Chapter 3 (e.g. Lowe, Horne, Harris, & Randle, 2002; Lowe, Horne & Hughes, 2005; Miguel & Kobari-Wright, 2013) and more specifically defined as Listener Bidirectional

Naming in Chapter 4. It is important to note that the researchers used a robust test to gauge for Listener Bidirectional Naming. This test entailed teaching the participants to tact novel contrived or non-contrived stimuli (speaker training). For example, two symbols were used with contrived names, "zog" and "vek." Participants were taught to tact the two items. Once the participants met the criterion for tacting the contrived names then a test measuring the corresponding untaught listener behaviour was conducted. To clarify, once the participant was taught to tact the contrived names of the stimuli ("zog" and "vek") a test was conducted to determine whether the participants discriminated between the two stimuli when directed to "point to zog/vek." If successful then Listener Bidirectional Naming was considered to be present; if unsuccessful then Listener Bidirectional Naming was absent.

Conversely, some researchers have tested for Speaker Bidirectional Naming by testing for untaught speaker behaviour following listener training (e.g. Horne, Lowe, & Randle, 2004; Sprinkle & Miguel, 2012). Participants in these studies were taught to point to novel contrived or non-contrived stimuli (listener training). Using similar stimuli to the previous example, the participants were taught to discriminate (by pointing) between the two items until mastery criterion was achieved. Subsequently, a test for untaught speaker behaviour was conducted to determine whether the participant tacted "zog" or "vek" when presented with a picture of the contrived stimuli. If the mastery criterion was met for tacting the contrived stimuli this suggested that Speaker Bidirectional Naming was present.

It was stated in Chapter 4 that the mastery criteria for Full Bidirectional Naming are met if an individual meets the criteria for both Listener Bidirectional Naming and Speaker Bidirectional Naming. Individuals may have Listener Bidirectional Naming, Speaker Bidirectional Naming or Full Bidirectional Naming as shown in the diagram in Figure 3 in Chapter 4 (see page 63).

While the previously cited studies tested for the presence of bidirectional naming, most research aimed to induce naming has focused on testing for Full Incidental Naming (Gilic & Greer, 2011; Greer et al., 2005b, 2007, 2011a). Participants in these studies were tested to determine if names of novel stimuli were acquired without any direct teaching of tacting or pointing to these novel stimuli. The test initially entailed a match-to-sample procedure conducted with novel stimuli. This consisted of the following teaching sequence: an array of contrived stimuli was presented which included an exemplar of “zog” and a non-exemplar of “zog;” a corresponding visual stimulus of “zog” was given to the participant with the vocal antecedent, “Match zog,” and reinforcement was provided for correctly matching “zog.” If an incorrect response occurred the vocal antecedent was repeated and a model showing the correct matching symbol was provided. It was important that the instructor did not just say “match,” but provided a vocal model of the word “zog” in the antecedent.

The purpose of this type of match-to-sample procedure was to provide a novel language experience in which direct reinforcement or correction was linked to the visual matching rather than the listener or speaker behaviour. The participants heard the name of the novel item while seeing it and matching it and this pairing of seeing and matching was an essential element of this procedure. The participants in these studies already had well established match-to-sample repertoires. Thus, the matching phase of this procedure was not intended to teach the child how to match, but to provide an emphasised language experience. Seeing a novel item and hearing the corresponding tact for that item provided this novel language experience. Greer and Ross (2008) argued that this procedure simulated the natural environment that exists when new vocabulary was acquired incidentally (i.e. hearing and seeing the novel item simultaneously).

After the matching phase was completed, a test for Full Incidental Naming occurred (untaught listener and untaught speaker behaviour). Untaught listener behaviour was tested first consisting of instruction to, “Point to___,” using the same items that were used in the matching session. Once the test for untaught listener behaviour was completed, the corresponding untaught speaker behaviour was tested. According to the previously published research referred to in this section, experimental criteria of 80% accuracy of untaught responses for determining the presence of Full Incidental Naming has been generally used by researchers in these studies. If the participant scored 80% correct responses across untaught listener and speaker behaviour then Full Incidental Naming was demonstrated. If 80% accuracy was scored across untaught listener behaviour, but not untaught speaker behaviour then Listener Incidental Naming was shown. Conversely, if 80% accuracy was scored across untaught speaker behaviour, but not untaught listener behaviour then Speaker Incidental Naming was demonstrated. If this accuracy level was not achieved, an MEI procedure was used to induce Full Incidental Naming and this procedure is described in the next section.

MEI Procedure for Inducing Naming

Greer and Ross (2008) described MEI to induce naming as a procedure that provided multiple opportunities to respond across listener and speaker behaviours in a randomly rotated fashion. They stated that the function of this procedure was to arrange the environment to mimic experiences of neuro-typical children in an intensive fashion, i.e. to provide multiple exposures to instructional or teaching interactions across different forms of behaviours. The MEI procedure consisted of match-to-sample instruction randomly rotated with listener instruction (pointing to items following the vocal antecedent to find that item) and speaker instruction (impure and pure tact instruction with and without a vocal antecedent respectively) in a counterbalanced

format so that the response from one presentation did not occasion the response to another presentation.

It is critical that the stimuli used in the MEI procedure were separate and unique from the stimuli used in the initial test for Full Incidental Naming as described in the previous section. A set of stimuli containing 3-5 items (referred to as Set 1) was used for the initial test for Full Incidental Naming. A different set of stimuli also containing 3-5 items (referred to as Set 2) was used for the MEI procedure. The Set 1 stimuli were used again to re-test for the presence or absence of Full Incidental Naming once the mastery criteria for the MEI procedure was met. The full procedure is shown in Figure 8.

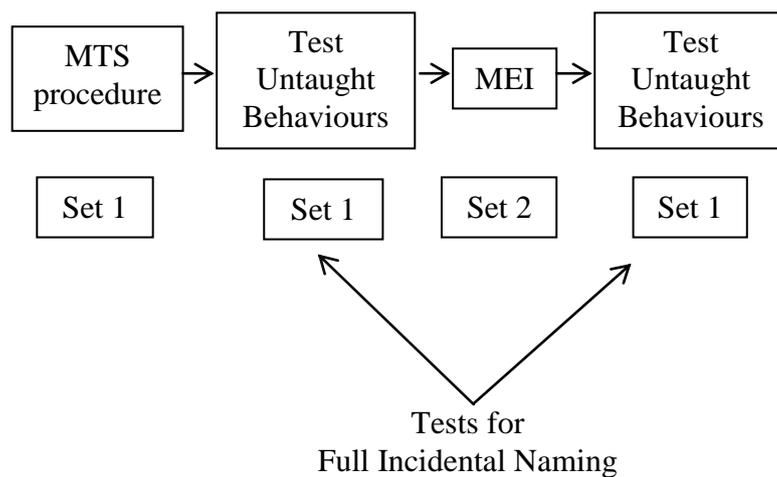


Figure 8: A diagram of the procedure for inducing Full Incidental Naming.

To illustrate an appropriate MEI sequence, instruction is presented in the order shown in Table 6 (target stimuli are flowers: tulip, daffodil, primrose, crocus and orchid).

Table 6

Example of a MEI sequence for a training set

Teaching Sequence	First Presentation	Second Presentation	Third Presentation	Fourth Presentation
1	Match <i>tulip</i>	Point to <i>daffodil</i>	Match <i>primrose</i>	Impure tact <i>orchid</i>
2	Tact <i>crocus</i>	Impure tact <i>tulip</i>	Point to <i>crocus</i>	Tact <i>primrose</i>
3	Match <i>daffodil</i>	Point to <i>orchid</i>	Impure tact <i>primrose</i>	Point to <i>tulip</i>
4	Tact <i>daffodil</i>	Impure tact <i>crocus</i>	Match <i>orchid</i>	Tact <i>tulip</i>
5	Point to <i>primrose</i>	Impure tact <i>daffodil</i>	Match <i>crocus</i>	Tact <i>orchid</i>

In each of these teaching sequences, instruction occurs as follows:

Match tulip. Pictures of flowers are presented (one being a tulip). Another picture of a tulip is presented along with the vocal antecedent, “Match *tulip*.” As stated earlier, it is important that the word “tulip” is heard as part of the vocal antecedent; the instructor must not just say, “Match.” This is to simulate an incidental learning experience in which a child hears the name of a new item while looking at it, but is not provided with explicit instruction to teach the name of that item. Reinforcement is provided for correctly matching the picture of the tulip with the picture of the tulip and a ‘+’ is scored on the data sheet. If an incorrect response occurs the vocal antecedent is repeated and the correct response is modeled. A ‘-’ is subsequently scored on the data sheet. Mastery criterion is generally set at 18/20 correct responses to trials over two consecutive sessions.

Point to daffodil. Pictures of flowers are presented (one being a daffodil). The vocal antecedent, “Point to *daffodil*” is given and pointing to the correct picture is reinforced. A ‘+’ is subsequently scored on the data sheet. If an incorrect response occurs the vocal antecedent is repeated and the correct response is modeled. A ‘-’ is then scored on the data sheet. Learn units⁴ (Greer, 2002; Greer and McDonough, 1999) are presented during this phase of the procedure. A learn unit consists of a clear

⁴ The term ‘learn unit’ is predominantly used as a moniker for learning trials within the CABAS model, but the term has also been used by other researchers, e.g. Emurian (2007) and Heward (1994).

antecedent (e.g. “Point to *daffodil*”), a clearly defined expected behaviour and a contingent consequence (reinforcement for a correct response and a correction procedure of repeating the antecedent and modeling the required response). Learn units require that the instructor always ensures the participant is motivated to provide a correct response and is attending to the stimuli presented. Mastery criterion is generally set at 18/20 correct responses to learn units over two consecutive sessions.

Impure Tact *orchid*. On presentation of the picture of an orchid and the vocal antecedent, “What is this?” the vocal response “orchid” is required. Learn units are also presented during this phase of the procedure. A correct response is reinforced and a ‘+’ is scored on the data sheet. If an incorrect response or a non-response occurs the vocal antecedent is repeated along with a model of the correct response “orchid.” A ‘-’ is subsequently scored on the data sheet. Mastery criterion is generally set as 18/20 correct responses to learn units over two consecutive sessions.

Tact *crocus*. On presentation of the picture of a *crocus*, the vocal tact “crocus” is required. Learn units are presented during this phase of the procedure. A correct response is reinforced and a ‘+’ is scored on the data sheet. If an incorrect response or a non-response occurs the picture is presented again along with a model of the correct response “crocus.” A ‘-’ is subsequently scored on the data sheet. Mastery criterion is also set as 18/20 correct responses to learn units over two consecutive sessions.

It is important to reiterate that multiple exemplars of stimuli are used in the MEI procedure. Referring back to Chapter 2, a critical aspect of MEI and MET includes the focus on teaching using a General Case Analysis. This general case teaching is embedded within the MEI instructional procedure.

Research Demonstrating the Relationship between MEI and Naming

Using the test for Full Incidental Naming and the MEI procedure previously described, Greer et al. (2005b) aimed to test the effectiveness of MEI on the emergence

of Full Incidental Naming in three pre-school children aged 3-4 years diagnosed with language or developmental delays. Contrived and non-contrived two-dimensional stimuli were used for this study. Contrived stimuli were used to ensure that participants did not come into contact with the stimuli outside of the experimental conditions. A time-lagged multiple probe design was used to control for practice effects and instructional history. The participants were initially tested for Full Incidental Naming. They did not meet the criterion for acquiring Full Incidental Naming via the initial test, thus the MEI procedure was implemented. Once mastery criteria were achieved on the MEI procedure, the participants were tested again for Full Incidental Naming. The post-MEI test used exactly the same set of stimuli as the pre-MEI test. This procedure determined if the participant responded differently to these stimuli strictly based on the MEI experience. The stimuli from the test for Full Incidental Naming were completely different from the stimuli used in the MEI procedure in order to ensure that the MEI was not designed to teach the exact targets from the initial test. In the post-MEI test the match-to-sample procedure was not repeated and the participants were tested for the untaught behaviours (see Figure 8 on page 81).

The results showed that Participant 1 met the experimental criterion for Listener Incidental Naming post-MEI, but not the criteria for Speaker Incidental Naming. This participant scored 18/20 correct responses for untaught listener behaviour and 15/20 (pure tacts) and 10/20 (impure tacts) for untaught speaker behaviour. These scores represent gains of 10 correct responses for untaught listener behaviour, 6 correct responses for pure tacts and 3 correct responses for impure tacts. Participant 2 met the criterion for Listener Incidental Naming in the initial test for Full Incidental Naming (pre-MEI procedure). Speaker Incidental Naming was induced for this participant in the post-MEI test demonstrating that Full Incidental Naming was now present. Participant 3 also met the criterion for Listener Incidental Naming in the initial test (pre-MEI

procedure) and the criteria for Speaker Incidental Naming were not met post-MEI. The gains for Participants 2 and 3 were similar to Participant 1 in relation to the untaught speaker behaviour. Each of the three participants made substantial gains for Listener Incidental Naming or Speaker Incidental Naming on the post-MEI test in accordance with the staggered multiple probe design. They did not, however, meet the experimental criteria for Full Incidental Naming. The pre-established experimental criteria were used to determine whether Listener Incidental Naming or Speaker Incidental Naming was induced, but a functional relationship was still demonstrated between MEI and Listener Incidental Naming or Speaker Incidental Naming for these participants.

Each participant was subsequently exposed to a further test for Full Incidental Naming using a novel set of stimuli (Set 3). This test for Full Incidental Naming included the match-to-sample procedure and the tests for untaught listener and speaker behaviours. All three participants produced similar scores in this Set 3 test for Full Incidental Naming as they did with the post-MEI test for Full Incidental Naming using Set 1 stimuli.

Table 7 provides a summary of the scores for each of the tests for Full Incidental Naming in the experiment by Greer et al. (2005b). Scores are highlighted if the criterion was met. All three scores for each test need to be highlighted to demonstrate that the criteria for Full Incidental Naming were met.

Table 7

A summary of the scores for each test for Full Incidental Naming (FIN) in the experiment by Greer et al. (2005b)

Participant	Pre-MEI Test for FIN			Post-MEI Test for FIN			Follow-Up Test for FIN		
	Listener	Pure Tact	Impure Tact	Listener	Pure Tact	Impure Tact	Listener	Pure Tact	Impure Tact
1	8/20	9/20	7/20	18/20	15/20	10/20	16/20	16/20	12/20
2	20/20	9/20	10/20	20/20	16/20	17/20	20/20	17/20	16/20
3	20/20	6/20	5/20	20/20	15/20	15/20	18/20	11/20	9/20

In summary, Greer et al. (2005b) showed that participants acquired the names of novel stimuli without direct teaching of those names. Their only exposure to the names of the novel stimuli was during the initial match-to-sample procedure. As stated before, the match-to-sample procedure mimics the language experiences neuro-typical children are exposed to regularly. These language experiences parallel the ‘blue bunting’ example provided in Chapter 4 (see page 47). This example illustrated that no direct teaching was provided, but the children acquired the name ‘blue bunting’ by simply hearing someone else name the item while the item was present. Thus, in the match-to-sample procedure, the experimenter simply stated the name of the item without direct listener or speaker training.

Similarly, Fiorile and Greer (2007) demonstrated that naming was induced following MEI with four distinctions from the aforementioned study. First, their participants were younger (2 years old) and were diagnosed with autism. Second, only contrived three-dimensional stimuli were used for this experiment. Third, the dependent variable in their study was Listener Bidirectional Naming (speaker behaviour was taught and corresponding untaught listener behaviour emerged) rather than Full Incidental Naming. Fourth, additional sets of MEI were implemented if the participants did not meet the experimental criterion for Listener Bidirectional Naming post-MEI.

The four participants were taught to tact items initially and tests were subsequently conducted for untaught listener and speaker (impure tact) behaviours. The tact training alone did not result in Listener Bidirectional Naming. Table 8 provides a summary of the results and scores are highlighted if the criterion was met.

Table 8

A summary of the scores for the Test for Listener Bidirectional Naming pre- and post-MEI for each participant in the study by Fiorile and Greer (2007)

Participant	Set 1		Set 2		Set 3	
	Pre-MEI	Post-MEI	Pre-MEI	Post-MEI	Pre-MEI	Post-MEI
1	6/18	18/18	12/18	18/18	18/18	N/A
2	8/18	12/18	13/18	18/18	16/18	18/18
3	7/18	18/18	7/18	18/18	17/18	N/A
4	9/18	18/18	17/18	N/A		

It is shown in Table 8 that each test for Listener Bidirectional Naming was scored out of 18 with criterion set at 17/18 or 18/18. It is the pre-MEI scores for Set 2 and Set 3 that are important as these show that each participant demonstrated emergent listener behaviour following the direct teaching of novel speaker behaviour (Listener Bidirectional Naming). Participant 2 did not meet the criterion for Listener Bidirectional Naming pre-MEI on the third set, but substantial gains were made with an initial score of 8/18 correct responses and a final pre-MEI score of 16/18 correct responses.

The initial tests (Set 1 pre-MEI tests for Listener Bidirectional Naming) reported by Fiorile and Greer (2007) confirmed the results of previous research summarised in Chapter 3 (e.g. Eikeseth & Smith, 1992; Guess & Baer, 1973; Tu, 2006). Untaught listener behaviour did not emerge following speaker training. Fiorile and Greer (2007) extended this research by implementing MEI to induce Listener Bidirectional Naming. The MEI procedure used in their study was identical to the MEI procedure used by Greer et al. (2005b). MEI continued until each participant produced untaught listener behaviour following tact training only, therefore demonstrating that Listener Bidirectional Naming had been induced. Each participant acquired Listener Bidirectional Naming as a direct result of MEI. This induction of untaught behaviour is an important finding in the area of behaviour analytic research and warrants further analyses and explanation. While the Greer et al. (2005b) and Fiorile and Greer (2007) studies did seemingly demonstrate a functional relationship between MEI and the

inducement of different components of naming, there were some confounding/extraneous variables that were not experimentally isolated. A possible area for further investigation is to determine whether the random rotation that occurs within MEI was an important factor or whether it simply intensified the procedure (the number of learn units delivered within MEI).

Greer et al. (2007) compared the effects of MEI and Single Exemplar Instruction (SEI) to address whether the random rotation of the MEI procedure is an essential component of the intervention. They also accounted for the amount of exposure to the experimental stimuli between MEI and SEI. This eliminated the number of exposures as a confounding variable which may have been a factor in the previous two studies. They achieved this by ensuring the participants received the same amount of instruction (learn units) across MEI as they did across SEI thus also isolating the random rotation as the operative variable. In their study the participants included eight pre-schoolers aged 3-5 years. Initially, none of the participants met the criteria for Full Incidental Naming on the first test with two-dimensional stimuli. After this initial test for Full Incidental Naming was conducted, the participants were matched in pairs according to their levels of verbal behaviour and academic ability and then randomly assigned to the MEI or SEI group. During SEI, the instructional sessions consisted of 80 trials⁵ or learn units with each behaviour taught in separate 20-trial/learn unit blocks (i.e. 20 trials of matching followed by 20 learn units of listener training followed by 40 learn units of speaker training (impure tacts and pure tacts) respectively). The results showed that the participants in the MEI group acquired Full Incidental Naming post-MEI instruction. Two of the participants required a second set of MEI to meet the mastery criteria for Full Incidental Naming. The participants in the SEI group, despite receiving the same

⁵ Note that the teaching interactions involving matching were referred to as *trials*. The teaching interactions were described in this way in order to acknowledge that the matching task was already mastered because the individuals had substantial evidence of mastery of two-dimensional to two-dimensional matching. In contrast *learn units* require that new learning occurs.

number of trials/learn units as the participants in the MEI group, did not acquire Full Incidental Naming. However, once the individual participants within the SEI group received MEI instruction with a novel set of stimuli they, too, acquired Full Incidental Naming. In contrast to the original study conducted by Greer et al. (2005b), this study did not include a further test for Full Incidental Naming using a novel set of stimuli. The authors suggested that the acquisition of Full Incidental Naming for these children was attributable to the random rotation of stimuli presented within MEI.

Table 9 provides a summary of the scores for each of the tests for Full Incidental Naming for the MEI experimental group in the study by Greer et al. (2007). Scores are highlighted if the criterion was met. All three scores for each test need to be highlighted to demonstrate that the criteria for Full Incidental Naming were met.

These results provide further evidence for the implementation of MEI to induce Full Incidental Naming. These scores in Table 9 can be compared to the scores in Table 10 which show the results for the SEI control group.

Table 9

A summary of the scores for each test for Full Incidental Naming (FIN) for the MEI experimental group in the study by Greer et al. (2007)

Participant	Pre-MEI Test for FIN			Post-MEI Test for FIN			Post-2 nd MEI Test for FIN		
	Listener	Pure Tact	Impure Tact	Listener	Pure Tact	Impure Tact	Listener	Pure Tact	Impure Tact
1	15/20	0/20	1/20	12/20	7/20	8/20	20/20	18/20	18/20
2	20/20	4/20	1/20	17/20	18/20	16/20			
3	13/20	2/20	0/20	20/20	18/20	19/20			
4	6/20	1/20	0/20	15/20	8/20	13/20	18/20	16/20	13/20

Table 10

A summary of the scores for each test for Full Incidental Naming (FIN) for the SEI control group in the study by Greer et al. (2007)

Participant	Pre-SEI Test for FIN			Post-SEI Test for FIN			Post-2 nd SEI Test for FIN		
	Listener	Pure Tact	Impure Tact	Listener	Pure Tact	Impure Tact	Listener	Pure Tact	Impure Tact
1	7/20	0/20	0/20	8/20	0/20	2/20	8/20	0/20	1/20
2	7/20	0/20	0/20	11/20	1/20	0/20			
3	11/20	0/20	1/20	17/20	2/20	2/20			
4	9/20	0/20	0/20	9/20	1/20	0/20	11/20	1/20	2/20

The scores in Table 10 show that SEI did not induce Full Incidental Naming for any of the participants. Listener Incidental Naming was induced for Participant 3. MEI was subsequently implemented for this SEI control group. Table 11 shows the results for this part of the study where MEI was implemented to induce Full Incidental Naming.

Table 11

A summary of the scores for each test for Full Incidental Naming (FIN) for the SEI control group (post-MEI) in the study by Greer et al. (2007)

Participant	Pre-MEI Test for FIN			Post-MEI Test for FIN			Post-2 nd MEI Test for FIN		
	Listener	Pure Tact	Impure Tact	Listener	Pure Tact	Impure Tact	Listener	Pure Tact	Impure Tact
1	12/20	0/20	0/20	13/20	12/20	8/20	18/20	16/20	16/20
2	6/20	0/20	5/20	18/20	14/20	16/20			
3	16/20	6/20	5/20	20/20	18/20	18/20			
4	14/20	4/20	2/20	18/20	18/20	18/20			

The scores in Table 11 show that FIN was induced for this second group of participants following the implementation of one or two sets of MEI.

To further the evidence of MEI inducing naming, Gilic and Greer (2011) provided a partial replication of the study by Greer et al. (2005b). All of the participants were from upper middle class professional families and did not demonstrate Full Incidental Naming when initial tests were conducted. A multiple probe design and three-dimensional non-contrived stimuli were used. The researchers reported that Full

Incidental Naming was induced using MEI for 7 out of 8 neuro-typical 2-year-olds.

Although one participant did not meet the experimental criteria for Full Incidental Naming (80% accuracy) the individual did make gains in untaught behaviours and scored 75% accuracy in the post-MEI test for Full Incidental Naming. The scores for the individual participants in this study are displayed in Table 12 (the untaught speaker behaviour scores are combined as one score).

Table 12

A summary of the scores for each test for Full Incidental Naming in the experiment by Gilic and Greer (2011)

Participant	Pre-MEI		Post-MEI	
	Listener	Speaker	Listener	Speaker
1	1/12	0/12	12/12	10/12
2	3/12	3/12	12/12	12/12
3	2/12	1/12	10/12	10/12
4	1/12	0/12	12/12	11/12
5	3/12	0/12	11/12	10/12
6	6/12	4/12	12/12	11/12
7	2/12	0/12	11/12	12/12
8	1/12	0/12	10/12	9/12

This study did not include a further set of MEI for the participant who did not meet the experimental criteria for Full Incidental Naming. In addition, this study did not include a further test for Full Incidental Naming using a novel set of stimuli (part of the procedure in the original study by Greer et al., 2005b). While the experimental procedures used in these studies controlled for some extraneous variables, there are still some unaccounted-for variables which need to be addressed. One of these variables is related to the limitations associated with pre-intervention tests.

This limitation was addressed by Greer et al. (2011a). They furthered this line of research by attempting to also demonstrate the effectiveness of MEI to induce Full Incidental Naming. A distinguishing feature of this study was that more than one initial test for Full Incidental Naming was conducted prior to the implementation of the MEI

procedure for half of the participants. In the four studies described thus far (Fiorile & Greer, 2007; Gilic & Greer, 2011; Greer et al., 2005b, 2007) each of the researchers conducted only one initial test to determine whether Listener Bidirectional Naming or Full Incidental Naming was present. This limitation regarding the number of initial tests in the previous studies may have produced false positive or false negative results when testing for a component of naming.

Four children, aged 2-6 years, participated in the study by Greer et al. (2011a). Two of the participants were neuro-typical and two had a diagnosis of autism. Similar to the study conducted by Greer et al. (2007) additional sets of MEI were presented until the participants met the experimental criteria for Full Incidental Naming. Similar to the study conducted by Greer et al. (2005b) a further test for Full Incidental Naming was conducted using a novel set of stimuli. A delayed multiple probe design across participants was used and MEI was shown to induce Speaker Incidental Naming with these four participants. The participants each met the criterion for Listener Incidental Naming in the pre-MEI test. Thus, Speaker Incidental Naming was induced meaning that the participants met the criteria for Full Incidental Naming post-MEI. The individual scores for each participant are shown in Table 13.

Table 13

A summary of the scores for each test for Full Incidental Naming in the experiment by Greer et al. (2011a)

Participant	Pre-MEI Test 1			Pre-MEI Test 2			Final Test Post-MEI		
	Listener	Pure Tact	Impure Tact	Listener	Pure Tact	Impure Tact	Listener	Pure Tact	Impure Tact
1	20/20	13/20	12/10	N/A	N/A	N/A	20/20	20/20	20/20
2	20/20	12/20	16/20	20/20	20/20	10/20	20/20	20/20	20/20
3	15/20	7/20	0/20	N/A	N/A	N/A	20/20	20/20	20/20
4	20/20	12/20	0/20	20/20	20/20	0/20	20/20	20/20	20/20

The number of initial experimental tests conducted in their research is an important consideration in the experimental procedure and will be discussed further in

Chapter 6 as it did have a bearing on the current work. This concludes all the research that used a validated single subject research design. The multiple probe design used an experimental sequence that was common across these experiments. Figure 8 (page 81) shows this general experimental sequence. The variations in this experimental sequence are highlighted in Table 14.

Table 14

Summary of the variations in procedures used in the studies demonstrating that MEI induces naming

Study	Stimuli	Inclusion of additional set of MEI	Further test for Full Incidental Naming with novel set of stimuli	Additional test for Full Incidental Naming pre-MEI
Greer et al. (2005b)	Contrived and non-contrived 2D stimuli	No	Yes	No
Fiorile & Greer (2007)	Contrived 3D stimuli	Yes	No	No
Greer et al. (2007)	Non-contrived 2D stimuli	Yes	No	No
Gilic & Greer (2011)	Non-contrived 3D stimuli	No	No	No
Greer et al. (2011a)	Contrived and non-contrived 2D & 3D stimuli	Yes	Yes	Yes

Two additional studies, based on case study format, used MEI to induce Full Incidental Naming in children diagnosed with autism (e.g. Hawkins, Charnock, & Gautreaux, 2007; Hawkins, Kingsdorf, Charnock, Szabo, & Gautreaux, 2009). In the study by Hawkins et al. (2007), three participants were exposed to MEI to induce Full Incidental Naming. Although data showed sizeable gains, only one participant met the experimental criteria for Full Incidental Naming post-MEI. Furthermore, the criterion for Listener Incidental Naming was met pre-MEI so Speaker Incidental Naming was

induced. Similarly, only one out of three participants met the criterion for establishing Full Incidental Naming post-MEI in the study by Hawkins et al. (2009). Subsequently, modifications were made to the experimental procedures which included repeating the MEI procedure for one participant and requiring an echoic response with every match-to-sample trial for the other participant. With these additional modifications in place the experimental criteria for Full Incidental Naming was met, however because this study was conducted in a case study format a functional relationship between MEI and Full Incidental Naming was not established. Overall, the lack of a sound single subject experimental design was the major limitation in the studies by Hawkins et al. (2007) and Hawkins et al. (2009).

The research summarised in this section indicated that Listener Bidirectional Naming and Full Incidental Naming may be induced following the MEI procedure. It should be noted however that quite young children (i.e. with less established instructional histories) participated in each of the studies demonstrating a functional relationship between MEI and naming. Some were neuro-typical children and some were diagnosed with language delays or autism. Table 15 summarises the studies with validated single subject experimental design, focusing specifically on the age and diagnoses of the participants.

While there is growing evidence that MEI is successful in inducing Listener Bidirectional Naming and Full Incidental Naming in young children, it is important to note that this evidence is based on studies that involved 27 participants aged 2-6 years with only four described as having a diagnosis of autism (see Table 15). The question of whether MEI is an effective procedure for inducing *all* components of naming remains to be addressed. Similarly, the question of whether MEI induces separate or all components of naming for individuals diagnosed with autism warrants further empirical research. Despite these limitations, demonstrations of MEI as an intervention to bring

together previously independent classes of behaviour have been an important contribution to the research literature in this area. Additional research, particularly with older children diagnosed with autism, is desirable because these individuals also have substantial language deficits and a well-established instructional history making them a related, but unique, participant group.

Table 15

Summary of the studies showing a functional relationship between MEI and naming

Author(s) & Year	Number of Participants	Age of Participants	Diagnosis of Participants
Greer, Stolfi, Chavez-Brown, & Rivera-Valdes (2005b)	3	2.5-4 years	Language or developmental delays
Greer, Stolfi, & Pistoljevic (2007)	8	3-5 years	Speech delay or Pervasive Developmental Disorder or language and cognitive delays
Fiorile & Greer (2007)	4	2-2.4 years	Autism
Gilic & Greer (2011)	8	2 years	Neuro-typical (from upper middle class professional families)
Greer, Corwin, & Buttigieg (2011a)	Experiment 2 (Part 1) 4	2-6 years	2 children with Autism & 2 neuro-typical children

Alternative Procedures for Inducing Naming

The previous section has specifically focused on MEI procedures for inducing naming (Listener Bidirectional Naming and Full Incidental Naming). It should be noted, however, that MEI is not the only procedure with empirical evidence to induce a sub-component of naming. As mentioned in Chapter 2, Multiple Exemplar Training (MET) also has empirical support for inducing Speaker Bidirectional Naming (Rosales,

Rehfeldt, & Lovett, 2011). The distinction between MET and MEI was made in Chapter 2 (see page 21) clarifying that researchers using MET appear to focus on using multiple exemplars of stimuli when teaching under a single type of responding behaviour (e.g. speaking or listening, reading or writing) whereas MEI researchers focus on the multiple exemplars of stimuli and types of responding behaviour. To clarify, MEI includes a random rotation across multiple behaviours, such as speaking and listening. As mentioned in Chapter 2, Rosales et al. (2011) used MET to induce the emergence of untaught speaker behaviour following listener training (which is synonymous to Speaker Bidirectional Naming). Four neuro-typical 3-year-old children participated in this study. They were taught the names of items in a foreign language as a listener, e.g. “Point to (name of item),” and were tested whether they subsequently tacted the same item as a speaker. This procedure matched the previously described test for Speaker Bidirectional Naming. If participants did not meet the criterion for Speaker Bidirectional Naming, MET was implemented where speaker and listener instruction were provided using multiple exemplars of each item. This continued until the participants were taught a novel name as a listener and subsequently tested for the corresponding speaker behaviour (the criterion for Speaker Bidirectional Naming). Results showed marked improvements in the untaught speaker behaviour following MET.

In addition to this research demonstrating the relationship between MET and naming, further alternative procedures have been utilised to induce naming. These procedures include an echoic intervention (Hawkins et al., 2009; Longano, 2008), a stimulus-stimulus pairing procedure (Longano, 2008), an ‘intensive tact instruction’ procedure (Pistoljevic, 2008) and an ‘auditory matching’ procedure (Speckman-Collins, Lee Park, & Greer, 2007). These four different procedures and the research

demonstrating the relationship between each of these procedures and naming will be described within this section.

Echoic intervention. Longano (2008) tested the effects of MEI across listener responses only (match and point) with an echoic component where participants were required to echo the name of the item while matching or pointing to it. For example, the instructor presented three contrived stimuli to the participant, provided a vocal antecedent of, “Point to (name of stimulus)” and ensured the participant echoed the name of the stimulus while simultaneously pointing to it. Reinforcement was provided for simultaneously pointing to the correct item while echoing its name. Three participants aged 5-6 years, diagnosed with autism or a developmental disability, took part in this study. The dependent variable was Full Incidental Naming (untaught listener and speaker behaviour following a matching procedure) and the independent variable was the rotation of match and point instruction with the echoic component. The study showed that Full Incidental Naming was induced for one participant following this adapted MEI procedure that included an echoic component. The remaining two participants made gains with untaught speaker and listener behaviours, but the mastery criteria were not met.

As mentioned earlier in this chapter, Hawkins et al. (2009) also added an echoic component to the MEI procedure to induce Full Incidental Naming with two older children diagnosed with autism. The MEI procedure was implemented initially and although gains in the untaught listener and speaker behaviour were made, the mastery criteria for Full Incidental Naming were not met. A second set of MEI was implemented with the echoic component for the match and point responses. The MEI procedure in this study included the speaker (pure and impure tact) responses. The procedure was therefore slightly different to the procedure utilised in the study by Longano (2008) where the speaker (pure and impure tact) responses were not included. The study by

Hawkins et al. (2009) was conducted in case study format therefore it was not possible to establish a functional relationship between this adapted MEI procedure with the echoic intervention and Full Incidental Naming. However, each of the participants did meet the mastery criteria for Full Incidental Naming following this adapted MEI procedure, having not met the criteria previously.

Stimulus-stimulus pairing procedure. Longano (2008) showed that Full Incidental Naming emerged as a function of a stimulus-stimulus pairing procedure for four pre-school children diagnosed with autism. All participants were exposed to several sessions of pairing visual and vocal speech stimuli. This procedure closely aligns with the pair-test procedure (Pérez-González, Blanco, & Carnerero, 2014; Pérez-González, García-Conde, & Carnerero, 2011) described in Chapter 4 (see page 65). The pair-test procedure used by Pérez-González et al. (2014) involved presenting an individual with a number of pictures while saying the names of the pictures one at a time without requiring any response from the individual other than attending. The individual was subsequently tested for untaught listener and speaker behaviour (using the same stimuli exposed to in the ‘pairing’ procedure). Longano (2008) suggested that a history of stimulus-stimulus pairings was necessary for the acquisition of Full Incidental Naming.

Intensive tact instruction. Pistoljevic (2008) demonstrated that Full Incidental Naming emerged as a function of an ‘intensive tact instruction’ procedure. Intensive tact instruction is a procedure that has been shown to be effective in substantially increasing children’s spontaneous tacts in non-instructional settings (Greer & Du, 2010; Pistoljevic & Greer, 2006; Schaffler & Greer, 2006). The procedure involved adding 100 additional tact learn units and resulted in a marked increase in mands, tacts and conversational units in non-instructional settings. Pistoljevic (2008) showed that with these 100 additional tact learn units per day, not only did three pre-school participants

demonstrate a notable increase in the number of verbal operants emitted in the non-instructional setting, but Full Incidental Naming was also induced.

Auditory matching. As previously mentioned in Chapter 4 (see page 57), auditory matching is a behavioural cusp included on the VBDT pre-reader pyramid. An auditory matching protocol is used to induce the auditory matching behavioural cusp. For individuals to demonstrate a reliable auditory matching behavioural cusp they must consistently discriminate between auditory sounds. This is tested using a match-to-sample procedure where two visually-identical sound-producing apparatus are presented. The child is provided with the opportunity to listen to two different sounds. Another sound-producing apparatus is presented and the child listens to the sound from this stimulus along with the vocal antecedent from the teacher, “Match.” Reinforcement is provided for correctly matching the auditory sounds. Speckman-Collins, Lee Park, and Greer (2007) showed that the auditory matching protocol also induced Listener Incidental Naming, as well as the behavioural cusp of auditory matching, with two preschool participants diagnosed with language disabilities. Participants were required to make finer and finer discriminations between different sounds during the auditory matching procedure. The procedure was presented to participants in a systematic format where the distinction between the two sounds became gradually finer. Participants were required to meet the mastery criteria at each stage before finer discriminations were introduced. Speckman-Collins et al. (2007) found that as the two participants moved through more difficult levels of the auditory matching procedure, they made further gains in untaught listener behaviour and eventually met the criterion for Listener Incidental Naming. To clarify, both participants showed the emergence of untaught listener behaviour following a match-to-sample procedure by the end of the auditory matching sequence.

Aligning the Research on Naming According to the Six Sub-Components

Because the components of naming described in Chapter 4 were not organised in this fashion prior to researchers conducting research on naming, it is important to re-visit the variables they measured in each of the experimental papers on naming.

The research on naming that has been described thus far (Chapters 3-4), the research on Multiple Exemplar Instruction (MEI) and naming (described in Chapter 5) and the research on alternate procedures for inducing naming (Chapter 5) is summarised in Table 16 (listed in the same order as the suggested six components in Table 5 of Chapter 4).

Table 16

A summary of all the research on naming with a re-defined dependent variable according to the suggested six sub-components of naming

Author(s)	Year	Re-defined Dependent Variable
Guess & Baer	1973	Full Bidirectional Naming was tested and not shown (neither Listener Bidirectional Naming nor Speaker Bidirectional Naming) Speaker behaviour & listener behaviour shown to be functionally independent of one another
Eikeseth & Smith	1992	Listener Bidirectional Naming was tested and not shown
Tu	2006	Listener Bidirectional Naming was tested and not shown
Guess	1969	Speaker Bidirectional Naming was tested and not shown
Horne, Lowe, & Randle	2004	Speaker Bidirectional Naming was tested and not shown
Lowe, Horne, Harris, & Randle	2002	Listener Bidirectional Naming was tested Listener Bidirectional Naming was shown
Lowe, Horne, & Hughes	2005	Listener Bidirectional Naming was tested Listener Bidirectional Naming was shown

Fiorile & Greer	2007	Listener Bidirectional Naming was tested Listener Bidirectional Naming was induced as a function of MEI
Miguel & Kobari-Wright	2013	Listener Bidirectional Naming was tested Listener Bidirectional Naming was shown
Rosales, Rehfeldt, & Lovett	2011	Speaker Bidirectional Naming was tested Speaker Bidirectional Naming was induced as a function of MET
Keller & Bucher	1979	Full Bidirectional Naming was tested Listener Bidirectional Naming was shown, Speaker Bidirectional Naming was not
Lee	1981	Full Bidirectional Naming was tested Listener Bidirectional Naming was shown, Speaker Bidirectional Naming was not
Sprinkle & Miguel	2012	Full Bidirectional Naming was tested Listener Bidirectional Naming was shown, Speaker Bidirectional Naming was not
Delfs et al.	2014	Full Bidirectional Naming was tested Listener Bidirectional Naming was shown, Speaker Bidirectional Naming was not
Horne, Hughes, & Lowe	2006	Speaker Bidirectional Naming was tested Speaker Bidirectional Naming was shown
Cuvo & Riva	1980	Full Bidirectional Naming was tested Full Bidirectional Naming was shown
Speckman-Collins, Lee Park & Greer	2007	Listener Incidental Naming was tested and not shown Listener Incidental Naming was induced as a function of an auditory matching procedure
Greer, Corwin, & Buttigieg	2011a	Speaker Incidental Naming was tested and not shown Speaker Incidental Naming was induced (therefore Full Incidental Naming was shown) as a function of MEI
Greer, Stolfi, Chavez-Brown, & Rivera-Valdes	2005b	Speaker Incidental Naming was tested and not shown. Speaker Incidental Naming was induced (therefore Full Incidental Naming was shown) as a function of MEI

Hawkins, Charnock, & Gautreaux	2007	Speaker Incidental Naming was tested and not shown Speaker Incidental Naming was induced (therefore Full Incidental Naming was shown) following an MEI procedure
Greer, Stolfi, & Pistoljevic	2007	Full Incidental Naming was tested and not shown Full Incidental Naming was induced as a function of MEI
Longano	2008	Full Incidental Naming was tested and not shown Full Incidental Naming was induced as a function of an adapted MEI procedure with an echoic component (for 1 out of 3 participants) or as a function of a stimulus-stimulus pairing procedure
Pistoljevic	2008	Full Incidental Naming was tested and not shown Full Incidental Naming was induced as a function of an intensive tact instruction procedure
Hawkins, Kingsdorf, Charnock, Szabo, & Gautreaux	2009	Full Incidental Naming was tested and not shown Full Incidental Naming was induced as a following repeated MEI or an adapted MEI procedure with an echoic component
Gilic & Greer	2011	Full Incidental Naming was tested and not shown Full Incidental Naming was induced as a function of MEI
Pérez-González, Garcia-Conde, & Carnerero	2011	Full Bidirectional Naming was tested Listener Bidirectional Naming was shown, but Speaker Bidirectional Naming was not Full Incidental Naming was tested and shown for most participants
Pérez-González, Cereijo-Blanco, & Carnerero	2014	Full Bidirectional Naming was tested Listener Bidirectional Naming and Speaker Bidirectional Naming was shown for some participants Full Incidental Naming was tested and shown for some participants.

As Table 16 indicates, the majority of research on naming has focused on demonstrating the presence of Listener Bidirectional Naming (10 of 27 studies). Only one study demonstrated the presence of Full Bidirectional Naming (Cuvo & Riva, 1980), though seven further studies tested for this (Delfs et al., 2014; Guess & Baer, 1973; Keller & Bucher, 1979; Lee, 1981; Pérez-González et al., 2011; Pérez-González

et al., 2014; Sprinkle & Miguel, 2014). Eleven studies focused on incidental naming as the dependent variable. Six of these eleven studies induced Full Incidental Naming having tested for it and shown that it was not present (i.e. both Listener Incidental Naming and Speaker Incidental Naming were induced; Greer et al., 2007; Gilic & Greer, 2011; Hawkins et al., 2009; Longano, 2008; Pérez-González et al., 2011; Pistoljevic, 2008). Three studies induced Speaker Incidental Naming (i.e. Listener Incidental Naming already present; Greer et al., 2005b, 2011a; Hawkins et al., 2007). One study induced Listener Incidental Naming (Speckman-Collins et al., 2007). One final study aimed to induce Full Incidental Naming, but the results were mixed and Full Incidental Naming was only induced for some participants (Pérez-González et al., 2014). While it appears that the research based on naming is predicated on a solid foundation, Table 16 shows that many of the studies used varying terminology and tested for different dependent variables.

Summary

In Chapter 2 research was summarised showing that previously independent classes of behaviour can be integrated using MET or MEI (e.g. Rosales et al., 2011; Nuzzolo-Gomez & Greer, 2004; Greer, Yuan, & Gautreaux, 2005c). The independent classes of behaviour included derived relations, mands and tacts, and speaker and writer behaviour. This chapter has added to that research base by describing how MEI can be effective in the fusion of speaker and listener behaviour: that is, it can induce naming. Chapter 4 emphasised the importance of naming in enabling more efficient teaching procedures to be used. In these ways it is significant that MEI has been shown to induce naming in individuals where it was not previously present.

Chapters 1-5 have introduced the concepts of Generalisation, MET/MEI and naming and how they are related to the presence of skills outside of the instructional setting and the emergence of untaught verbal behaviour. MEI has been shown as an

effective procedure for inducing naming in young children. A detailed analysis of research in the area of emergent verbal behaviour indicated that there are missing behavioural cusps for the participants in these studies, specifically in older children diagnosed with autism.

There exists ample opportunity for further conceptual discussion and experimental research. This opportunity sets the stage for a series of fundamental experimental questions. To begin, does MEI induce Full Incidental Naming for older children diagnosed with autism? The findings generated from this experimental question will drive other experimental questions that necessitate answers in order to more fully understand naming and the emergence of untaught verbal behaviour.

Chapter 6

Testing the Effects of Multiple Exemplar Instruction on the Induction of Full Incidental Naming in Older Children Diagnosed with Autism

Experiment 1

The purpose of Experiment 1 was to evaluate the effectiveness of Multiple Exemplar Instruction (MEI) to induce Full Incidental Naming (FIN) with a group of older children with a diagnosis of autism. To date four published studies (Gilic & Greer, 2011; Greer, Corwin, & Buttigieg, 2011a; Greer, Stolfi, Chavez-Brown, & Rivera-Valdes, 2005b; Greer, Stolfi, & Pistoljevic, 2007) specifically demonstrated the effectiveness of MEI in inducing FIN, but all the studies were with younger participants (2-6 years) and none of the studies had participant pools exclusively with a diagnosis of autism.

Method

Participants. This experiment took place at an independent day school for children and young adults aged 4-19 years diagnosed with autism and a severe or moderate learning difficulty. According to the Verbal Behaviour Development Theory (VBBDT) pre-reader pyramid of behavioural cusps (Greer & Ross, 2008; Figure 2 in Chapter 4, page 53), each of the participants were required to show evidence of the prerequisites assumed to be needed for inducing FIN. That is, each participant met the criteria for the prerequisite behavioural cusps for the 'speaker component of naming' which is synonymous with Speaker Incidental Naming (SIN) in the sense that both refer to the emergence of untaught speaker behaviour following an incidental language experience. To clarify, all participants met the mastery criteria for the prerequisite behavioural cusps of echoic-to-tact, independent mands and transformation of establishing operations across mands and tacts. All pupils at the school were systematically tested for the suggested prerequisite behavioural cusps. The procedures

for testing for these behavioural cusps are outlined in the VBDT and are summarised in Table 17. According to the VBDT, if an individual meets the criteria for these three prerequisite behavioural cusps then this provides an optimal opportunity for individuals to be tested for FIN and, if not present, it may be induced. The first four children or young adults within the school to meet these prerequisites were selected for Experiment 1.

Table 17

Prerequisite behavioural cusps for testing for and inducing FIN, according to the VBDT

Behavioural Cusp	Description	Test
Echoic-to-tact	The language model (the echoic) is provided by a speaker to introduce the tact. The echoic model evokes production of the corresponding word. The echoic model is faded until the correct tact occurs independently. Antecedent control is shifted from verbal to non-verbal.	This behavioural cusp is considered present when an individual produces at least two new tacts reliably under generalised reinforcement conditions.
Independent Mands	To mand consistently without prompting (e.g. echoic vocal prompt, picture prompt or text prompt) and under conditions where the target stimuli are either present or absent.	This behavioural cusp is considered present when an individual produces at least two new mands reliably under conditions where the target stimuli are either present or absent.
Transformation of establishing operations across mands and tacts	This involves learning a new mand and using that same word as a tact (or vice versa) without further direct teaching.	This behavioural cusp is considered present when an individual produces at least two new mands reliably that have only been taught as tacts and produces at least two tacts reliably that have only been taught as mands.

Participation in the study was voluntary and participants' parents were provided with an information sheet and consent form. Parents were told they could withdraw

participants from the study at any time. See Appendix B for an example information sheet and consent form. The school's Ethics Committee and the University of Kent's Ethics Committee approved the study. Signed, informed consent was obtained from participants' parents prior to commencing data collection.

Table 18 provides an overview of the participants' characteristics. This includes information about each participant's age (reported in years (y) and months (m)), gender, number of years as a pupil in the school (reported in years (y) and months (m)), level of learning disability and national curriculum levels for speaking and listening (see Appendix C for an explanation of these levels). Additional speech and language therapy test scores (see Appendix D for an explanation of these test results) are presented in Table 19.

Table 18

Participants' Characteristics

Participant	Age	Gender	Duration in Current Setting	Level of Learning Disability	National Curriculum Levels Achieved	
					Eng (Speaking)	Eng(Listening)
1	5y, 9m	Male	7m	Moderate	P5.2	P4.8
2	6y, 3m	Male	7m	Moderate	P7.2	P7.2
3	10y, 4m	Male	2y, 2m	Severe	P5.2	P5.4
4	15y, 6m	Male	5y, 8m	Severe	P7.4	P8.6

Table 19

Speech and Language Therapy Test Scores

Participant	DLS Score			TALC Score			
	2-word level	3-word level	4-word level	Level 1 Naming	Level 2 Describing	Level 3 Re-telling	Level 4 Justifying
1	72%	54%	31%	Not tested	Not tested	Not tested	Not tested
2			62%	100%	61%	65%	36%
3	72%			83%	44%	0%	N/A
4			86%	100%	72%	65%	0%

The participants were all male and ranged in age from 5 years 9 months to 15 years 6 months. Their mean age was 9 years 5 months (SD = 3.915). Their duration in

the current setting ranged from 7 months to 5 years 8 months with a mean duration of 2 years 3 months. Their national curriculum levels ranged from P4.8 to P7.2.

Setting. The study took place in an independent day school for children and young adults aged 4-19 years diagnosed with autism. There were twelve classrooms which measured approximately 7 metres by 10 metres and contained a chair and table for each pupil, a larger table for group work, an interactive whiteboard and at least two computer stations. The pupils were placed in classes based on their level of verbal behaviour, i.e. all the pupils termed as pre-listeners were placed with one another as were the pupils with a self-management repertoire. Other pupils and staff were present, but the environment was quiet.

Materials. Solely contrived stimuli were used throughout the current body of work. The use of contrived stimuli ensured that the participants had no previous or current experience with the selected stimuli. The names of the stimuli were selected based on research by Mandell and Sheen (1994) who showed that responding in accord with equivalence varied as a function of pronounceability. To clarify, it was deemed important that the contrived stimuli in the current study could be easily pronounced and that there was a clear distinction between the names of the stimuli.

A set of contrived two-dimensional stimuli were used to test for FIN and a different set was used for the teaching sequences within the MEI procedure. Each set consisted of five contrived symbols with five contrived names. The contrived names were all consonant-vowel-consonant (CVC) words, e.g. *fip*, *mag*, *jed*. The sets did not contain rhyming words or words with the same starting or end consonants. Examples of all the stimuli used are shown in Appendix E. There were multiple exemplars of each of the stimuli within each set (e.g. stimuli of different sizes, colours and fonts). Individualised sets of stimuli were specific to each participant.

Procedure. The diagram in Figure 9 illustrates the experimental procedure. Set 1 and Set 2 stimuli were selected by conducting initial tact probes to determine the participants' familiarity with the stimuli. A match-to-sample (MTS) procedure was run with each participant using Set 1 stimuli. Once the mastery criteria were achieved for the MTS procedure, a test for untaught behaviours was conducted (listener behaviour followed by speaker behaviour). A second test for untaught behaviours was then conducted. After this second test was completed, the MEI procedure with Set 2 stimuli was implemented and once the mastery criteria were met an additional test for untaught behaviours (with Set 1 stimuli) was conducted (listener behaviour followed by speaker behaviour).

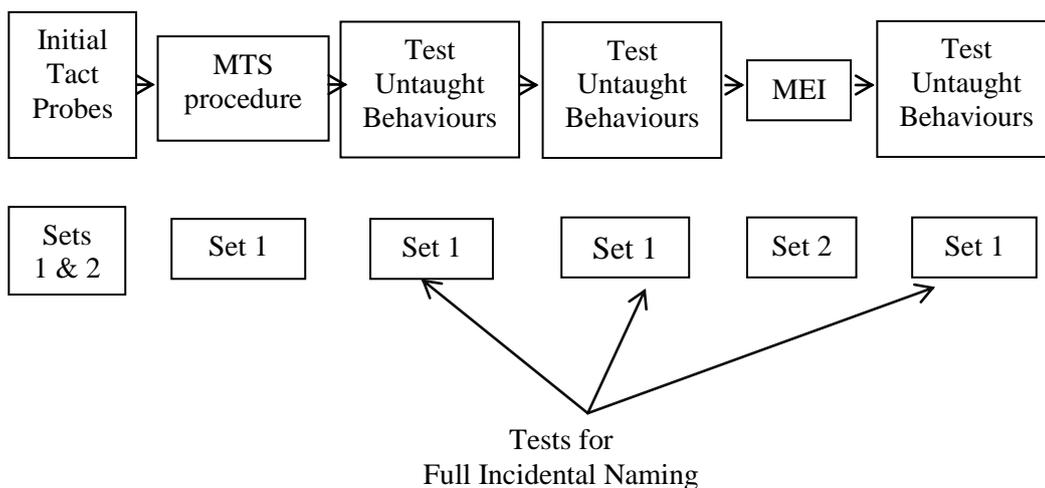


Figure 9: Experimental procedure for Experiment 1.

Initial tact probes. Initial tact probes were conducted with each participant for a set of stimuli (five tacts for each participant; one for each contrived stimulus) to provide evidence that the participants had limited prior direct or indirect experience with the stimuli. It was important to eliminate confounding variables by ensuring that the stimuli were unfamiliar to the participants. Each symbol was presented to each participant

without a vocal antecedent and feedback was not provided for correct or incorrect responses. For example, the participant was shown a card with a picture of a symbol (*tesh*) and the participant was provided with an opportunity to produce a vocal response stating the name of the symbol. The participants' responses were unsequenced for these tact probes meaning that reinforcement and corrections were not provided. Each stimulus was probed once. If the participants did not respond or produced an incorrect response then these stimuli were selected for the experimental sets. For each participant two experimental sets were selected (one for the tests for FIN and one for the MEI procedure). Each experimental set contained five stimuli.

Match-to-sample (MTS) procedure. Using one of the experimental sets of stimuli, e.g. Set 1, presented in a field size of five, each participant was exposed to MTS trials⁶. Following the vocal antecedent, "Match (name)," and presentation of a matching stimulus, the participant was required to visually match the stimuli by placing a card with the target symbol onto the corresponding matching card that was within the field size of five. The field size included one exemplar of each stimulus from the set. The position of the stimuli within the field size was changed for every trial and alternate exemplars of the stimuli were rotated. Correct responses were vocally reinforced and incorrect responses were corrected by the researcher. This correction involved repeating the vocal antecedent, "Match (name)," and modeling the correct response for the participant to imitate. Corrected responses were not reinforced. This part of the study continued until the participant met the criterion of 18/20 correct responses over two consecutive sessions or 20/20 correct responses over one session.

⁶ As mentioned in Chapter 5, in the MTS procedure the teaching interactions were referred to as *trials*. The teaching interactions were described in this way in order to acknowledge that the matching task was already mastered because the individuals had substantial evidence of mastery of two-dimensional to two-dimensional matching. The purpose of the MTS procedure was simply to provide an opportunity for participants to hear the names of the symbols while seeing those symbols while engaging in the matching task. It is this hear-see correspondence that is necessary that sets the stage for the test of emergent untaught behaviour. In contrast learn units require that new learning occurs.

Test for FIN (untaught listener and speaker behaviour). Once the predetermined criterion level of responding for matching was achieved, a test for FIN occurred (untaught listener and untaught speaker behaviour). The participants' responses within this test for FIN were not consequated (reinforced or corrected). Untaught listener behaviour was tested first. This test consisted of instructing the participant to, "Point to___," using the same items that were used in the matching session. The five stimuli within the set were presented to the participant. Once the test for untaught listener behaviour was completed, the corresponding untaught speaker behaviour was tested in the form of an impure tact (stimulus presented along with vocal antecedent, "What's this?") and a pure tact (stimulus presented; no vocal antecedent). If the participant scored 80% correct responses across untaught listener and speaker behaviour then FIN was demonstrated. Alternatively, if 80% accuracy was scored across untaught listener behaviour, but not untaught speaker behaviour then Listener Incidental Naming (LIN) was shown. However, if 80% accuracy was scored across untaught speaker behaviour, but not untaught listener behaviour then Speaker Incidental Naming (SIN) was demonstrated. A second identical test for the untaught behaviours was also conducted to control for practice effects. In accordance with a multiple probe design the number of initial tests for FIN was increased with each participant to ensure the participants were not exposed to the MEI intervention at the same time. To clarify, each participant was exposed to at least two pre-MEI tests for FIN. The MTS procedure was not presented again prior to this second test for untaught behaviours. If the criteria level was not achieved, a MEI procedure was used in an attempt to induce FIN.

Multiple exemplar instruction (MEI) procedure. In accordance with multiple probe design logic, the first participant then entered the intervention phase (MEI procedure) while the remaining three participants were tested for untaught behaviours a third time. Once the intervention phase was completed for the first participant, the

second participant entered this intervention phase while the remaining participants were tested for untaught behaviours a fourth time.

The intervention phase consisted of MEI across four behaviours with a novel set of stimuli (e.g. Set 2). Multiple exemplars of each stimulus were used within each set (e.g. *desh* printed in different colours, fonts and sizes). Learn units were presented during the MEI procedure (Greer, 2002; Greer & McDonough, 1999). A learn unit consisted of a clear antecedent (vocal or non-vocal), a clearly defined expected behaviour and a contingent consequence (reinforcement for a correct response and a correction procedure of repeating the antecedent and modeling the required response). Learn units require that the teacher must always ensure that motivational operations are in place for the participant and that the participant is attending to the stimuli presented. To illustrate an appropriate MEI sequence, the instruction was presented in the order shown in Table 20 (target stimuli were *desh*, *fip*, *kozz*, *mag* and *jed*).

Table 20

Example of a MEI sequence for a training set

Teaching Sequence	First Presentation	Second Presentation	Third Presentation	Fourth Presentation
1	Match <i>desh</i>	Point to <i>fip</i>	Match <i>kozz</i>	Impure tact <i>mag</i>
2	Tact <i>jed</i>	Impure tact <i>desh</i>	Point to <i>jed</i>	Tact <i>kozz</i>
3	Match <i>fip</i>	Point to <i>mag</i>	Impure tact <i>kozz</i>	Point to <i>desh</i>
4	Tact <i>fip</i>	Impure tact <i>jed</i>	Match <i>mag</i>	Tact <i>desh</i>
5	Point to <i>kozz</i>	Impure tact <i>fip</i>	Match <i>jed</i>	Tact <i>mag</i>

In each of these teaching sequences, instruction occurred as follows:

Match desh. The set of five stimuli were presented to the participant, one being the contrived symbol *desh*. Another corresponding contrived stimulus of *desh* was presented along with the vocal antecedent, “Match *desh* with *desh*.” Correct matching of *desh* with *desh* was reinforced and a ‘+’ was scored on the data sheet. If an incorrect

response occurred the vocal antecedent was repeated and the correct response was modeled. A ‘-’ was subsequently scored on the data sheet.

Point to fip. The set of five stimuli were presented to the participant, one being the contrived symbol *fip*. The vocal antecedent, “Point to *fip*” was provided and pointing to the corresponding symbol was reinforced. A ‘+’ was subsequently scored on the data sheet. If an incorrect response occurred the vocal antecedent was repeated and the correct response was modeled. A ‘-’ was then scored on the data sheet.

Impure tact kozz. After presenting the contrived symbol *kozz* and the vocal antecedent, “What is this?” the vocal response “kozz” was required. A correct response was reinforced and a ‘+’ was scored on the data sheet. If an incorrect response or a non-response (no response within 5-7 seconds of presenting the antecedent) occurred the vocal antecedent was repeated along with a model of the correct vocal response “kozz” and the participant was required to echo this modeled response. A ‘-’ was subsequently scored on the data sheet.

Tact mag. On presentation of the contrived symbol *mag*, the vocal response “mag” was required. A correct response was reinforced and a ‘+’ was scored on the data sheet. If an incorrect response or a non-response (no response within 5-7 seconds of presenting the antecedent) occurred the stimulus *mag* was presented again along with a model of the correct vocal response “mag.” The participant was required to echo this modeled response. A ‘-’ was subsequently scored on the data sheet.

Mastery criteria. Mastery criteria were set at a minimum of 18/20 correct responses to learn units over two consecutive sessions for each behaviour (match, point to, impure tact and tact). A MEI session was considered mastered if responses to each of the behaviours were achieved at 90% accuracy over two sessions. To clarify, if a participant scored 18/20 correct responses for the matching over two consecutive

sessions then the match trials were still presented to the participant until criteria were met on *all* behaviours.

If the mastery criteria were not met on the MEI procedure after the presentation of 120 learn units for each behaviour then the MEI procedure was discontinued.

It is important to note that the MEI teaching sequence was randomly rotated across behaviours. This is an essential element of the MEI procedure in order to create an intensive language and environmental experience. The random rotation was also important to ensure that the response for one behaviour did not occasion the response for the next behaviour.

Post-MEI test for FIN. Once the mastery criteria were met on the MEI procedure, a post-MEI test for FIN was conducted with the original set of stimuli (e.g. Set 1) testing for the three untaught behaviours (listener behaviour, pure tacts and impure tacts). To clarify, the participants were only exposed to the names of the Set 1 stimuli during the *initial* MTS procedure.

If the mastery criteria were not met on the MEI procedure then the post-MEI test for FIN was not conducted.

Design. A multiple probe design (Horner & Baer, 1978) was used to test for the acquisition of FIN. Typically a multiple probe design is used to demonstrate that a multiple step task has been mastered (e.g. making a sandwich). All of the steps are assessed for task completion via a task analysis. Subsequently each probe determines how many steps in the task have been mastered. In regards to FIN as a behavioural cusp, tests are conducted to gauge the development of the cusp defined by meeting criteria on the number of correct untaught responses in the test. All of the participants received the initial tact probes, MTS procedures and test for FIN concurrently prior to Participant 1 entering the next component of the study. Participant 1 then received the second test for FIN and the remaining participants received their second test for FIN prior to

Participant 1 entering the intervention phase of the study. Participant 1 entered the intervention phase (MEI procedure) while the remaining participants continued with a third test for FIN. Once Participant 1 had completed the intervention phase, Participant 2 entered the intervention phase while the remaining participants continued with a fourth test for FIN. Each subsequent participant followed this same experimental sequence.

Inter-Observer Agreement. Inter-observer agreement (IOA) was conducted by the author of the current work and a second trained independent observer for 25% of all sessions (probe and MEI sessions). The TPRA (Teacher Performance Rate/Accuracy; Ingham & Greer, 1992; Ross, Singer-Dudek, & Greer, 2005) was utilised to collect IOA and procedural fidelity data. The TPRA measures the accuracy of the presentation of the antecedent and consequence as well as participant responses. There was 100% accuracy regarding the presentation of the antecedent, therefore minimising procedural fidelity as an extraneous variable. The following formula was used to establish percentage of agreement across both observers: $\text{number of agreements}/(\text{number of agreements} + \text{number of disagreements}) \times 100 = \% \text{ of agreement}$ (Cooper, Heron, & Heward, 2007). The IOA was 97% across all sessions (range 92-100%).

Results

The results of the study are shown in Figure 10. Correct responses of untaught listener and speaker behaviours are shown. The pre-MEI results are shown to the left of the broken vertical line and post-MEI results (final test for FIN) to the right of the broken vertical line. For the initial test for FIN, Participant 1 scored 4/20 for untaught listener behaviour and 4/20 for untaught speaker behaviours (both tacts and impure tacts). For the second test for FIN this participant scored an additional correct response for untaught listener behaviour (5/20), but scored 0/20 for both untaught speaker

behaviours. Following the MEI intervention phase the participant scored 6/20 for untaught listener behaviour and 0/20 for both untaught speaker behaviours.

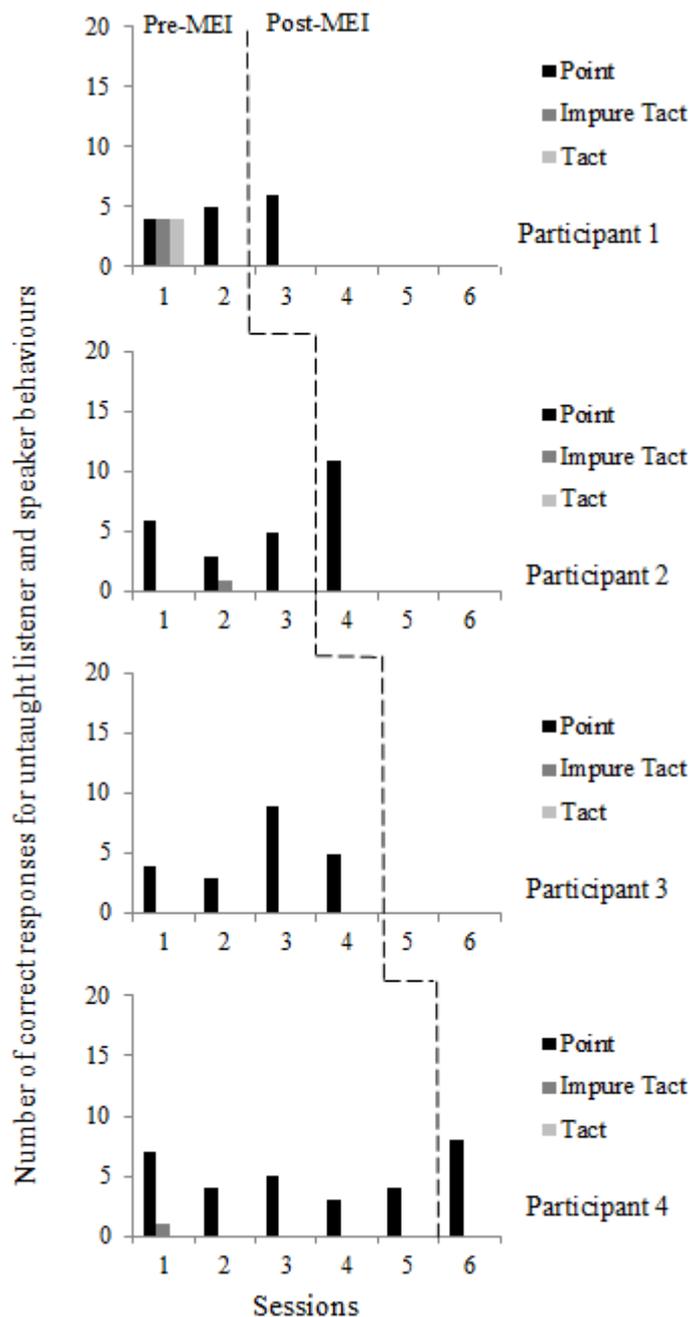


Figure 10: Results for Experiment 1: Number of correct responses for each of the untaught listener and speaker behaviours. Note Participant 3 did not receive the Post-MEI test.

Three initial tests for FIN were conducted for Participant 2 prior to the intervention phase. Participant 2 scored 6/20, 3/20 and 5/20 for untaught listener behaviour across the three tests respectively. Apart from the second test for FIN,

Participant 2 scored 0/20 for all untaught speaker behaviours. Participant 2 scored 1/20 on the second test for the impure tacts. In the post-MEI test for FIN, following the intervention phase, he made gains with untaught listener behaviour scoring 11/20, but scored 0/20 for both untaught speaker behaviours.

Four initial tests for FIN were conducted for Participant 3. He scored 4/20, 3/20, 9/20 and 5/20 for untaught listener behaviour across the four tests respectively.

Participant 3 scored 0/20 for all untaught speaker behaviours. Participant 3 did not meet the mastery criteria for the intervention phase therefore the post-MEI test for FIN was not conducted.

Five initial tests for FIN were conducted for Participant 4. He scored 7/20, 4/20, 5/20, 3/20 and 4/20 for untaught listener behaviour across the five tests respectively. He scored 0/20 for untaught speaker behaviours apart from the first test where he scored 1/20 for the impure tacts. In the post-MEI test for FIN he scored 8/20 for untaught listener behaviour and 0/20 for the untaught speaker behaviours.

In summary, Participants 1 and 4 did not demonstrate any gains in each post-MEI test for FIN. Participant 3 did not meet mastery criteria on the MEI intervention, therefore the post-MEI test for FIN was not conducted. Participant 2 scored an average of 4.6 correct responses for untaught listener behaviour pre-MEI which increased to 11 correct responses post-MEI.

Figure 11 shows the MEI graphs (independent variable) for each participant and Table 21 shows the number of learn units presented to each participant and the number of days required to complete the intervention.

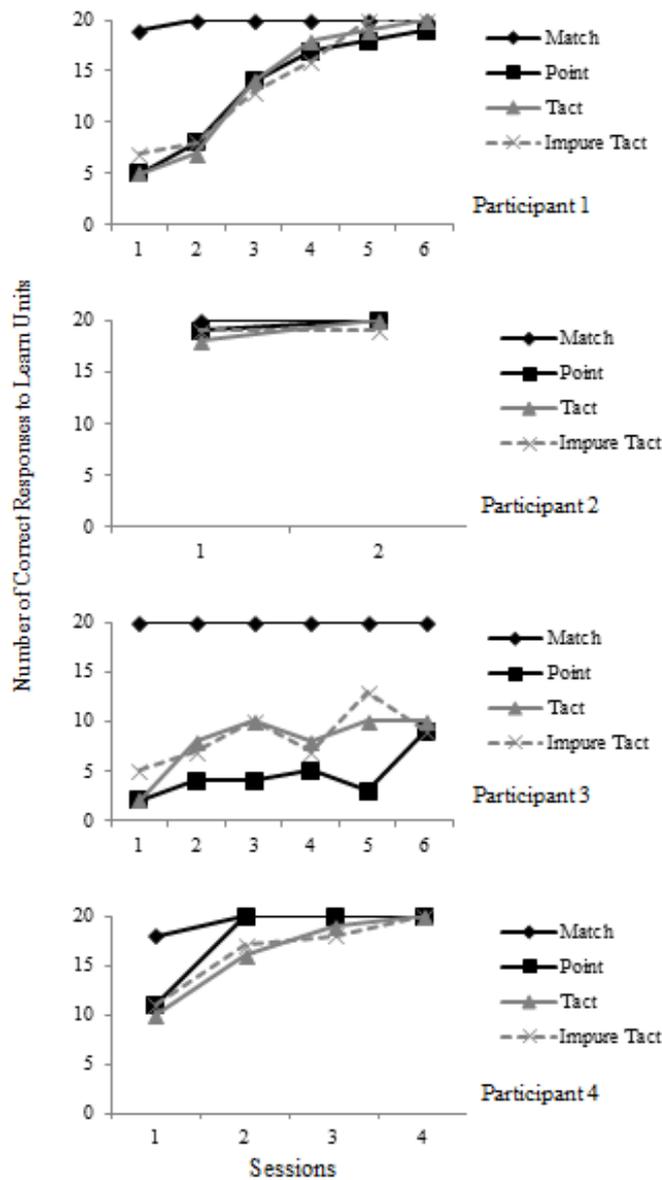


Figure 11: The results for the MEI procedure for each participant.

Table 21

Number of learn units presented during MEI procedure and duration of procedure for each participant

Participant	Number of learn units presented during intervention	Number of days to complete the intervention
1	480	3
2	160	1
3	480	N/A
4	320	2

Discussion

The results showed that none of the participants acquired FIN. Three out of the four participants demonstrated a higher number of listener responses post-MEI. Participant 3 did not meet the mastery criteria for MEI, thus a post-MEI test for FIN was not conducted.

Additionally, it is important to note that the only time the participants heard the names of the items in Set 1 was during the *initial* MTS procedure. There was a considerable span of time between the initial exposure to the names and the post-MEI test for FIN. Furthermore, there was a difference between the participants' exposure to the names of the stimuli. Participant 1 received 60 MTS trials before meeting the criterion. This participant heard the names of the items, while looking at the items, 12 times for each stimulus. The remaining three participants met the criterion for these MTS trials after one session of 20 trials. The participants therefore only heard the names of the items, while looking at the items, four times for each stimulus.

All participants heard the names of the items again during the test for untaught listener behaviour (e.g. "Point to ___"), but no feedback was provided during this test. The initial test for FIN was preceded by the MTS procedure and this allowed the individual to hear the names of the items. The individual was then required to point to and tact the items in follow-up tests for FIN. Therefore, it may be necessary to consider conducting the MTS procedure again prior to each test for FIN. Running an additional MTS procedure prior to each test for FIN does not compromise the fidelity of the experimental sequence. Hypothetically, individuals may still demonstrate the acquisition of the names of new items incidentally. This additional MTS procedure prior to each test for FIN was not used in any of the published studies on MEI and FIN, but is the impetus for Experiment 2.

Experiment 2

The purpose of this study was to replicate Experiment 1 but using a MTS procedure prior to each test for FIN (untaught listener and speaker behaviours). This additional exposure to the names of the items provided within the MTS procedure minimised the effects of the passage of time as a possible extraneous variable in all of the tests for FIN.

Method

Participants and Setting. The participants in Experiment 2 were unique from the participants in Experiment 1. Four children with a diagnosis of autism and a learning disability participated in this experiment. As with Experiment 1, according to the VBDT pre-reader pyramid of behavioural cusps (Greer & Ross, 2008; Figure 2 in Chapter 4), each of the participants showed evidence of the prerequisites assumed to be needed for inducing FIN. That is, each participant met the criteria for the prerequisite behavioural cusps for the ‘speaker component of naming’ which is synonymous with Speaker Incidental Naming (SIN). To clarify, all participants met the mastery criteria for the prerequisite behavioural cusps of echoic-to-tact, independent mands and transformation of establishing operations across mands and tacts. All pupils at the school were systematically tested for the suggested prerequisite behavioural cusps. The procedures for testing for these behavioural cusps are outlined in the VBDT and are summarised in Table 17 in Experiment 1. The second set of four children or young adults within the school to meet these prerequisites were selected for Experiment 2.

Table 22 provides an overview of the participants’ characteristics. This includes information about each participant’s age (reported in years (y) and months (m)), gender, number of years as a pupil in the school (reported in years (y) and months (m)), level of learning disability and national curriculum levels for speaking and listening (see Appendix C for an explanation of these levels). Note that Participant 4 had attended the

school for less than four weeks at the time of Experiment 2. Additional speech and language therapy test scores (see Appendix D for an explanation of these test results) are presented in Table 23.

Table 22

Participants' Characteristics

Participant	Age	Gender	Duration in Current Setting	Level of Learning Disability	National Curriculum Levels Achieved	
					Eng (Speaking)	Eng(Listening)
1	16y, 6m	Male	5y, 0m	Severe	1A.8	1A.8
2	14y, 11m	Male	10 y, 0m	Severe	P6.4	P6.6
3	12y, 11m	Male	1y, 0m	Severe	P5.6	P6.2
4	11y, 6m	Male	0y, 0m	Moderate	P6.6	P6.6

Table 23

Speech and Language Therapy Test Scores

Participant	DLS Score			TALC Score			
	2-word level	3-word level	4-word level	Level 1 Naming	Level 2 Describing	Level 3 Re-telling	Level 4 Justifying
1			72%	83%	66%	52%	N/A
2		72%		83%	5%	N/A	N/A
3	86%	54%		Not tested	Not tested	Not tested	Not tested
4	88%	81%	47%	100%	61%	35%	N/A

The participants' ages ranged from 11 years 6 months to 16 years 6 months. The mean age of the participants was 14 years ($SD = 1.905$). Their duration in the current setting ranged from less than 1 month to 10 years with a mean duration of 4 years. Their national curriculum levels ranged from P5.6 to 1A.8.

Participation in the study was voluntary and participants' parents were provided with an information sheet and consent form. Parents were told they could withdraw participants from the study at any time. See Appendix B for an example information sheet and consent form. The school's Ethics Committee and the University of Kent's Ethics Committee approved the study. Signed, informed consent was obtained from participants' parents prior to commencing data collection.

The study took place in an independent day school for children and young adults aged 4-19 years diagnosed with autism. Experiment 1 provided a fuller overview of the setting which was identical to this experiment (see page 107).

Materials. Because the participants in Experiment 2 were not exposed to the stimuli in Experiment 1, the same stimuli for Experiment 1 were used for Experiment 2. See Appendix E and see Experiment 1 for a fuller description of the stimuli (see page 107).

Procedure. The experimental procedure for Experiment 2 is illustrated in Figure 12. The main distinction between the current procedure and the procedure in Experiment 1 was that the MTS procedure was run prior to every test for FIN (untaught behaviours). Otherwise the procedure was identical to Experiment 1.

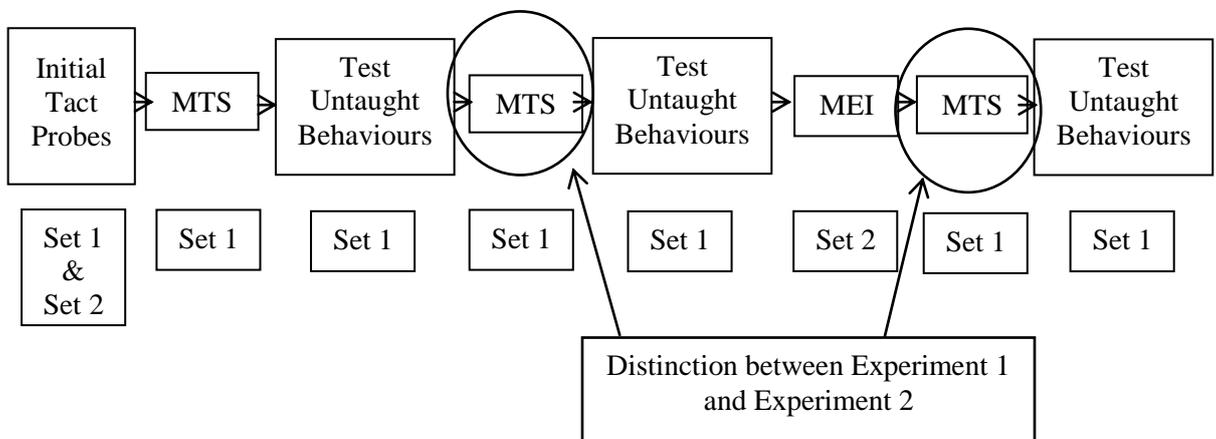


Figure 12: Experimental procedure for Experiment 2.

Design. A multiple probe design (Horner & Baer, 1978) was used to test for the acquisition of FIN. All of the participants received the initial tact probes, MTS procedures and test for FIN concurrently prior to Participant 1 entering the next component of the study. Participant 1 then received the second test for FIN and the

remaining participants received their second test for FIN prior to Participant 1 entering the intervention phase of the study. Participant 1 entered the intervention phase (MEI procedure) while the remaining participants continued with a third test for FIN. Once Participant 1 had completed the intervention phase, Participant 2 entered the intervention phase while the remaining participants continued with a fourth test for FIN. Each subsequent participant followed this same experimental sequence.

Inter-Observer Agreement. Inter-observer agreement (IOA) was conducted by the author of the current work and a second trained independent observer for 23% of all sessions (probe and MEI sessions). The TPRA (Teacher Performance Rate/Accuracy; Ingham & Greer, 1992; Ross, Singer-Dudek, & Greer, 2005) was utilised to collect IOA and procedural fidelity data. The TPRA measures the accuracy of the presentation of the antecedent and consequence as well as participant responses. There was 100% accuracy regarding the presentation of the antecedent, therefore minimising procedural fidelity as an extraneous variable. The following formula was used to establish percentage of agreement across both observers: $\text{number of agreements}/(\text{number of agreements} + \text{number of disagreements}) \times 100 = \% \text{ of agreement}$ (Cooper, Heron, & Heward, 2007). The inter-observer agreement was 99% across all sessions (range 96-100%).

Results

The results of the study are presented in Figure 13. Correct responses of untaught listener and speaker behaviours are shown. The pre-MEI results are displayed to the left of the broken vertical line and post-MEI results (final test for FIN) to the right of the broken vertical line. For the initial test for FIN, Participant 1 scored 8/20 for untaught listener behaviour and 0/20 for untaught speaker behaviours (both tacts and impure tacts). For the second test for FIN this participant scored one less correct response for untaught listener behaviour (7/20) and again scored 0/20 for both untaught

speaker behaviours. Following the intervention phase the participant scored 5/20 for untaught listener behaviour and 0/20 for both untaught speaker behaviours.

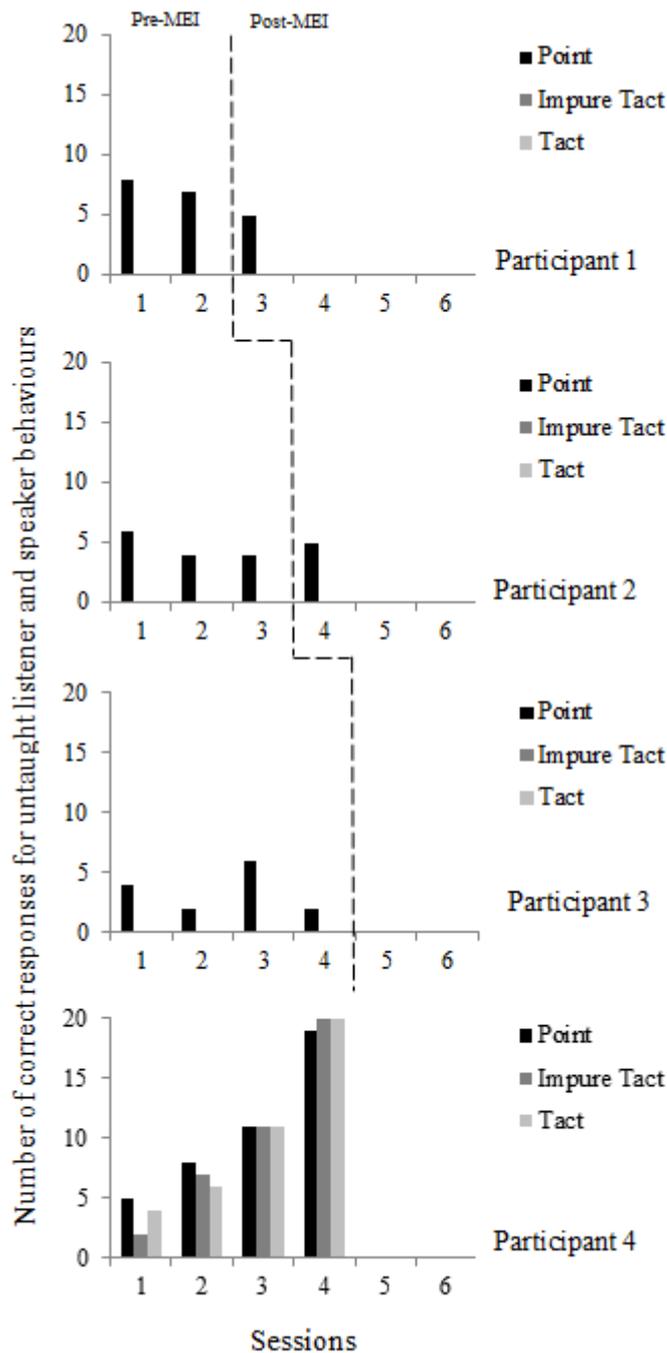


Figure 13: Results for Experiment 2: Number of correct responses for each of the untaught listener and speaker behaviours. Note Participant 3 did not receive the Post-MEI test and Participant 4 did not receive MEI.

Three initial tests for FIN were conducted for Participant 2 prior to the intervention phase. Participant 2 scored 6/20, 4/20 and 4/20 for untaught listener behaviour across the three tests respectively. Participant 2 scored 0/20 for all untaught speaker behaviours across all 3 tests for FIN. In the post-MEI test for FIN, following the intervention phase, he scored 5/20 for untaught listener behaviour and his score remained 0/20 for both untaught speaker behaviours. Participants 1 and 2 did not show gains in correct responses to untaught behaviours following the MEI procedure.

Four initial tests for FIN were conducted for Participant 3. He scored 4/20, 2/20, 6/20 and 2/20 for untaught listener behaviour across the four tests respectively. Participant 3 scored 0/20 for all untaught speaker behaviour across each of the four tests for FIN. Participant 3 did not meet the mastery criteria for the intervention phase therefore a post-MEI test for FIN was not conducted.

Four initial tests for FIN were conducted for Participant 4. An overall ascending trend was shown for these data with Participant 4 meeting the criteria for FIN before the MEI intervention was implemented (on the fourth test for FIN). He scored 5/20, 8/20, 11/20 and 19/20 for the untaught listener behaviour across the four tests respectively. For the untaught speaker behaviour, he scored 2/20, 7/20, 11/20 and 20/20 for the impure tacts and 4/20, 6/20, 11/20 and 20/20 for the tacts.

In summary, Participants 1 and 2 did not demonstrate any gains in each of the tests for FIN following the MEI-intervention phase. Participant 3 did not meet the criteria for the MEI intervention therefore the post-MEI test for FIN was not conducted. Participant 4 met the mastery criteria for the test for FIN prior to the implementation of the MEI intervention (on the fourth test for FIN).

Table 24 shows the number of learn units presented to each participant and the number of days required to complete the intervention and Figure 14 shows the MEI graphs (independent variable) for each participant.

Table 24

Number of learn units presented during MEI procedure and duration of procedure for each participant

Participants	Number of learn units presented during intervention	Number of days to complete the intervention
1	240	4 (including weekend)
2	320	2
3	480	N/A
4	N/A	N/A

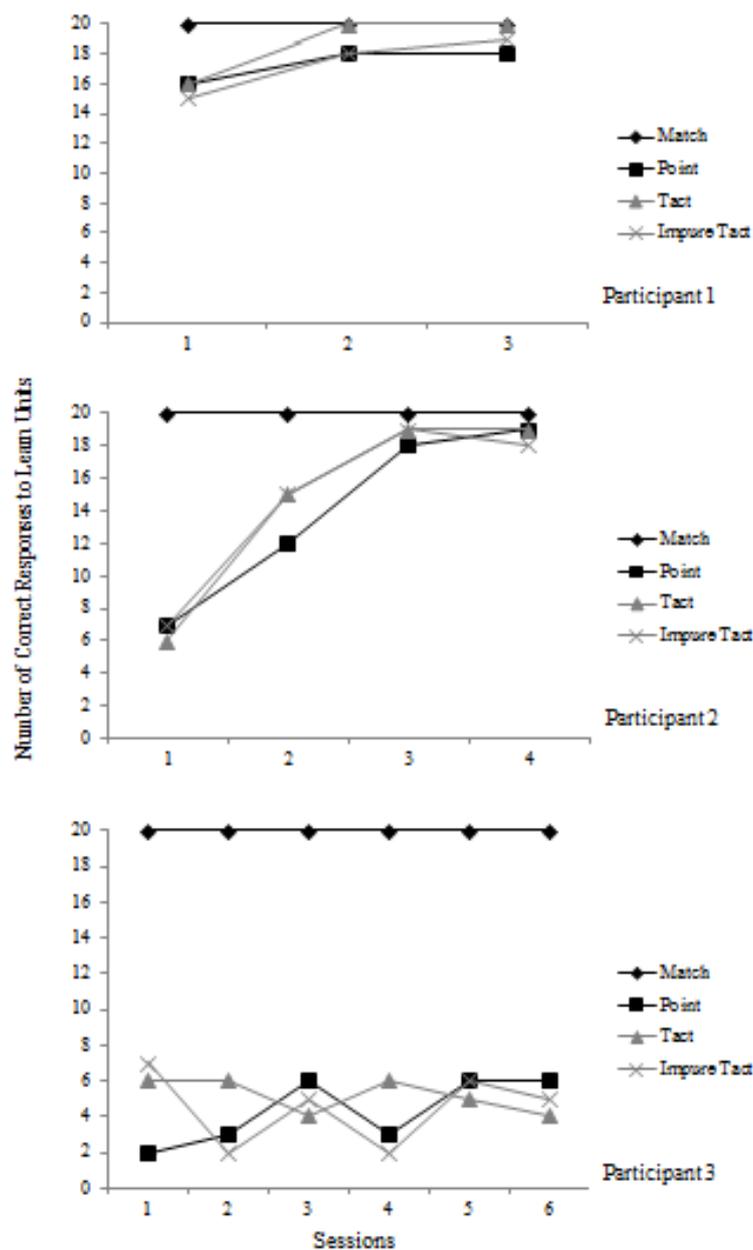


Figure 14: The results for the MEI procedure for Participants 1-3.

Discussion

The results showed that FIN was not induced by MEI for any of the participants. In contrast to Experiment 1, none of the participants produced a higher number of listener responses post-MEI compared to pre-MEI. However, one participant met the criteria for FIN prior to the implementation of the MEI procedure.

The potential of tests producing false negative scores. It is of interest that Participant 4 (the only participant with correct responses across all untaught behaviours in the initial test for FIN) achieved mastery criteria for FIN prior to the implementation of the MEI procedure. The participant showed ascending gains throughout the pre-intervention tests for FIN; however this raises the question whether the data from the initial test for FIN generated false negative scores (the participant had the behavioural cusp, but the test did not indicate it) or whether the fourth test data produced false positive scores (the participant did not have the behavioural cusp, but the test indicated it).

The effects of multiple testing. In addition, the impact of multiple testing may bear further consideration. It is possible that the additional MTS procedure preceding each test for FIN produced enough of an intensive language experience to induce FIN. Because this participant was exposed to the names of the items in the MTS procedure provided before each test for untaught behaviours, the combination of the fact he emitted correct responses in the initial test plus the cumulative impact of the language exposure may have led to the increase of correct responses prior to the intervention. Regardless, the participant did meet the criteria for FIN without needing to complete the MEI procedure.

Prerequisite behavioural cusps. Even with the additional MTS procedure prior to each test for FIN, Participants 1-3 did not meet the criteria for FIN. Interestingly, no correct speaker responses in the initial test for FIN were demonstrated for these three

participants. This raises the question of whether other prerequisite behavioural cusps, for example, at least *minimal* emergent speaker behaviour, need to be considered prior to using MEI to induce FIN.

Validity of the test for FIN. Across Experiments 1 and 2, none of the participants met the mastery criteria for FIN on the first test. One participant (Participant 4 in Experiment 2) met the criteria for FIN on the fourth test (when additional MTS procedures were presented prior to each test), but without being exposed to MEI. One question that surfaces through this analysis is whether the test for FIN is a valid measure. In order to begin to investigate the validity of the test for FIN, it would be informative to determine how neuro-typical individuals, who seemingly show evidence of FIN, respond to the test for FIN.

Sub-components of naming as prerequisites. The eight participants in Experiments 1 and 2 each showed evidence for the prerequisites for testing for FIN identified in Greer and Ross's (2008) VBBDT pre-reader pyramid of behavioural cusps (Figure 2 in Chapter 4). An additional question is whether there are more prerequisites necessary for the inducement of FIN. It was suggested in Chapter 4 that there are possibly different sub-components of naming, a bidirectional component and an incidental component. The bidirectional component was not specifically included in Greer and Ross's (2008) VBBDT pre-reader pyramid of behavioural cusps nor was it mentioned directly in the Verbal Behaviour Development Theory (VBBDT; Greer & Keohane, 2005; Greer & Ross, 2008; Greer & Speckman, 2009). Bidirectional naming may be a prerequisite to incidental naming for individuals diagnosed with autism. In review, the VBBDT only described one prerequisite stage of FIN (related to naming) and that was the 'speaker half of naming' or Speaker Incidental Naming. The VBBDT did not mention additional possible sub-components of naming. These possible missing

components of the VBDT may be accounted for by the six sub-components of naming discussed in Chapter 4.

Further experiments. Two additional experimental questions are analysed in the next two chapters of this thesis. Firstly, the test for FIN is analysed with fully verbal neuro-typical adults (Experiments 3-5). Secondly, older children and young adults diagnosed with autism, with evidence of the prerequisites to be tested for FIN, will be tested for all six components of naming to determine whether bidirectional naming is a prerequisite for incidental naming (Experiment 6).

Chapter 7

Examining the Test for Full Incidental Naming with Neuro-Typical Adults

Experiment 3

The purpose of Experiment 3 was to examine the test for Full Incidental Naming (FIN) with neuro-typical adults with fluent verbal behaviour.

Method

Participants and Setting. Eight neuro-typical adults, with fluent verbal behaviour, no prior experience of Multiple Exemplar Instruction (MEI) as an intervention procedure and who were naïve to the nature of the study, participated in Experiment 3. Participants were staff at the site where the school-aged participants in previous experiments attended school. Participation in the study was voluntary and participants were provided with an information sheet and consent form and were told they could withdraw from the study at any time. The school's Ethics Committee and the University of Kent's Ethics Committee approved the study. Signed, informed consent was obtained from the participants prior to commencing data collection. See Appendix B for an example information sheet and consent form.

One male and seven females, ranging from 21 to 25 years, participated in this experiment. The mean age was 23 years ($SD = 1.45$). Although there were no standardised test results available, there were no noted events in their instructional histories nor did the participants self-report any history with learning difficulties.

The study took place in an office measuring 6 metres by 6 metres. A large table and several chairs were in the office. Each participant sat at the table opposite the researcher.

Materials. Because the materials used in Experiment 1 were developed as contrived stimuli, the same materials were used for this study. Examples of all the stimuli used are shown in Appendix E. There were four sets of stimuli for the four

participants in Experiment 1 (one set of stimuli per participant). Pairs of participants in Experiment 3 used the same stimuli (i.e. four sets of stimuli were used across eight participants).

Procedure. Experiment 3 was an assessment for FIN. The procedure is illustrated in Figure 15. See Experiment 1 (Chapter 6) for a full description of the procedure (see page 108) which included initial tact probes, a match-to-sample (MTS) procedure and a test for untaught listener behaviour and untaught speaker behaviour (the test for FIN). If the participant scored 16/20 correct responses for untaught listener behaviour then criterion was met for Listener Incidental Naming (LIN). If the participant scored 16/20 correct responses for both untaught speaker behaviours (pure tact and impure tact) then criteria were met for Speaker Incidental Naming (SIN). If the participant met the criteria for LIN and also SIN then the criteria for FIN were met.

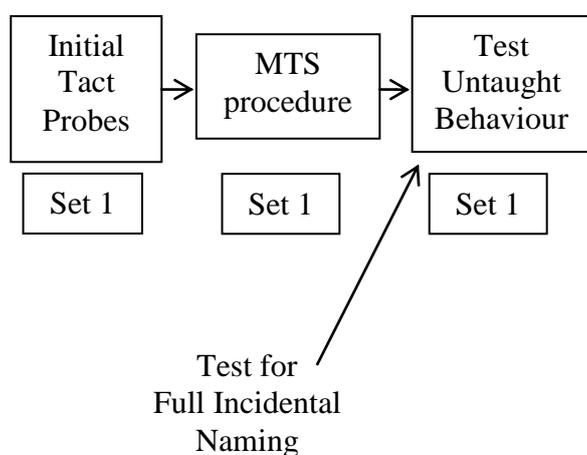


Figure 15: Procedure for Experiment 3.

Inter-observer agreement. Inter-observer agreement was conducted by the author of the current work and a second trained independent observer for 50% of all sessions. The TPRA (Teacher Performance Rate/Accuracy; Ingham & Greer, 1992; Ross, Singer-Dudek, & Greer, 2005) was utilised to collect IOA and procedural fidelity data. The TPRA measures the accuracy of the presentation of the antecedent and

consequence as well as participant responses. There was 100% accuracy regarding the presentation of the antecedent, therefore minimising procedural fidelity as an extraneous variable. The following formula was used to establish percentage of agreement across both observers: $\text{number of agreements} / (\text{number of agreements} + \text{number of disagreements}) \times 100 = \% \text{ of agreement}$ (Cooper, Heron, & Heward, 2007). The inter-observer agreement was 100% across all sessions.

Results

The results of the analysis conducted in Experiment 3 are shown in Figure 16. Correct responses of untaught listener and speaker behaviours, following the MTS procedure, are shown. The dotted horizontal line depicts the criteria level for FIN (16/20 correct responses across each of the untaught behaviours). Only four out of eight of the neuro-typical participants met the mastery criteria for FIN. Participants 1, 2, 4 and 8 met the criteria for FIN scoring at least 16/20 for untaught listener and speaker behaviours. Participant 3 produced the lowest scores with 10/20 correct responses for untaught listener behaviour; 6/20 and 7/20 correct responses for untaught speaker behaviour (impure tacts and tacts respectively). Participants 5, 6 and 7 met the criterion for LIN each scoring 20/20 for untaught listener behaviour. With regard to untaught speaker behaviour, Participant 5 scored 13/20 for the impure tacts and 12/20 for the pure tacts, Participant 6 scored 15/20 for the impure tacts and 12/20 for the pure tacts, and Participant 7 scored 15/20 for the impure tacts and 16/20 for the pure tacts. In summary, four participants met the criteria for FIN, three participants met the criterion for LIN, but not SIN (therefore, not FIN). One participant did not meet the criteria for FIN, SIN or LIN.

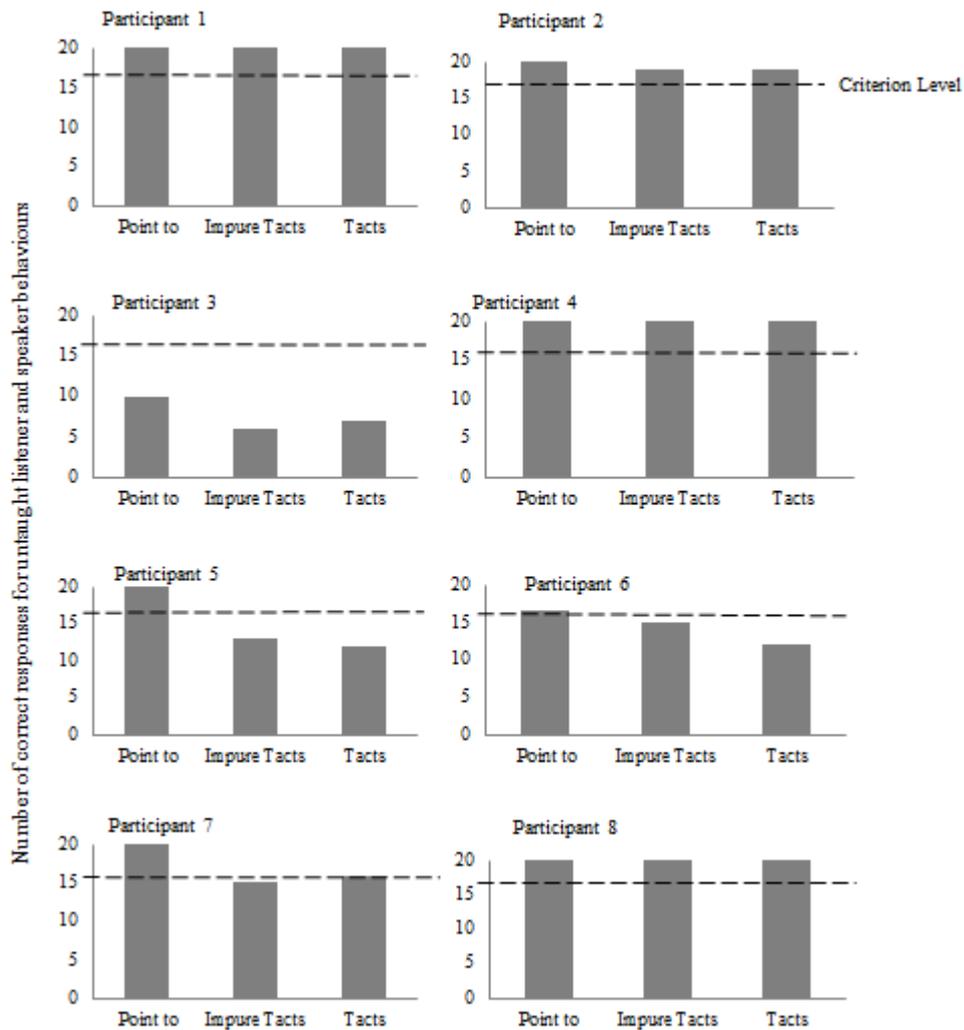


Figure 16: Results for Experiment 3 showing the number of correct responses for the untaught behaviours.

Discussion

The results showed that 50% of the neuro-typical adults did not meet the criteria for the test for FIN. Three out of these four adults met the criterion for LIN, and near criterion levels of responding for SIN were demonstrated. There could be several explanations for why neuro-typical adults who seemingly exhibit FIN did not demonstrate this experimentally. Although not likely, it is possible that some of these adults did not have a fully developed naming behavioural cusp. Or, it may be possible that the test designed to determine the presence of FIN is not a valid test for neuro-typical adults as their extensive learning histories may interfere with their responses.

The most parsimonious explanation may lie in the fact that the adult participants were not familiar with the type of instruction used in the tests for FIN. Thus, a consideration for conducting a second test may subvert this problem. These results provide a rationale for re-testing neuro-typical adults and continuing to use the additional MTS procedure established in Experiment 2.

Experiment 4

Two tests for FIN were conducted in Experiment 4 with a separate and unique group of neuro-typical adults with fluent verbal behaviour. The purpose of Experiment 4 was to explore whether exposing them to two tests, which were preceded by additional MTS procedures, supports individuals in meeting the criteria in the test for FIN. The test for FIN determines whether an individual can demonstrate emergent listener and speaker behaviour after being exposed to the names of contrived stimuli via a MTS procedure.

Method

Participants and Setting. The participants in Experiment 4 were unique from the participants in Experiment 3. Eight neuro-typical adults, with fluent verbal behaviour, no prior experience of MEI as an intervention procedure and who were naïve to the nature of the study, participated in Experiment 4. Participants were recruited in the same fashion as in Experiment 3. Six males and two females, ranging from 19 to 43 years, participated in this experiment. The mean age was 27 years ($SD = 8.90$).

Although there were no standardised test results available, there were no noted events in their instructional histories nor did the participants self-report any history with learning difficulties.

Participation in the study was voluntary and participants were provided with an information sheet and consent form and were told they could withdraw from the study at any time. See Appendix B for an example information sheet and consent form.

The study took place in the same setting as Experiment 3 and there was also ethical approval in place as per Experiment 3.

Materials. The same materials as in Experiment 1 were used for this study. Examples of all the stimuli used are shown in Appendix E. There were four sets of stimuli for the four participants in Experiment 1 (one set of stimuli per participant). Pairs of participants in Experiment 4 used the same stimuli (i.e. four sets of stimuli were used across eight participants).

Procedure. The procedure for Experiment 4 was the same as the procedure for Experiment 3 with the addition of a second test for FIN preceded by an additional MTS procedure as illustrated in Figure 17.

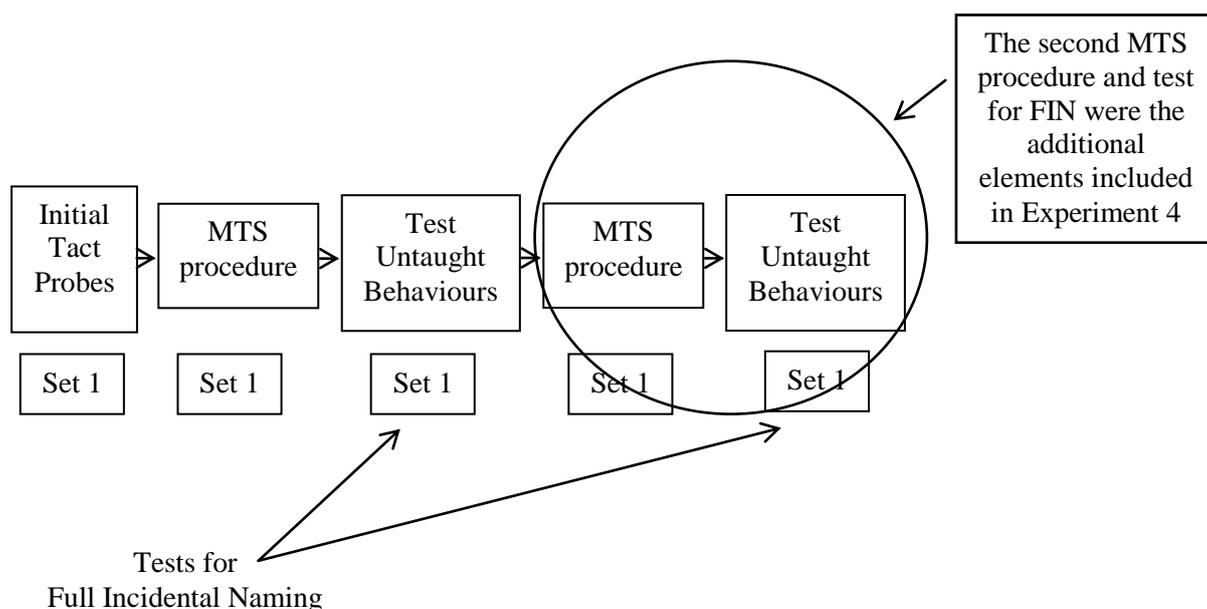


Figure 17: Procedure for Experiment 4.

The participants were tested for FIN on two occasions using the same set of contrived stimuli. Each test for FIN was preceded by a MTS procedure. If the participant scored 16/20 correct responses for untaught listener behaviour then criterion was met for LIN. If the participant scored 16/20 correct responses for both untaught

speaker behaviours (pure tact and impure tact) then criteria were met for SIN. If the participant met the criteria for LIN and also SIN then the criteria for FIN were met.

From herein, if participants scored less than 4 on the first 10 opportunities for untaught speaker behaviour then they were scored out of 10 rather than provided with 20 opportunities. The rationale supporting this decision was based on the design of the probes. For example, if an individual only scored 3 correct responses out of the first 10 opportunities then providing more opportunities without reinforcement or correction would not necessarily yield accurate results.

Inter-observer agreement. Inter-observer agreement was conducted by the author of the current work and a second trained independent observer for 25% of all sessions. The TPRA (Teacher Performance Rate/Accuracy; Ingham & Greer, 1992; Ross, Singer-Dudek, & Greer, 2005) was utilised to collect IOA and procedural fidelity data. The TPRA measures the accuracy of the presentation of the antecedent and consequence as well as participant responses. There was 100% accuracy regarding the presentation of the antecedent, therefore minimising procedural fidelity as an extraneous variable. The following formula was used to establish percentage of agreement across both observers: $\text{number of agreements} / (\text{number of agreements} + \text{number of disagreements}) \times 100 = \% \text{ of agreement}$ (Cooper et al., 2007). The inter-observer agreement was 100% across all sessions.

Results

The results of the study are shown in Figure 18. Correct responses of untaught listener and speaker behaviours are shown (following a MTS procedure). The responses to the left of the solid line followed the initial MTS procedure and the responses to the right of the solid line followed the second MTS procedure.

Seven out of the eight participants (Participants 2-8) met the criteria for FIN. One participant (Participant 1) did not meet the criteria for FIN on either test, but gains

were made on the second test for FIN. This participant met the criterion for LIN in both tests. Participant 1's score increased from 4/10 to 16/20 for the impure tacts, but only from 3/10 to 12/20 for the pure tacts which did not meet the criteria for FIN.

Participant 6 met the criteria for FIN on the first test therefore a second test for FIN was not conducted. The criteria for FIN for the first test were not met for the remaining six participants (Participants 2-5, 7 & 8), but criteria were met for the second test for FIN which was preceded by the second MTS procedure.

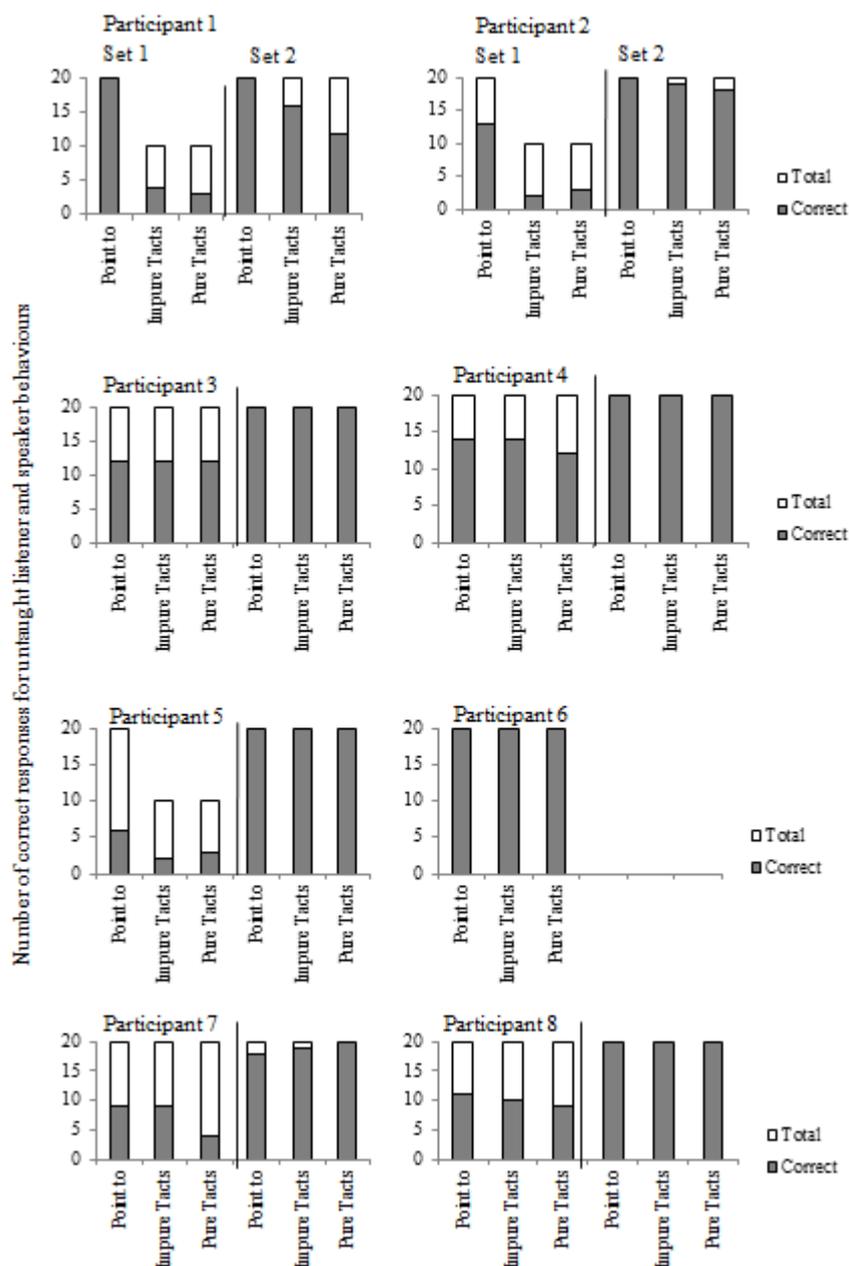


Figure 18: Results for Experiment 4: Number of correct responses for each of the untaught behaviours.

In summary, one participant met the criteria for FIN on the first test, one participant did not meet the criteria for FIN on the first or second test and six participants did not meet the criteria for FIN on the first test, but they met the criteria for FIN on the second test (following the second MTS procedure).

Discussion

Sixteen neuro-typical adults were tested for FIN in Experiments 3 and 4, and five of these adults met the criteria for FIN on the first test. Six of the eight participants in Experiment 4 met the criteria for FIN when the test was conducted a second time. The effectiveness of the second test for producing results that aligned with the individuals' current levels of verbal behaviour may support the notion that the administration of the second test, with the additional MTS procedure, is necessary to determine if FIN is present for an individual.

Interestingly, in Experiment 4, Participants 2-5, 7 and 8 did not meet the criterion for LIN in the first test for FIN. Furthermore, the correct responses in the first test for FIN were substantially below the criterion level for these six participants ranging from 6/20 to 14/20 for the untaught listener responses and ranging from 2/20 to 14/20 for the untaught speaker responses. It could be hypothesised that once the adults verbally mediated what was expected in the test for FIN the results of the second test for FIN were more reflective of their current repertoires.

The results of these experiments suggested that it may be beneficial to conduct two tests for FIN (each preceded by a MTS procedure) before it is determined whether an individual has met the criteria for FIN. One possible confounding variable that needs to be considered when conducting multiple tests in an experiment is the impact of practice effects on the dependent variable (FIN). This consideration led to the main rationale for Experiment 5. In order to address the potential impact of practice effects

Experiment 5 was designed to include all of the components of Experiment 4 and include a novel set of stimuli used for the second test for FIN (preceded by the MTS procedure). Using a novel set of stimuli potentially reduces the chance that the performance on the second test for FIN is a cumulative effect of multiple exposures to the content from the first test for FIN.

Experiment 5

The purpose of Experiment 5 was to test whether neuro-typical adults, with fluent verbal behaviour, met the criteria for FIN if tested on two occasions with different sets of contrived stimuli for each test for FIN. As with Experiment 4, each test for FIN was preceded by a MTS procedure.

Method

Participants and Setting. A separate and unique group of eight neuro-typical adults, with fluent verbal behaviour, no prior experience of MEI as an intervention procedure and who were naïve to the nature of the study, participated in Experiment 5. The participants were all females, ranging from 19 to 50 years. The mean age was 28 years ($SD = 12.01$). Although there were no standardised test results available, there were no noted events in their instructional histories nor did the participants self-report any history with learning difficulties.

Participation in the study was voluntary and participants were provided with an information sheet and consent form and were told they could withdraw from the study at any time. See Appendix B for an example information sheet and consent form.

The study took place in the same setting as Experiment 3 and there was also ethical approval in place as per Experiment 3.

Materials. The same materials as in Experiment 1 were used. Examples of all the stimuli used are shown in Appendix E. There were four sets of stimuli for the four participants in Experiment 1. Pairs of participants in Experiment 5 used the same stimuli

(i.e. four sets of stimuli were used across eight participants) and different stimuli (novel sets) were used for the second test for FIN (and the preceding MTS procedure).

As a reminder to the reader, a different novel set of stimuli were used for the second MTS procedure and second test for FIN in order to eliminate a possible confounding variable (the impact of practice effects on the test for FIN).

Procedure. The procedure for Experiment 5 was the same as the procedure for Experiment 4 with the addition of a novel set of contrived stimuli used in the second test for FIN (and the preceding MTS procedure) as illustrated in Figure 19. The participants were tested for FIN on 2 occasions using a different set of contrived stimuli for each test. If the participant scored 16/20 correct responses for untaught listener behaviour then criterion was met for LIN. If the participant scored 16/20 correct responses for both untaught speaker behaviours (pure tact and impure tact) then criteria were met for SIN. If the participant met the criteria for LIN and also SIN then the criteria for FIN were met.

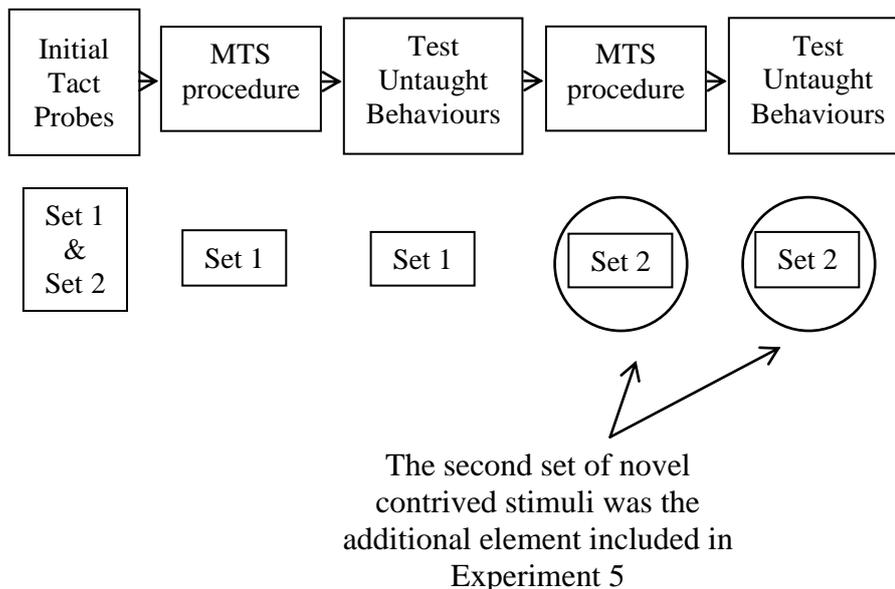


Figure 19: Procedure for Experiment 5.

Inter-observer agreement. Inter-observer agreement was conducted by the author of the current work and a second trained independent observer for 31% of all sessions. The TPRA (Teacher Performance Rate/Accuracy; Ingham & Greer, 1992; Ross, Singer-Dudek, & Greer, 2005) was utilised to collect IOA and procedural fidelity data. The TPRA measures the accuracy of the presentation of the antecedent and consequence as well as participant responses. There was 100% accuracy regarding the presentation of the antecedent, therefore minimising procedural fidelity as an extraneous variable. The following formula was used to establish percentage of agreement across both observers: $\text{number of agreements} / (\text{number of agreements} + \text{number of disagreements}) \times 100 = \% \text{ of agreement}$ (Cooper et al., 2007). The inter-observer agreement was 100% across all sessions.

Results

The results of the study are shown in Figure 20. Correct responses of untaught listener and speaker behaviours are shown (following a MTS procedure). The responses to the left of the solid line followed the initial MTS procedure and the responses to the right of the solid line followed the second MTS procedure.

Six of the eight participants (Participants 2-6 & 8) met the criteria for FIN. Two participants (Participants 1 & 7) did not meet the criteria for FIN on either test, but both participants made gains in each of untaught behaviour. Participant 1 scored 8/20 and then 14/20 for untaught listener behaviour. She scored 1/20 and 0/20 for untaught speaker behaviour (impure tacts and pure tacts respectively) for the first test for FIN. Then the scores for impure tacts and pure tacts increased to 4/20 and 4/20 respectively on the second test for FIN. Participant 7 met the criterion for LIN on both the first and second test for FIN. Her scores increased from 10/20 to 15/20 for impure tacts and 8/20 and 16/20 for pure tacts (criterion level for tacts on the second test for FIN).

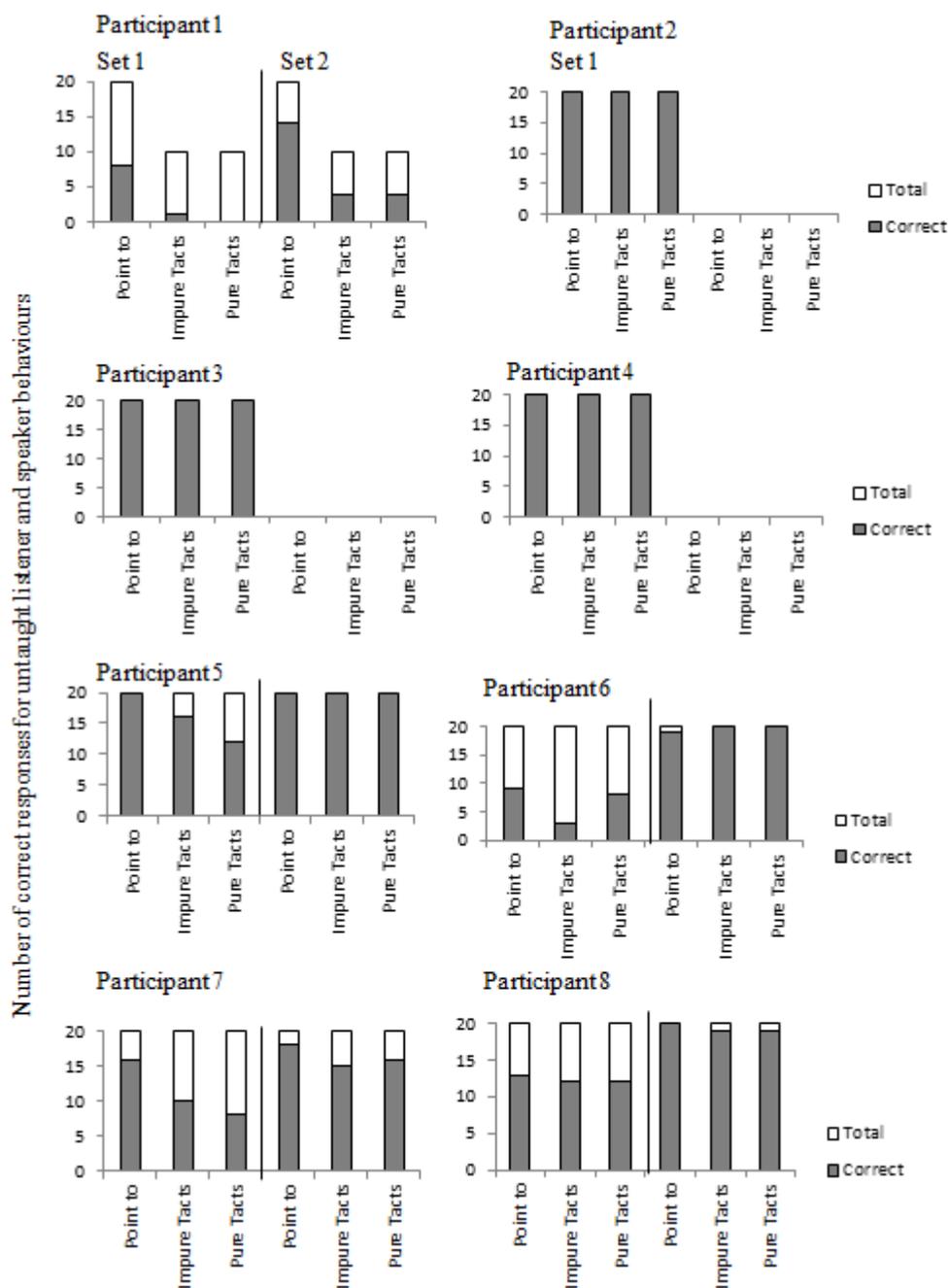


Figure 20: Results for Experiment 5: Number of correct responses for each of the untaught behaviours.

Three participants (Participants 2, 3 & 4) met the criteria for FIN on the first test therefore a second test for FIN was not conducted. The criteria for FIN was not met on the first test for the remaining three participants (Participants 5, 6 & 8), but criteria was met on the second test for FIN. Participant 5 met the criterion for LIN in the first and second test for FIN. The criterion was met for impure tacts (16/20) in the first test and

12/20 was scored for pure tacts in the first test. Participant 5 scored 20/20 across all untaught behaviours in the second test for FIN. Participant 6 scored 9/20 for the untaught listener behaviour in the first test for FIN and 3/20 and 8/20 for the untaught speaker behaviour (impure tacts and pure tacts respectively). These scores increased to 19/20 (listener behaviour), 20/20 (impure tacts) and 20/20 (pure tacts) in the second test for FIN. Participant 8 scored 13/20 for the untaught listener behaviour in the first test for FIN and 12/20 for both untaught speaker behaviours. These scores increased to 20/20 (listener behaviour), 19/20 (impure tacts) and 19/20 (tacts) in the second test for FIN.

Discussion

The rationale for this experiment was related to developing a second set of stimuli for the second test for FIN, thus reducing possible practice effects. Practice effects may have been a confounding variable if the second test for FIN would have resulted in noticeably different scores for individuals being exposed to the exact same content from the first test for FIN. In this case 6 out of 8 participants did make substantial gains in the second test for FIN, but since the stimuli used in the second test were different from the first test for FIN, the effects of practicing with the same stimuli were potentially negligible. Thus, the results from Experiment 5, in which different sets of stimuli were used in the tests for FIN, did not differ significantly from the results in Experiment 4 which used identical sets of stimuli for the tests. These comparable results indicated that testing using identical sets of stimuli did not magnify practice effects.

It was stated on page 51 that relational frame theorists view multiple exemplar training as a building block for language development. The repeated testing for FIN (with the additional MTS procedure) provides a type of multiple exemplar experience. The use of different stimuli for each test for FIN, as per Experiment 5, intensifies this multiple exemplar experience due to the increased number of exemplars included in the

procedure. Therefore, RFT theorists might hypothesise that it is possible for participants to meet the criteria for FIN through repeated testing with different stimuli for each test. This is an area that warrants further research.

General Discussion

Upon review of the data in Experiments 3-5, the results were somewhat unexpected because it was assumed that neuro-typical adults with fluent verbal behaviour would meet the criteria on the first test for FIN. Table 25 shows a summary of the results from the three experiments.

Table 25

Summary Scores for Participants in Experiments 3, 4 and 5

Participants who met criteria on first test for FIN		Participants who met criteria on second test for FIN (same stimuli)		Participants who met criteria on second test for FIN (different stimuli)	
Number	Percentage	Number	Percentage	Number	Percentage
8/24	33.33%	6/7	85.7%	3/5	60%

Table 25 shows that 33.33% of the 24 neuro-typical adults met the criteria for FIN on the first test. The criteria for FIN were met by 85.7 % of the participants on the second test when the same stimuli were used, whereas the criteria for FIN were met by 60% of the participants on the second test when different stimuli were used. Because the first test for FIN resulted in unexpectedly low correct responses for neuro-typical adults with well-established verbal behaviour, relying solely on one test to determine the presence of FIN is questionable. Thus, the first issue related to the test for FIN was associated with the limitations of determining the presence of FIN based on one test.

The second issue related to the test for FIN emanated from the concern that in the first test for FIN the participants did not have a history of instruction which included probes, learn units and trials. Without any clarifying instructions it may have made the test experience ambiguous and confusing. Thus, the results of the first test for FIN were

potentially false negatives. If this was a reasonable assumption then a second comparable test may yield more accurate findings.

The results of Experiments 3-5 informed the decision-making process for determining the procedures for future experiments. One of those decisions was related to the number of tests for FIN conducted prior to an intervention. Thus, two considerations emerged from the data in Experiments 3-5. One is the importance of conducting two tests for FIN prior to implementing an intervention and the other is related to questions that remain regarding the use of different stimuli for the first and second test for FIN. The use of a second (novel) set of stimuli did not appear to reflect the existing behavioural cusp of the adults as only 60% met the criteria for FIN on the second test. Thus, a decision was made to use the same stimuli twice because those results appeared to validate the performance of the adults.

Chapter 8

Testing Older Children and Young Adults Diagnosed with Autism for Six Sub-Components of Naming

Experiment 6

The results of Experiments 1 and 2 provided an opportunity to question whether there are more prerequisites necessary for the inducement of Full Incidental Naming (FIN). As Chapter 4 suggested, there are potentially different sub-components of naming, a bidirectional component and an incidental component. Bidirectional naming may be a prerequisite to incidental naming⁷ for individuals diagnosed with autism.

The purpose of Experiment 6 was to test older children and young adults diagnosed with autism and a learning disability, with evidence of the prerequisites to be tested for FIN, for all six sub-components of naming (Listener Bidirectional Naming (LBN), Speaker Bidirectional Naming (SBN), Full Bidirectional Naming (FBN), Listener Incidental Naming (LIN), Speaker Incidental Naming (SIN) and FIN) to determine whether bidirectional naming is a prerequisite for incidental naming and to determine whether listener naming is a prerequisite for speaker naming.

Method

Participants and Setting

The 8 participants who had already participated in Experiments 1 and 2 were selected for the study. Twelve additional individuals, also with a diagnosis of autism, were participants in this study; thus there were 20 participants in total. According to the Verbal Behaviour Development Theory (VBDT) pre-reader pyramid of behavioural cusps (Greer & Ross, 2008; Figure 2 in Chapter 4), each of the participants showed evidence of the prerequisites assumed to be needed for inducing FIN. That is, each

⁷ The broader terms of bidirectional naming and incidental naming are used when the category of bidirectional naming or incidental naming is being referred to (see Figure 5 in Chapter 4). For clarity purposes, bidirectional naming includes LBN, SBN and FBN and incidental naming includes LIN, SIN and FIN.

participant met the criteria for the prerequisite behavioural cusps for the ‘speaker component of naming’ which is synonymous with SIN. Thus, according to the VBDT, this stage provides an optimal opportunity for individuals to be tested for FIN and, if not present, it may be induced. To clarify, all participants met the mastery criteria for the prerequisite behavioural cusps of echoic-to-tact, independent mands and transformation of establishing operations across mands and tacts. All pupils at the school were systematically tested for the suggested prerequisite behavioural cusps. The procedures for testing for these behavioural cusps are outlined in the VBDT and are summarised in Table 17 (Experiment 1). The next set of 12 children or young adults within the school to meet these prerequisites were selected for Experiment 6 along with the participants from Experiments 1 and 2.

Table 26 provides an overview of the participants’ characteristics. This includes information about each participant’s age (reported in years (y) and months (m)), gender, number of years as a pupil in the school (reported in years (y) and months (m)), level of learning disability and national curriculum levels for speaking and listening (see Appendix B for an explanation of these levels). Additional speech and language therapy test scores (see Appendix C for an explanation of these test results) are presented in Table 27. A ‘-’ on Table 27 denotes that the participant was not tested.

The study took place in an independent day school for children and young adults aged 4-19 years diagnosed with autism. Experiment 1 provided a fuller overview of the setting which was identical for this experiment. The school’s Ethics Committee and the University of Kent’s Ethics Committee approved the study. Signed, informed consent was obtained from participants’ parents prior to commencing data collection.

There were one female and nineteen male participants. The age range across the 20 participants was 6 years 3 months to 18 years 5 months. Their mean age was 13 years 9 months ($SD = 3.29$). Their duration in the current setting ranged from 6 months

to 10 years 6 months with a mean duration of 4 years 6 months. Their national curriculum levels ranged from P5.2 to 2B.8.

Table 26

Participants' Characteristics

Participant	Age	Gender	Duration in Current Setting	Level of Learning Disability	National Curriculum Levels Achieved	
					Eng (Speaking)	Eng(Listening)
A	15y, 3m	Male	2y, 7m	Moderate	3.4	3.4
B	12y, 0m	Male	0y, 6m	Moderate	P6.6	P6.6
C	10y, 3m	Male	3y, 6m	Moderate	1B.8	1B.8
D	6y, 9m	Male	1y, 1m	Moderate	P7.2	P7.2
E	6y, 3m	Male	1y, 1m	Moderate	P5.2	P4.8
F	18y, 5m	Female	6y, 6m	Severe	3.6	3.6
G	14y, 3m	Male	2y, 1m	Severe	2C.4	2C.4
H	11y, 9m	Male	7y, 2m	Severe	2C.6	2C.2
I	16y, 0m	Male	4y, 6m	Severe	3.8	3.8
J	15y, 0m	Male	9y, 4m	Moderate	2A	2A
K	11y, 0m	Male	3y, 6m	Moderate	1C.8	1C.8
L	16y, 0m	Male	6y, 2m	Severe	P7.4	P8.6
M	17y, 3m	Male	9y, 6m	Moderate	3.6	3.6
N	14y, 6m	Male	2y, 0m	Moderate	2B.8	2B.8
O	15y, 5m	Male	4y, 4m	Severe	P6.4	P7.2
P	17y, 1m	Male	5y, 6m	Severe	2B.6	2B.6
Q	10y, 10m	Male	2y, 8m	Severe	P5.4	P5.6
R	15y, 5m	Male	10y, 6m	Severe	P6.4	P6.6
S	17y, 0m	Male	5y, 6m	Severe	1A.8	1A.8
T	13y, 5m	Male	1y, 6m	Severe	P5.6	P6.2

Table 27

Speech and Language Therapy Test Scores

Participant	DLS Score			TALC Score			
	2-word level	3-word level	4-word level	Level 1 Naming	Level 2 Describing	Level 3 Re-telling	Level 4 Justifying
A	-	-	-			94%	72%
B	88%	81%	47%	100%	61%	35%	N/A
C		100%	72%	100%	100%	88%	61%
D			62%	100%	61%	65%	36%
E	72%	54%	31%	-	-	-	-
F	-	-	-	-	-	-	-
G		90%	68%	100%	72%	59%	39%
H	-	-	-	100%	88%	82%	27%
I	-	-	-		94%	94%	97%
J	-	-	-			100%	72%
K	-	-	-	100%	88%	100%	72%
L			86%	100%	72%	65%	0%
M	-	-	-	-	-	-	-
N	-	-	-		77%	82%	88%
O	-	-	-	-	-	-	-
P			86%	83%	66%	58%	0%
Q	72%			83%	44%	0%	N/A
R		72%		83%	5%	N/A	N/A
S			72%	83%	66%	52%	N/A
T	86%	54%		-	-	-	-

Materials

New sets of contrived two-dimensional stimuli were developed for Experiment 6. Each set consisted of five contrived symbols with five contrived names. The contrived names were all consonant-vowel-consonant (CVC) words. The sets did not contain rhyming words or words with the same starting or end consonants. Examples of all the stimuli used are shown in Appendix A. There were multiple exemplars of each of the stimuli within each set (e.g. stimuli of different sizes, colours and fonts). Individualised sets of stimuli were specific to each participant. Each participant used a different set of stimuli from the stimuli used in previous experiments and a different set of stimuli was used for each test for naming.

Procedure

Three tests for naming were conducted and each test used a different procedure:

Test for Listener Bidirectional Naming (LBN). The diagram in Figure 21 illustrates the procedure for this test. Speaker behaviour was taught initially. Each symbol was taught as a pure tact using learn units (Greer, 2002; Greer & McDonough, 1999). This involved presenting the symbol to the participant without a vocal antecedent. Correct responses were reinforced and scored as a '+' Non-responses (no response within 5-7 seconds of presenting the antecedent) and incorrect responses were corrected with an echoic of the name of the symbol which the participant repeated before the presentation of the next learn unit. These non-responses and incorrect responses were scored as a '-' and no reinforcement was provided. Criterion was set at 18/20 correct responses to learn units over two consecutive sessions. Once the criterion was met the participant was tested for untaught listener behaviour. The test involved presenting the same five stimuli to the participant (in a field size of five) and saying, "Point to (name of symbol)." No reinforcement or corrections were provided. Twenty trials were conducted (four for each stimulus).

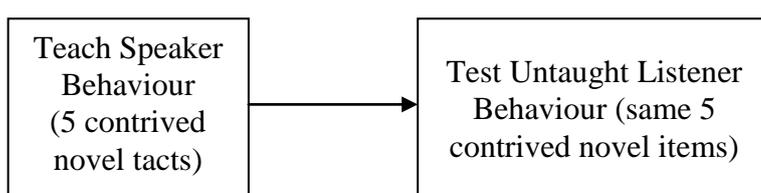


Figure 21: Procedure for the Test for Listener Bidirectional Naming (LBN).

If the participant scored 16/20 correct responses for untaught listener behaviour then the mastery criterion for LBN was met.

Test for Speaker Bidirectional Naming (SBN). The diagram in Figure 22 illustrates the procedure for this test. Listener behaviour was taught initially (using a

different set of stimuli to the previous test for naming). Each symbol was taught as a 'point to' response using learn units. The five stimuli were presented in front of the participant and the experimenter provided the vocal antecedent, "Point to (name of symbol)." Correct responses were reinforced and scored as a '+.' If the participant emitted an incorrect response or a non-response then the experimenter gestured to the correct symbol and the participant was required to imitate this action. Incorrect responses and non-responses were scored as a '-' and no reinforcement was provided for these. Criterion was set at 18/20 correct responses to learn units over two consecutive sessions. Once this criterion was met the participant was tested for untaught speaker behaviour. This involved presenting the symbol to the participant without a vocal antecedent. During this test for untaught speaker behaviour, no reinforcement or corrections were provided. Twenty trials were conducted (four for each stimulus).

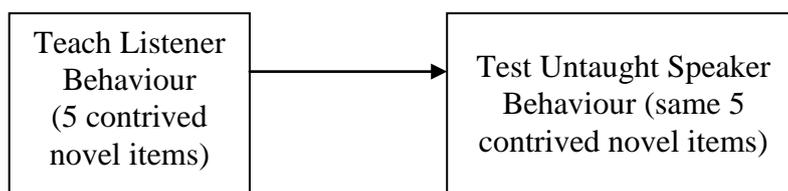


Figure 22: Procedure for the Test for Speaker Bidirectional Naming (SBN).

If the participant scored 16/20 correct responses for untaught speaker behaviour then the mastery criterion for SBN was met. If the participant met the mastery criteria for LBN and also SBN then the mastery criteria for FBN was met.

Test for Full Incidental Naming (FIN). The diagram in Figure 23 illustrates the procedure for this test. The first element of the procedure was a match-to-sample (MTS) session where each participant was taught to match stimuli in a field size of five following the vocal antecedent, "Match (name) with (name)." The field size of five included one exemplar of each stimulus from the set. A different set of stimuli were

used compared to the previous two tests. The position of the stimuli within the field size was changed for every presentation and alternate exemplars of the stimuli were rotated. Correct responses were vocally reinforced and incorrect responses were corrected by the researcher. This correction involved repeating the vocal antecedent, “Match (name),” and modeling the correct response for the participant to imitate. Corrected responses were not reinforced. The criterion for the MTS procedure was 18/20 correct responses over two consecutive sessions.

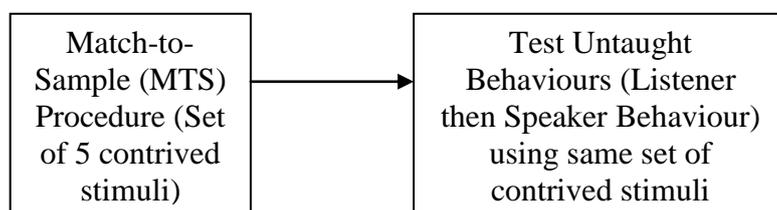


Figure 23: Procedure for the Test for Full Incidental Naming (FIN).

Once this criterion for the MTS procedure was met, each participant was tested for untaught behaviours of the ‘point to’ (listener) response (stimulus presented in a field size of 5 and the vocal antecedent, “Point to (name)”), impure tact (stimulus presented along with vocal antecedent, “What’s this?”) and pure tact (stimulus presented; no vocal antecedent).

If the participant scored 16/20 correct responses for untaught listener behaviour then the criterion for LIN was met. If the participant scored 16/20 correct responses for both untaught speaker behaviours (pure tact and impure tact) then the criteria for SIN were met. If the participant met the criteria for LIN and also SIN then the criteria for FIN were met.

Inter-Observer Agreement

A total of 60 tests for naming were conducted (three for each participant) and inter-observer agreement was completed for 17 of these tests (28% of sessions). The TPRA (Teacher Performance Rate/Accuracy; Ingham & Greer, 1992; Ross, Singer-Dudek, & Greer, 2005) was utilised to collect IOA and procedural fidelity data. The TPRA measures the accuracy of the presentation of the antecedent and consequence as well as participant responses. There was 100% accuracy regarding the presentation of the antecedent, therefore minimising procedural fidelity as an extraneous variable. Inter-observer agreement was calculated as 96% overall, ranging from 73-100%.

Results

The results of the study are shown in Table 28. The results have been ordered by the six sub-components of naming. Those participants showing evidence of FIN were listed first followed by those with SIN, LIN, FBN, SBN and LBN. In Table 27, a highlighted 'yes' indicated that criteria for FBN or FIN were met. A 'no' indicated the criteria were not met. An asterisk (*) was added if the criterion was not met on the teaching procedure, i.e. a test for untaught listener or speaker behaviour was not conducted. The actual scores for each of the tests of untaught behaviours are included in Table 27 and were highlighted if the criterion was met. The column for SIN includes two scores, one for the impure tacts and one for the pure tacts. If the participant scored below 5 for these tests then only 10 opportunities to respond were provided rather than 20.

Table 28

Participant Scores for each Test for Naming

Participant	LBN	SBN	FBN	LIN	SIN	FIN
A	20/20	14/20	NO	18/20	17/20 & 16/20	YES
B	19/20	7/20	NO	19/20	20/20 & 20/20	YES
C	20/20	16/20	YES	20/20	7/20 & 5/20	NO
D	20/20	20/20	YES	9/20	9/20 & 10/20	NO
E	20/20	17/20	YES	11/20	7/20 & 4/20	NO
F	20/20	20/20	YES	8/20	4/10 & 4/10	NO
G	20/20	20/20	YES	5/20	0/10 & 0/10	NO
H	12/20	17/20	NO	2/20	2/10 & 0/10	NO
I	18/20	15/20	NO	5/20	0/10 & 0/10	NO
J	20/20	12/20	NO	7/20	1/20 & 0/20	NO
K	20/20	3/20	NO	4/20	0/20 & 0/20	NO
L	20/20	0/20	NO	1/20	0/10 & 0/10	NO
M	20/20	N/A*	NO	2/20	0/10 & 0/10	NO
N	N/A*	8/20	NO	5/20	4/10 & 3/10	NO
O	N/A*	8/20	NO	5/20	0/10 & 0/10	NO
P	N/A*	N/A*	NO	2/20	0/10 & 0/10	NO
Q	N/A*	N/A*	NO	2/20	0/10 & 0/10	NO
R	N/A*	N/A*	NO	4/20	0/10 & 0/10	NO
S	N/A*	N/A*	NO	5/20	0/10 & 0/10	NO
T	N/A*	N/A*	NO	4/20	0/10 & 0/10	NO

More of the participants met the criterion for bidirectional naming compared to the criterion for incidental naming, but Participants A and B met the criterion for FIN but not SBN (therefore not FBN). Only Participants A and B met the mastery criteria for the test for FIN and not FBN. Both met the mastery criterion for LBN. Participant A scored 14/20 correct responses for SBN (the criterion is 16/20 correct responses). Participant B scored 7/20 correct responses in the test for SBN. The incorrect responses were due to ambiguity of the responses. The participant tended to respond with approximations of the names of the stimuli, e.g. “mop” for “moop” and “kock” for “kong.” These were scored as incorrect responses, but were consistent throughout therefore could be considered to be a false negative. Due to this discrepancy Participants A and B were tested for SBN again.

Participant H met the criterion for SBN but not for LBN. The participant scored 12/20 correct responses in the test for LBN. The participant consistently confused two

of the stimuli and scored 100% accuracy for the remaining three stimuli. These data may therefore also be a false negative because untaught behaviour did emerge, but not necessarily at the pre-determined experimental criterion level. This participant was tested for LBN again.

Re-Tests for Participants A, B and H

Participant A was re-tested for SBN using a novel set of stimuli. He scored 13/20 correct responses to untaught speaker behaviour showing very similar results to the results in the original test (14/20 correct responses). Even with the second test, he did not meet the criterion for SBN (and therefore FBN) despite meeting the criterion for FIN in the first test.

Participant B was re-tested for SBN using a novel set of stimuli. He scored 19/20 correct responses for untaught speaker behaviour. With the second test he met the criterion for SBN (and therefore FBN).

Participant H was re-tested for LBN using a novel set of stimuli. He scored 20/20 correct responses to untaught listener behaviour. With the second test he met the criterion for LBN (and therefore FBN). Results for Experiment 6 are presented again in Table 29 with the updated scores for Participants A, B and H included.

Table 29

Updated Participant Scores for each Test for Naming

Participant	LBN	SBN	FBN	LIN	SIN	FIN
A	20/20	13/20	NO	18/20	17/20 & 16/20	YES
B	19/20	19/20	YES	19/20	20/20 & 20/20	YES
C	20/20	16/20	YES	20/20	7/20 & 5/20	NO
D	20/20	20/20	YES	9/20	9/20 & 10/20	NO
E	20/20	17/20	YES	11/20	7/20 & 4/20	NO
F	20/20	20/20	YES	8/20	4/10 & 4/10	NO
G	20/20	20/20	YES	5/20	0/10 & 0/10	NO
H	20/20	17/20	YES	2/20	2/10 & 0/10	NO
I	18/20	15/20	NO	5/20	0/10 & 0/10	NO
J	20/20	12/20	NO	7/20	1/20 & 0/20	NO
K	20/20	3/20	NO	4/20	0/20 & 0/20	NO
L	20/20	0/20	NO	1/20	0/10 & 0/10	NO
M	20/20	N/A*	NO	2/20	0/10 & 0/10	NO
N	N/A*	8/20	NO	5/20	4/10 & 3/10	NO
O	N/A*	8/20	NO	5/20	0/10 & 0/10	NO
P	N/A*	N/A*	NO	2/20	0/10 & 0/10	NO
Q	N/A*	N/A*	NO	2/20	0/10 & 0/10	NO
R	N/A*	N/A*	NO	4/20	0/10 & 0/10	NO
S	N/A*	N/A*	NO	5/20	0/10 & 0/10	NO
T	N/A*	N/A*	NO	4/20	0/10 & 0/10	NO

Discussion

It is difficult to determine from Table 29 whether bidirectional naming is a prerequisite for incidental naming. More of the participants met the criteria for FBN compared to the criteria for FIN, but Participant A met the criteria for FIN but not SBN (therefore not FBN). Seven participants (Participants B-H) met the criteria for FBN and two participants (Participants A & B) met the criteria for FIN. This implies that FBN could be a prerequisite for FIN because more participants met the criteria for FBN than FIN. Thus, for Participants C-H an opportunity existed to implement the Multiple Exemplar Instruction (MEI) procedure and test its effects on FIN and this was the impetus for Experiment 7.

Thirteen participants (Participants A-M) met the criterion for LBN compared to seven participants (Participants B-H) for SBN. These results imply that LBN may be a prerequisite for SBN.

The data showed that Participants N-T required additional instruction with tact training before a test for naming could be conducted. Thus, these data demonstrated that these participants may not have the prerequisite skills to be considered for this study. These data highlighted that a more developed tact repertoire is also a potential prerequisite for inducing FIN. This is somewhat evident of a possible missing element in the VBBDT pre-reader pyramid of behavioural cusps (Greer & Ross, 2008) as these participants initially demonstrated that the prerequisites were met for this study.

Participants I-M all met the criterion for LBN, but not the criteria for SBN. MEI needs to be considered as a procedure to induce FBN for these four participants before targeting FIN. The score for Participant I was very close to criterion level (15/20); therefore this participant could be tested again prior to implementing MEI. If the participant meets the criterion then this participant should join the previous group (Participants C-H) and MEI should be considered to induce FIN.

The testing procedures completed in Experiment 6 allowed for the organisation of the participants based on prerequisites outlined in Chapter 4 and suggested in previous research by Horne and Lowe (1996) and Greer and Ross (2008). This process allowed the experimenter to determine which of the participants appeared to be best candidates suited for receiving intervention procedures to induce FIN. Because the preponderance of research emphasised the use of MEI to induce FIN with younger children with and without autism it was decided the use of MEI with older individuals with autism to induce FIN was the most parsimonious next step in the experimental sequence. Thus, the use of MEI to induce FIN set the stage for the next experiment.

Chapter 9

Using Multiple Exemplar Instruction to Induce Full Incidental Naming or Full Bidirectional Naming in Older Children and Young Adults Diagnosed with Autism

Experiment 7

Experiment 7 was a partial replication of Experiment 2. In both Experiments 2 and 7, Multiple Exemplar Instruction (MEI) was used to induce Full Incidental Naming (FIN) in older children and young adults diagnosed with autism. As with Experiment 2, match-to-sample (MTS) procedures were implemented prior to each test for FIN in order to address the span of time between the initial exposure to the stimuli names and the post-MEI test for FIN. The results of Experiment 2 showed that FIN was not induced by MEI for any of the participants. One explanation for these results was that the participants did not demonstrate sufficient prerequisites for FIN. The purpose of Experiment 6 was to account for the prerequisites by testing participants for the six sub-components of naming (Listener Bidirectional Naming (LBN), Speaker Bidirectional Naming (SBN), Full Bidirectional Naming (FBN), Listener Incidental Naming (LIN), Speaker Incidental Naming (SIN) and FIN).

It was hypothesised that FBN was a prerequisite for FIN as FBN was conceivably a foundational behavioural cusp to FIN. To illustrate, FBN involves demonstrating untaught emergent verbal behaviour. A test for FBN includes both direct teaching of listener behaviour to an individual followed by a subsequent test for corresponding emergent speaker behaviour *and* direct teaching of speaker behaviour to that same individual followed by a subsequent test for corresponding emergent listener behaviour. In contrast, FIN involves demonstrating untaught emergent verbal behaviour *without* direct teaching. A test for FIN involves exposing individuals to the names of novel items and then demonstrating the emergence of *both* untaught listener behaviour

and untaught speaker behaviour following that exposure. This sequence illustrates that FBN is foundational to FIN so it is plausible that FBN is a prerequisite for FIN.

The participants were selected for Experiment 7 based on the results from Experiment 6. Six children and young adults diagnosed with autism met the criteria for FBN, but not FIN, in Experiment 6 and these participants were selected for Experiment 7. These were Participants C-H in Experiment 6 and the same letter names are used to denote the same participants in Experiment 7. The purpose of Experiment 7 was to test the effects of MEI on the acquisition of FIN in older children and young adults diagnosed with autism who met the mastery criteria for FBN (the suggested prerequisite for FIN).

Method

Participants and setting. Six children and young adults participated in this study each with a diagnosis of autism and a learning disability. According to the Verbal Behaviour Development Theory (VBDT) pre-reader pyramid of behavioural cusps (Greer & Ross, 2008; Figure 2 in Chapter 4, page 53), all of the participants showed evidence of the prerequisites needed for inducing FIN. That is, each participant met all of the criteria for the prerequisite behavioural cusps for the ‘speaker component of naming’ which is synonymous with SIN. Furthermore the participants were selected based on the results of Experiment 6. These participants met the mastery criteria for FBN in Experiment 6 (Participants C-H in Experiment 6). To clarify, all participants met the mastery criteria for the prerequisite behavioural cusps of echoic-to-tact, independent mands and transformation of establishing operations across mands and tacts. They had previously been tested for each of the behavioural cusps described in the VBDT and were selected for this study based on meeting the criteria for the three prerequisite behavioural cusps listed above.

Table 30 provides an overview of the participants' characteristics. This includes information about each participant's age (reported in years (y) and months (m)), gender, number of years as a pupil in the school (reported in years (y) and months (m)), level of learning disability and national curriculum levels for speaking and listening (see Appendix C for an explanation of these levels). Additional speech and language therapy test scores (see Appendix D for an explanation of these test results) are presented in Table 31. A '-' on Table 31 denotes that the participant was not tested.

Table 30

Participants' Characteristics

Participant	Age	Gender	Duration in Current Setting	Level of Learning Disability	National Curriculum Levels Achieved	
					Eng (Speaking)	Eng(Listening)
C	10y, 9m	Male	4y, 1m	Moderate	2C.4	2C.4
D	7y, 3m	Male	1y, 8m	Moderate	1B.6	1B.6
E	6y, 9m	Male	1y, 8m	Moderate	P5.2	P5.6
F	18y, 11m	Female	7y, 1m	Severe	3.6	3.6
G	14y, 9m	Male	2y, 6m	Severe	2C.4	2C.4
H	12y, 3m	Male	7y, 9m	Severe	2B	2B

Table 31

Speech and Language Therapy Test Scores

Participant	DLS Score			TALC Score			
	2- word level	3- word level	4- word level	Level 1 Naming	Level 2 Describing	Level 3 Re-telling	Level 4 Justifying
C		100%	72%	100%	100%	88%	61%
D			68%	100%	61%	65%	36%
E	72%	54%	31%	-	-	-	-
F	-	-	-	-	-	-	-
G		90%	68%	100%	83%	71%	44%
H	-	-	-	100%	88%	82%	27%

There were one female and five male participants. Their ages ranged from 6 years 9 months to 18 years 11 months. Their mean age was 11 years 3 months (SD = 4.25). Their duration in the current setting ranged from 1 year 8 months to 7 years 9

months with a mean duration of 4 years 2 months. Their national curriculum levels ranged from P5.2 to 3.6.

The study took place in an independent day school for children and young adults aged 4-19 years diagnosed with autism. Experiment 1 provided a fuller overview of the setting which was identical for this experiment (see page 107). The school's Ethics Committee and the University of Kent's Ethics Committee approved the study. Signed, informed consent was obtained from participants' parents prior to commencing data collection.

Materials. A set of contrived two-dimensional stimuli were used to test for FIN and a different set was used for the teaching sequences within the MEI procedure. Each set consisted of five contrived symbols with five contrived names. The contrived names were all consonant-vowel-consonant (CVC) words. The sets did not contain rhyming words or words with the same starting or end consonants. Examples of all the stimuli used are shown in Appendix E. There were multiple exemplars of each of the stimuli within each set (e.g. stimuli of different sizes, colours and fonts). Individualised sets of stimuli were specific to each participant. Each participant used a different set of stimuli from the stimuli used in previous experiments.

Procedure. The procedure replicated the experimental sequence in Experiment 2 with one exception. A delayed multiple probe design was utilised instead of a multiple probe design. This modification resulted in each participant receiving only two or three pre-MEI tests for FIN. A summary of the procedure is provided below and a full description can be found in Chapter 6. The diagram in Figure 24 illustrates the experimental procedure.

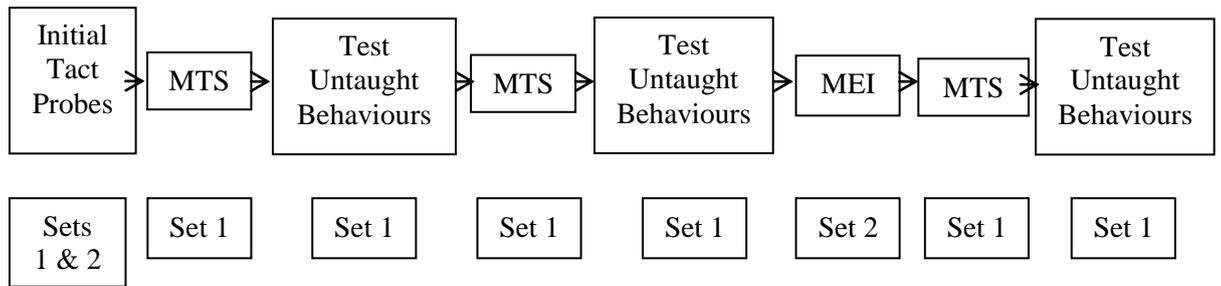


Figure 24: Experimental procedure for Experiment 7.

Initial tact probes. Initial tact probes were conducted with each participant for a set of stimuli (five tacts for each participant; one for each contrived stimulus) to provide evidence that the participants had limited prior direct or indirect experience with the stimuli. Each symbol was presented to each participant without a vocal antecedent and feedback was not provided for correct or incorrect responses. Each stimulus was probed once. If the participants did not respond or produced an incorrect response then these stimuli were selected for the experimental sets. For each participant two experimental sets were selected (one for the tests for FIN and one for the MEI procedure). Each experimental set contained five stimuli.

Match-to-sample (MTS) procedure. Using one of the experimental sets of stimuli, e.g. Set 1, presented in a field size of five, each participant was exposed to a MTS procedure. Following the vocal antecedent, “Match (name),” and presentation of a matching stimulus, the participant was required to visually match the stimuli. Correct responses were vocally reinforced and incorrect responses were corrected by the researcher. This part of the study continued until the participant met the criterion of 18/20 correct responses over two consecutive sessions or 20/20 correct responses in one session.

Test for FIN (test for untaught listener and speaker behaviour). Once the predetermined criterion level of responding for matching was achieved, a test for FIN occurred (untaught listener and untaught speaker behaviour). Untaught listener

behaviour was tested first. This test consisted of instructing the participant to “point to ___” using the same items that were used in the matching session. The five stimuli within the set were presented to the participant. Once the test for untaught listener behaviour was completed, the corresponding untaught speaker behaviour was tested in the form of an impure tact (stimulus presented along with vocal antecedent, “What’s this?”) and a pure tact (stimulus presented; no vocal antecedent). If the participant scored 80% correct responses across untaught listener and speaker behaviour then FIN was demonstrated. Alternatively, if 80% accuracy was scored across untaught listener behaviour, but not untaught speaker behaviour then LIN was shown. However, if 80% accuracy was scored across untaught speaker behaviour, but not untaught listener behaviour then SIN was demonstrated.

The MTS procedure and tests for untaught listener and speaker behaviours were repeated for each participant. For Participants D, C and G the MTS procedure and tests for untaught listener and speaker behaviours were repeated a third time.

Multiple exemplar instruction (MEI) procedure. In accordance with multiple probe design logic, the first participant then entered the intervention phase (MEI procedure) while the remaining three participants were tested for untaught behaviours a third time. Once the intervention phase was completed for the first participant, the second participant entered this intervention phase while the remaining participants were tested for untaught behaviours a fourth time.

The intervention phase consisted of MEI across four behaviours with a novel set of stimuli (e.g. Set 2). The participants were required to match, point to and produce a pure tact and impure tact for each stimulus in a randomly rotated format. See Experiment 1 in Chapter 6 (page 105) for a full description of the MEI procedure.

Post-MEI test for FIN. Once the mastery criteria were met on the MEI procedure, a post-MEI test for FIN was conducted with the original set of stimuli (e.g.

Set 1) testing for the three untaught behaviours (listener behaviour, pure tacts and impure tacts). The MTS procedure preceded this post-MEI test for FIN (as in Experiment 2 in Chapter 6).

Design. A delayed multiple probe design (Horner & Baer, 1978) was used to test for the acquisition of FIN. This involved each participant receiving initial tact probes, the MTS procedure and tests for untaught behaviours in a delayed format. The participants were allocated to the intervention phase in random order. For example, Participant F was exposed to MEI while Participant H was tested for FIN. Once Participant F had completed the intervention phase (MEI), Participant H entered the intervention phase while Participant E was tested for FIN. This sequence continued for all six participants in order to isolate whether MEI induced FIN.

Inter-observer agreement. Inter-observer agreement was conducted by the author of the current work and a second trained independent observer for 35% of all sessions (probe and MEI sessions). The TPRA (Teacher Performance Rate/Accuracy; Ingham & Greer, 1992; Ross, Singer-Dudek, & Greer, 2005) was utilised to collect IOA and procedural fidelity data. The TPRA measures the accuracy of the presentation of the antecedent and consequence as well as participant responses. There was 100% accuracy regarding the presentation of the antecedent, therefore minimising procedural fidelity as an extraneous variable. The following formula was used to establish percentage of agreement across both observers: $\text{number of agreements}/(\text{number of agreements} + \text{number of disagreements}) \times 100 = \% \text{ of agreement}$ (Cooper, Heron, & Heward, 2007). The inter-observer agreement was 99% across all sessions (range 94-100%).

Results

The results of the study are shown in Figure 25. Correct responses of untaught listener and speaker behaviours are shown. The pre-MEI results (first and second tests

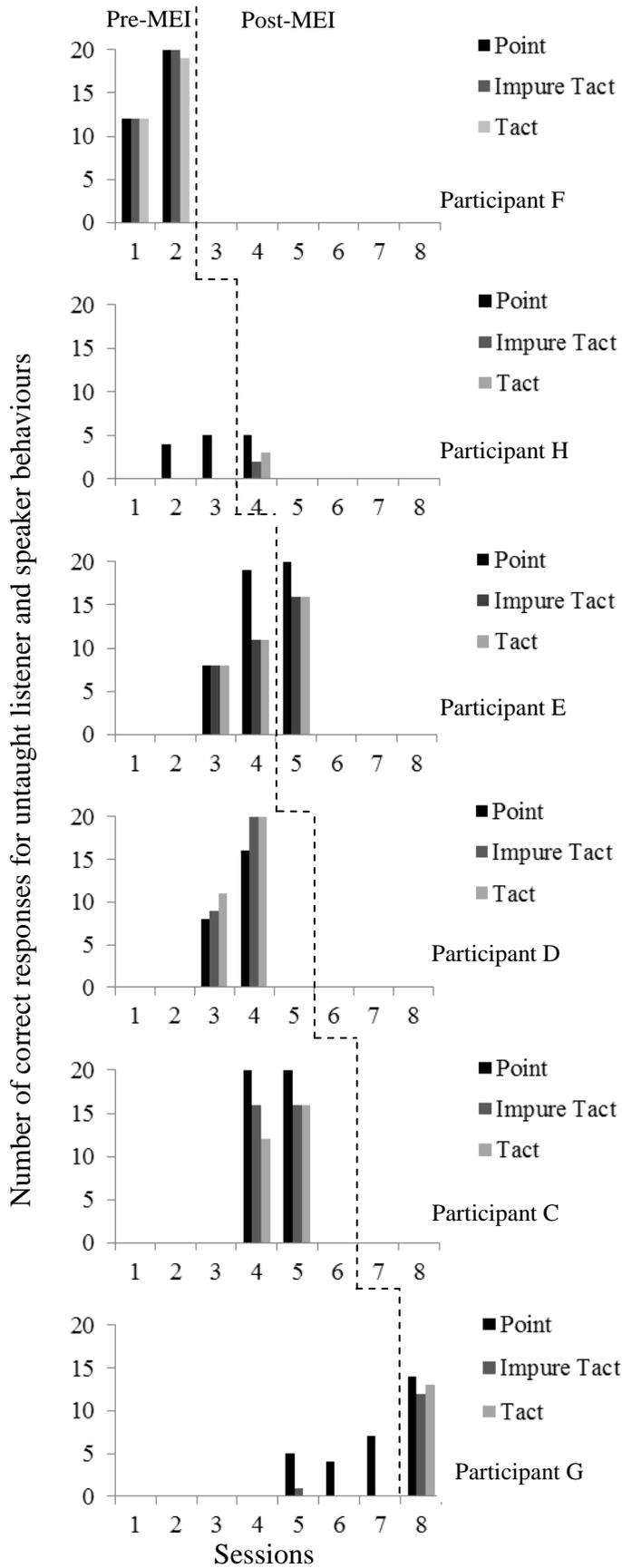


Figure 25: Results for Experiment 7: Number of correct responses for the untaught listener and speaker behaviour. Note Participants F, D and C did not receive the Post-MEI test.

for FIN) are shown to the left of the broken vertical line and post-MEI results (final test for FIN) to the right of the broken vertical line.

In the initial test for FIN, Participant F scored 12/20 across all untaught behaviours and she met the mastery criteria for FIN on the second test for FIN scoring 20/20 for untaught listener behaviour and 20/20 and 19/20 for untaught impure tacts and pure tacts respectively.

Participant H scored consistently low throughout the experiment. He scored 0/20 for untaught speaker behaviour pre-MEI. This increased to 2/20 and 3/20 for impure tacts and pure tacts respectively post-MEI. For untaught listener behaviour he scored 4/20 and 5/20 pre-MEI and 5/20 post-MEI.

In the initial test for FIN, Participant E scored 8/20 across all untaught behaviours. These scores increased for the second test for FIN to 19/20 for untaught listener behaviour (meeting the mastery criterion for LIN) and 11/20 for both the impure tacts and pure tacts. Following the MEI intervention, Participant E met the mastery criteria for FIN scoring 16/20 for both untaught speaker behaviours.

Participant D met the mastery criteria for FIN pre-MEI on the second test for FIN. In the initial test for FIN, he scored 8/20 for untaught listener behaviour and 9/20 and 11/20 for untaught speaker behaviour (impure tacts and pure tacts respectively). For the second test he scored 16/20 for untaught listener behaviour and 20/20 for both tests for untaught speaker behaviour.

Participant C met the criterion for LIN in the initial test for FIN scoring 20/20 correct responses for untaught listener behaviour. In the initial test he scored 16/20 for the impure tacts (criterion level) and 12/20 for the pure tacts. For the second test the listener score remained constant and he scored 16/20 for both tests for untaught speaker behaviour therefore meeting the mastery criteria for FIN pre-MEI.

Three tests for FIN were conducted for Participant G pre-MEI. He scored 5/20, 4/20 and 7/20 for untaught listener behaviour, 1/20, 0/20 and 0/20 for the impure tacts and 0/20 for each of the three tests for the pure tacts. Gains were made across all three areas post-MEI. He scored 14/20 for untaught listener behaviour and 12/20 and 13/20 for untaught speaker behaviour (impure tacts and pure tacts respectively).

To summarise, three participants (Participants F, D and C) met the mastery criteria for FIN prior to the implementation of the MEI intervention. Participant E met the mastery criteria for FIN post-MEI intervention. Participants H and G did not meet the mastery criteria for FIN pre- or post-MEI, though Participant G made gains with untaught listener and speaker behaviour post-MEI.

Table 32 shows the number of learn units presented to each participant and the number of days required to complete the intervention and Figure 24 shows the MEI graphs (independent variable) for the participants exposed to MEI.

Table 32

Number of learn units presented during MEI procedure and duration of procedure for each participant

Participant	Number of learn units presented during MEI procedure	Duration of MEI (Days)
F	N/A	N/A
H	400	10 (including weekend)
E	240	2
D	N/A	N/A
C	N/A	N/A
G	160	2

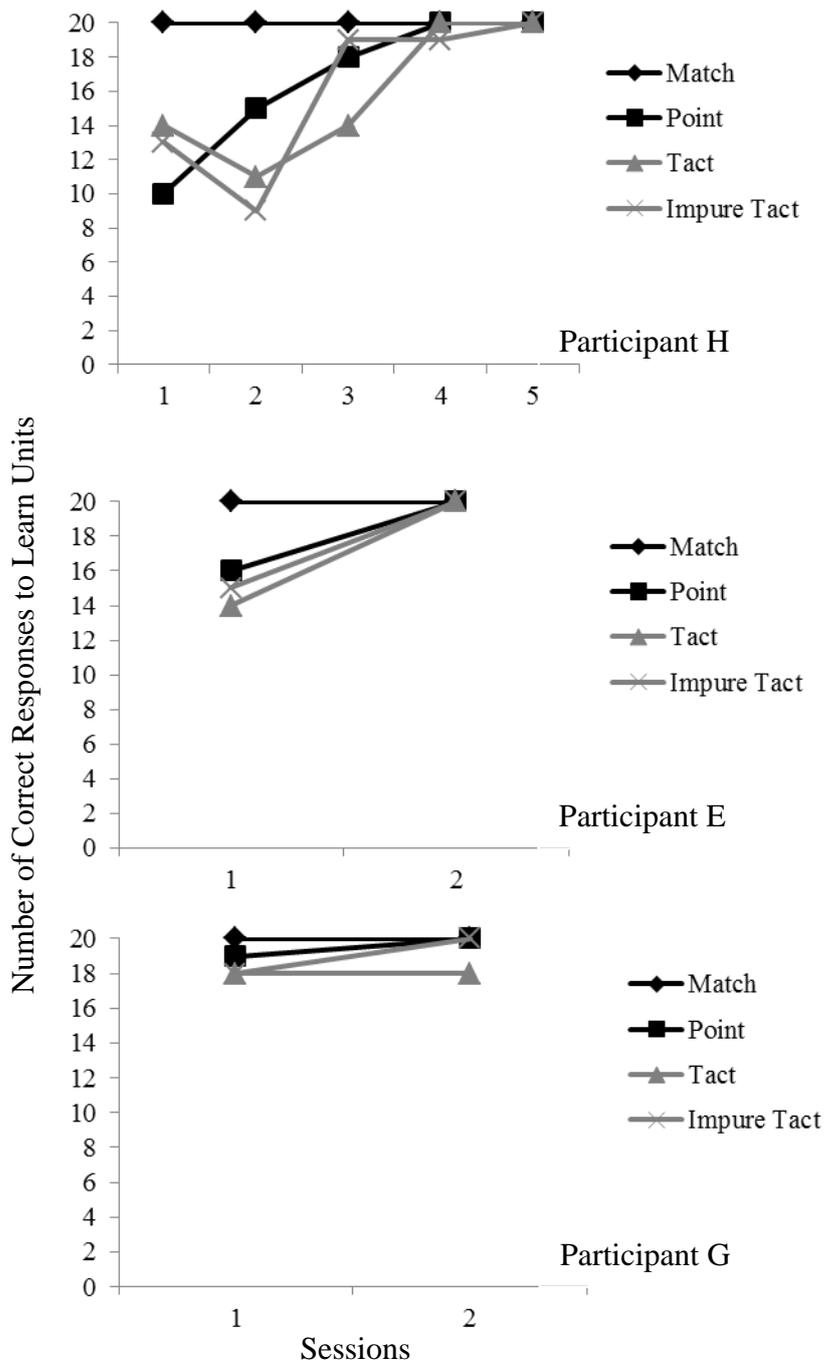


Figure 26: The results for the MEI procedure for Participants H, E and G.

Discussion

Despite all of the participants in this study meeting the experimental criteria for FBN, the outcomes in regards to FIN for these participants showed large variation. For example, of the six participants, Participants F, E, D and C met the criteria for FIN. Three of these four (Participants F, D and C) met the criteria for FIN pre-MEI after exposure to two tests and one of these four (Participant E) met the criteria for FIN following the MEI procedure. Of the two remaining participants (Participants H and G), untaught behaviours emerged post-MEI to near criteria levels for Participant G, while Participant H showed minimal gains with untaught behaviours post-MEI. Participant H did, however, acquire some untaught speaker behaviour post-MEI.

Through synthesising the results of Experiments 6 and 7, a notable finding surfaced. The results seemingly supported the notion that FBN is a prerequisite for FIN. This was demonstrated in Experiment 7 as, of the six participants with FBN, four also met the criteria for FIN. Thus, of the six participants who met the criteria for FIN across Experiments 6 and 7 only one did not meet the criteria for FBN. However, evidence of FBN may not be the only prerequisite necessary in order to induce FIN. It was noted that some individuals with FBN did not acquire FIN and more data are needed to make this assumption. There may be additional prerequisites or co-requisites related to acquiring FIN, such as specific instructional history and other types of behavioural cusps or combinations of behavioural cusps.

The identification of FBN as a possible prerequisite for FIN then warrants the inducement of FBN for participants that did not meet the criteria for FBN in Experiment 6. The apparent logic behind focusing on the inducement of FBN is related to the evidence that shows it would be difficult to meet the criteria for FIN without showing evidence for FBN.

Experiment 8

The purpose of Experiment 8 was to test the effects of MEI on the inducement of FBN in six children and young adults diagnosed with autism. In the tests used for Experiment 6 the results showed that six participants did not meet the criteria for FBN, but the criterion for LBN was met. Thus, the rationale for Experiment 8 was to determine whether MEI induced FBN. No previously published research has shown that MEI has induced FBN and only one study has shown that MEI induced LBN (Fiorile & Greer, 2007).

Method

Participants and setting. Six children and young adults participated in this study, aged 11 years 7 months -18 years 10 months, all with a diagnosis of autism and a learning disability. According to the Verbal Behaviour Development Theory (VBDT) pre-reader pyramid of behavioural cusps (Greer & Ross, 2008; Figure 2 in Chapter 4), each participant showed evidence of the prerequisites needed for inducing FIN. That is, each participant met all of the criteria for the prerequisite behavioural cusps for the ‘speaker component of naming’ which is synonymous with SIN in the sense that both refer to the emergence of untaught speaker behaviour following listener training. To clarify, all participants met the mastery criteria for the prerequisite behavioural cusps of echoic-to-tact, independent mands and transformation of establishing operations across mands and tacts. They had previously been tested for each of the behavioural cusps described in the VBDT and were selected for this study based on meeting the criteria for the three prerequisite behavioural cusps listed above.

Furthermore the participants in this experiment were selected based on the results of Experiment 6. In Experiment 6, these participants did not meet the mastery criteria for FBN (Participant A and Participants I-M in Experiment 6; see Table 28 in

Chapter 8). The experimental criterion for LBN was met by each participant; therefore the purpose of Experiment 8 was to induce SBN and therefore FBN.

Table 33 provides an overview of the participants' characteristics. This includes information about each participant's age (reported in years (y) and months (m)), gender, number of years as a pupil in the school (reported in years (y) and months (m)), level of learning disability and national curriculum levels for speaking and listening (see Appendix C for an explanation of these levels). Additional speech and language therapy test scores (see Appendix D for an explanation of these test results) are presented in Table 34. A '-' on Table 34 denotes that the participant was not tested.

Table 33

Participants' Characteristics

Participant	Age	Gender	Duration in Current Setting	Level of Learning Disability	National Curriculum Levels Achieved	
					Eng (Speaking)	Eng(Listening)
A	15y, 10m	Male	3y, 3m	Moderate	3.4	3.4
I	16y, 7m	Male	5y, 2m	Severe	3.8	3.8
J	15y, 7m	Male	10y, 0m	Moderate	2A.4	2A.4
K	11y, 7m	Male	4y, 2m	Moderate	1C.8	1C.8
L	16y, 7m	Male	6y, 10m	Severe	1A.4	1A.4
M	17y, 10m	Male	10y, 2m	Moderate	3.6	3.6

Table 34

Speech and Language Therapy Test Scores

Participant	DLS Score			TALC Score			
	2- word level	3- word level	4- word level	Level 1 Naming	Level 2 Describing	Level 3 Re-telling	Level 4 Justifying
A	-	-	-			94%	72%
I	-	-	-		94%	94%	97%
J	-	-	-			100%	72%
K	-	-	-	100%	88%	100%	72%
L			86%	100%	72%	65%	0%
M	-	-	-	-	-	-	-

The participants were all male and their mean age was 15 years 8 months (SD = 1.97). Their duration in the current setting ranged from 3 years 3 months to 10 years 2 months with a mean duration of 6 years 7 months. Their national curriculum levels ranged from 1C.8 to 3.8.

The study took place in an independent day school for children and young adults aged 4-19 years diagnosed with autism. Experiment 1 provided a fuller overview of the setting which was identical for this experiment (see page 107). The school's Ethics Committee and the University of Kent's Ethics Committee approved the study. Signed, informed consent was obtained from participants' parents prior to commencing data collection.

Materials. A set of contrived two-dimensional stimuli were used to test for FBN and a different set was used for the teaching sequences within the MEI procedure. Examples of all the stimuli used are shown in Appendix E. There were multiple exemplars of each of the stimuli within each set (e.g. stimuli of different sizes, colours and fonts). Individualised sets of stimuli were specific to each participant. Each participant used a different set of stimuli from the stimuli used in previous experiments.

Procedure. A summary of the procedure is provided below and a full description can be found in Chapter 8 (page 148). The diagram in Figure 27 illustrates the experimental procedure.

Initial tact probes. Initial tact probes were run with each participant (five tacts for each participant; one for each contrived stimulus) to provide evidence that the participants had limited prior direct or indirect experience with the stimuli. It was important to eliminate confounding variables by ensuring that the stimuli were unfamiliar to the participants. Each symbol was presented to each participant without a vocal antecedent and feedback was not provided for correct or incorrect responses. Each stimulus was probed once. Five stimuli were selected following this pre-probe

contingent upon non-responses (no response within 5-7 seconds of presenting the antecedent) or incorrect responses being emitted during the pre-probe.

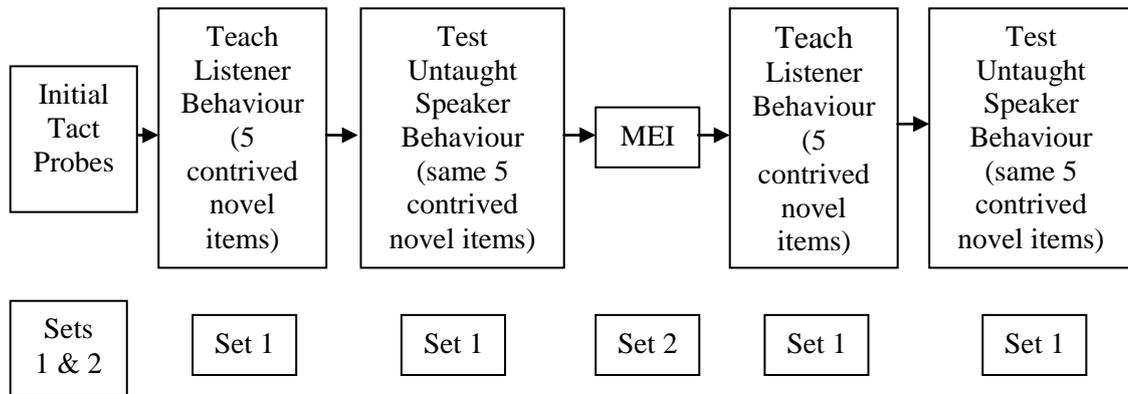


Figure 27: Experimental procedure for Experiment 8.

Test for speaker bidirectional naming (SBN). As illustrated in Figure 27, the test for SBN consisted of teaching listener behaviour and testing for untaught speaker behaviour. Listener behaviour was taught initially. Each symbol was taught as a ‘point to’ response using learn units. The five stimuli were presented in front of the participant and the experimenter provided the vocal antecedent, “Point to (name of symbol).” Correct responses were reinforced and scored as a ‘+.’ If the participant emitted an incorrect response or a non-response (no response within 5-7 seconds of presenting the antecedent) then the experimenter gestured to the correct symbol and the participant was required to imitate this action. Incorrect responses and non-responses were scored as a ‘-’ and no reinforcement was provided for these. Criterion was set at 18/20 correct responses to learn units over two consecutive sessions. Once this criterion was met the participant was tested for untaught speaker behaviour. This involved presenting the symbol to the participant without a vocal antecedent. No reinforcement or corrections were provided. Twenty trials were conducted (four for each stimulus).

This test for SBN (teaching listener behaviour and testing for untaught speaker behaviour) was conducted again to control for practice effects. This second test used the same stimuli as the first test. Participants A, L and M completed a third test for SBN prior to the implementation of the MEI intervention.

Multiple exemplar instruction (MEI) procedure. The first participant was then exposed to the intervention phase. Once the intervention phase was complete for the first participant then the second participant was exposed to this phase.

The intervention phase consisted of MEI across four behaviours with a novel set of stimuli (e.g. Set 2). This phase was described in detail in Chapter 6 (page 110). Once the mastery criteria were achieved (18/20 correct responses across two consecutive sessions) across all four behaviours the intervention phase was complete.

Post-test for SBN. Subsequently, a post-test for SBN was conducted with the original set of stimuli (e.g. Set 1) consisting of teaching listener behaviour and testing for untaught speaker behaviour.

Design. A delayed multiple probe design (Horner & Baer, 1978) was used to test for the acquisition of SBN (and therefore FBN). The design sequence involved each of the participants receiving initial tact probes, teaching listener behaviour and tests for untaught speaker behaviour in a delayed format. Participants were assigned to the intervention phase in random order. For example, Participant J was exposed to MEI while Participant I was tested for SBN. Once Participant J had completed the MEI, Participant I entered the intervention phase while Participant K was tested for SBN. This sequence continued for each participant in order to isolate whether MEI induced FBN.

Inter-observer agreement. Inter-observer agreement was conducted by the author of the current work and a second trained independent observer for 28% of all sessions (probe and MEI sessions). The TPRA (Teacher Performance Rate/Accuracy;

Ingham & Greer, 1992; Ross, Singer-Dudek, & Greer, 2005) was utilised to collect IOA and procedural fidelity data. The TPRA measures the accuracy of the presentation of the antecedent and consequence as well as participant responses. There was 100% accuracy regarding the presentation of the antecedent, therefore minimising procedural fidelity as an extraneous variable. The following formula was used to establish percentage of agreement across both observers: $\text{number of agreements}/(\text{number of agreements} + \text{number of disagreements}) \times 100 = \% \text{ of agreement}$ (Cooper et al., 2007). The inter-observer agreement was 98% across all sessions (range 94-100%).

Results

The results of the study, indicating correct responses of untaught speaker behaviour, are shown in Figure 28. The pre-MEI results (the initial tests for SBN) are shown to the left of the broken vertical line and post-MEI results (final test for SBN) to the right of the broken vertical line.

In the initial test for SBN, Participant J scored 20/20 correct responses for untaught speaker behaviour meeting the mastery criterion for SBN. Having previously met the mastery criterion for LBN in Experiment 6, he now met the mastery criteria for FBN.

Participant I scored 4/20 correct responses for untaught speaker behaviour in the first test for SBN and scored 13/20 correct responses for untaught speaker behaviour in the second test for SBN. Following the MEI intervention, he scored 16/20 correct responses for untaught speaker behaviour meeting the mastery criterion for SBN. Having previously met the mastery criterion for LBN in Experiment 6, he now met the mastery criteria for FBN.

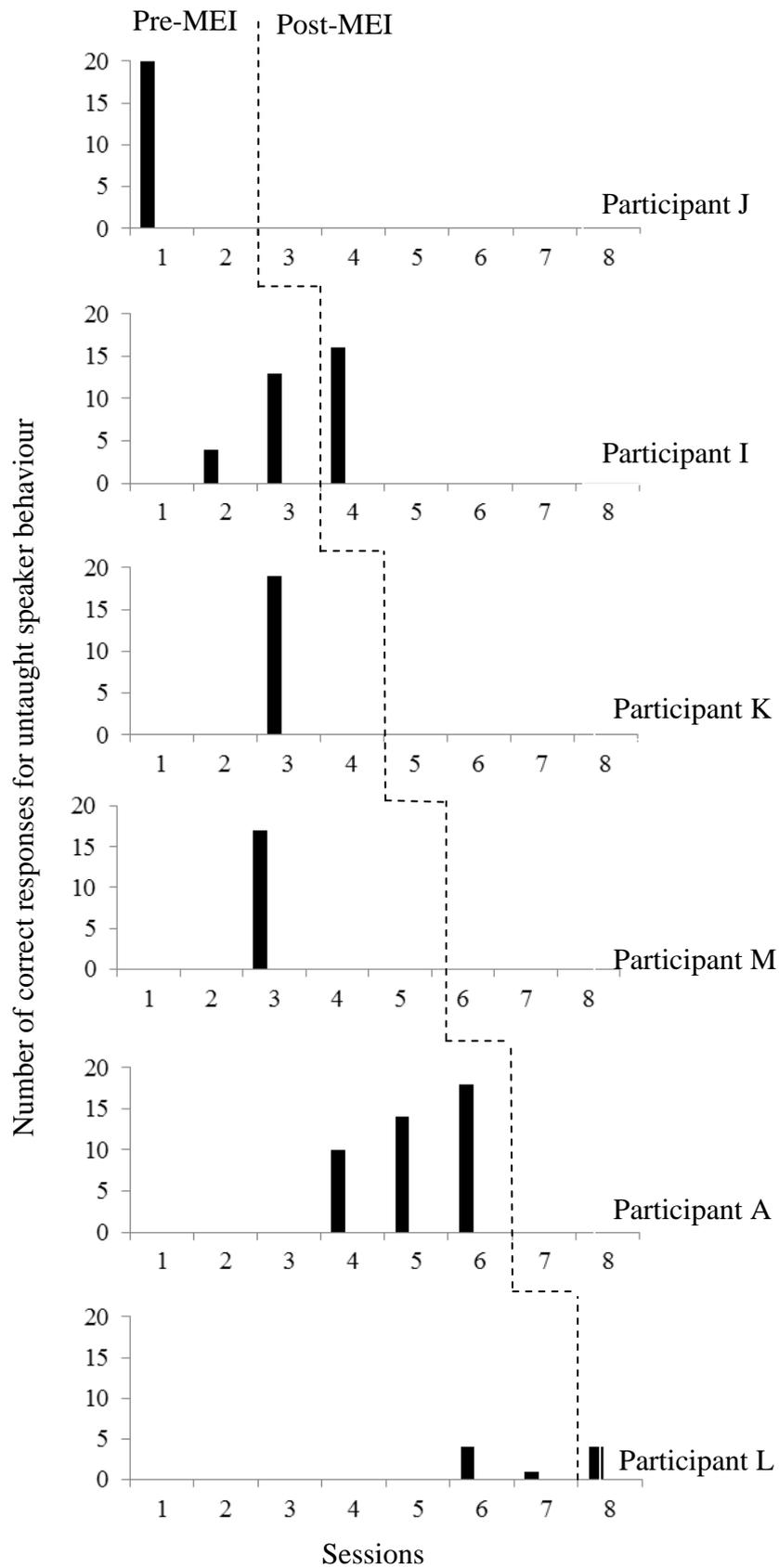


Figure 28: Results for Experiment 8: Number of correct responses for untaught speaker behaviour. Note Participants J, K, M and A did not receive the Post-MEI test.

In the initial test for SBN, Participant K scored 19/20 correct responses for untaught speaker behaviour meeting the mastery criterion for SBN. Having previously met the mastery criterion for LBN in Experiment 6, he now met the mastery criteria for FBN.

In the initial test for SBN, Participant M scored 17/20 correct responses for untaught speaker behaviour meeting the mastery criterion for SBN. Having previously met the mastery criterion for LBN in Experiment 6, he now met the mastery criteria for FBN.

Three tests for SBN were conducted for Participant A prior to the implementation of the MEI procedure. The mastery criterion for SBN was met on the third test. He scored 10/20, 14/20 and 18/20 correct responses for untaught speaker behaviour in each of the successive tests for SBN. Having previously met the mastery criterion for LBN in Experiment 6, he now met the mastery criteria for FBN.

Participant L scored few correct responses for untaught speaker behaviour in the three tests for SBN pre-MEI (0/20, 4/20 and 1/20 correct responses in each of the successive tests for SBN). Post-MEI he scored 4/20 correct responses for untaught speaker behaviour.

In summary, four participants (Participants J, K, M and A) met the mastery criterion for SBN (and therefore FBN) prior to the implementation of the MEI intervention. Participant I met the mastery criterion for SBN post-MEI intervention. Participant L did not meet the criterion for SBN pre- or post-MEI.

Table 35 shows the number of learn units presented to each participant and the number of days required to complete the intervention and Figure 29 shows the MEI graphs (independent variable) for each participant.

Table 35

Number of learn units presented during MEI procedure and duration of procedure for each participant

Participant	Number of learn units presented during MEI procedure	Duration of MEI (Days)
J	N/A	N/A
I	240	4 (including weekend)
K	N/A	N/A
M	N/A	N/A
A	N/A	N/A
L	320	6 (including weekend)

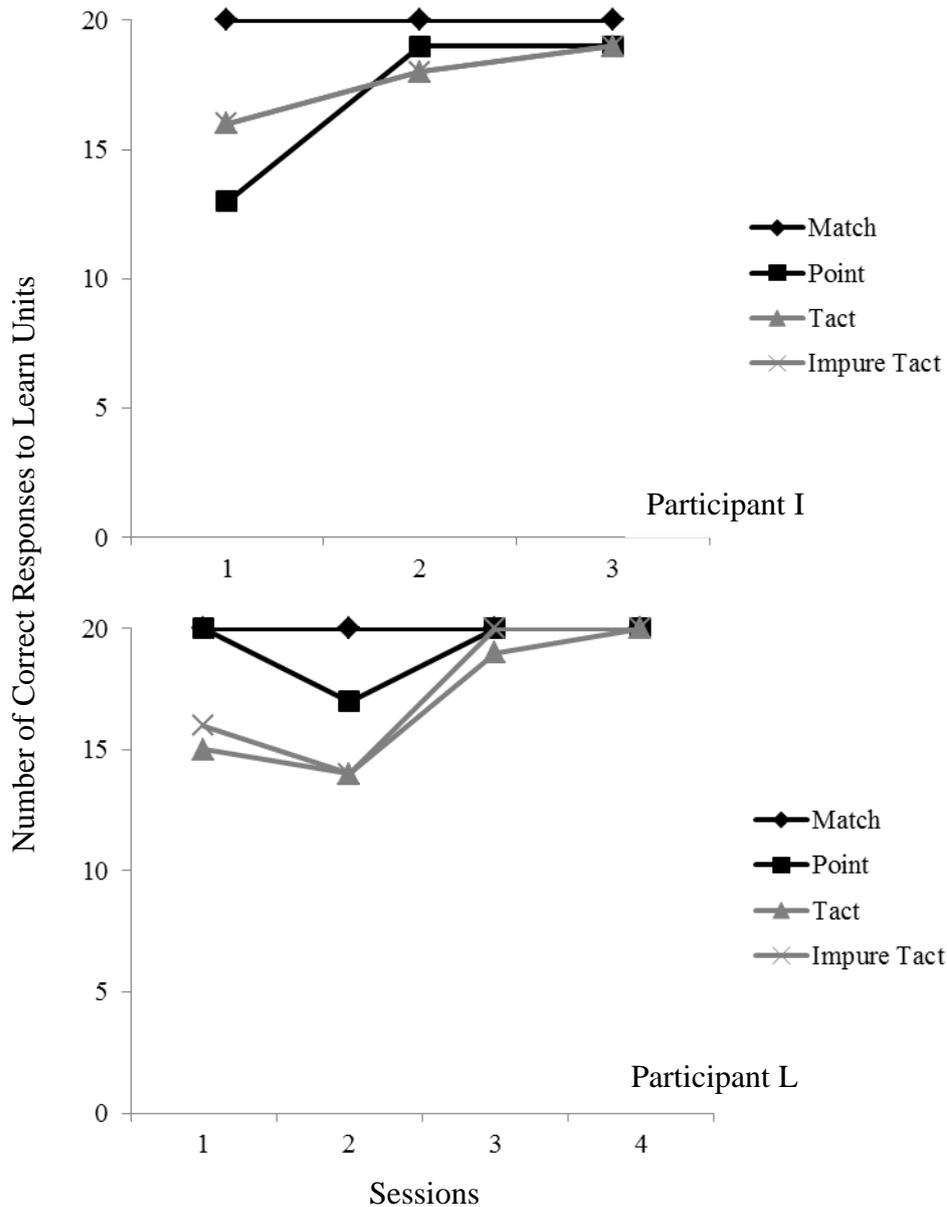


Figure 29: The results for the MEI procedure for Participants I and L.

Discussion

Despite each of the participants in this study meeting the experimental criteria for LBN in Experiment 6, the outcomes in regard to FBN for these participants showed large variation. For example, of the six participants, five met the criteria for FBN in this experiment (Participants A, I, J, K and M). Four of these five (Participants A, J, K and M) met the criteria for FBN pre-MEI. Of these four participants, three met the criteria for FBN on the first test for FBN (Participants J, K and M) and one met the criteria for FBN on the third test for FBN (Participant A). The remaining participant who met the criteria for FBN did so post-MEI (Participant I). Participant L produced minimal gains with untaught behaviours pre-MEI and post-MEI.

Similar to the discussion of the results in Experiment 7, the same analytical framework applies to this experiment. Having evidence of LBN may not be the only prerequisite needed in order to induce FBN. One individual with LBN did not acquire FBN (Participant L) and more data are needed to make this assumption. There may be additional prerequisites or co-requisites related to acquiring FBN, such as specific instructional history and other types of behavioural cusps or combinations of behavioural cusps.

Participant A met the criteria for FBN in Experiment 8 and the criteria for FIN in Experiment 6. The remaining four participants who met the criteria for FBN in this experiment seemingly have a potential prerequisite for FIN (Participants I, J, K and M). Thus, in accordance with the previous logic used, the next step and the purpose of Experiment 9 was to test the effects of MEI on the inducement of FIN for these participants.

Experiment 9

The purpose of Experiment 9 was to test the effects of MEI on the acquisition of FIN in four children and young adults with a diagnosis of autism and a learning

disability who had all met the criteria for FBN in Experiment 8. The procedure for this experiment was a replication of Experiment 7 (within current chapter). Both of these experiments included a MTS procedure prior to each test for FIN to address the span of time between the initial exposure to the stimuli names and the post-MEI test for FIN.

Method

Participants and Setting. Four children and young adults were selected for this study, aged 11 years 9 months -19 years 0 months, all with a diagnosis of autism.

According to the Verbal Behaviour Development Theory (VBDT) pre-reader pyramid of behavioural cusps (Greer & Ross, 2008; Figure 2 in Chapter 4), each participant showed evidence of the prerequisites needed for inducing FIN. That is, each participant met all of the criteria for the prerequisite behavioural cusps for the ‘speaker component of naming’ which is synonymous to SIN. To clarify, all participants met the mastery criteria for the prerequisite behavioural cusps of echoic-to-tact, independent mands and transformation of establishing operations across mands and tacts. They had previously been tested for each of the behavioural cusps described in the VBDT and were selected for this study based on meeting the criteria for the three prerequisite behavioural cusps listed above.

Furthermore the participants were selected for this study based on the results of Experiment 8. These participants met the mastery criteria for FBN in Experiment 8 (Participants I, J, K and M).

Table 36 provides an overview of the participants’ characteristics. This includes information about each participant’s age (reported in years (y) and months (m)), gender, number of years as a pupil in the school (reported in years (y) and months (m)), level of learning disability and national curriculum levels for speaking and listening (see Appendix C for an explanation of these levels). Additional speech and language therapy

test scores (see Appendix D for an explanation of these test results) are presented in Table 37. A ‘-’ on Table 37 denotes that the participant was not tested.

Table 36

Participants’ Characteristics

Participant	Age	Gender	Duration in Current Setting	Level of Learning Disability	National Curriculum Levels Achieved	
					Eng (Speaking)	Eng(Listening)
I	16y, 10m	Male	5y, 5m	Severe	3.8	3.8
J	15y, 10m	Male	10y, 3m	Moderate	2A.4	2A.4
K	11y, 10m	Male	4y, 5m	Moderate	1C.8	1C.8
M	18y, 0m	Male	10y, 5m	Moderate	3.6	3.6

Table 37

Speech and Language Therapy Test Scores

Participant	DLS Score			TALC Score			
	2-word level	3-word level	4-word level	Level 1 Naming	Level 2 Describing	Level 3 Re-telling	Level 4 Justifying
I	-	-	-	-	94%	94%	97%
J	-	-	-	-	-	100%	72%
K	-	-	-	100%	88%	100%	72%
M	-	-	-	-	-	-	-

The participants were all male with a mean age of 15 years 7 months (SD = 2.32). Their duration in the current setting ranged from 4 years 5 months to 10 years 5 months with a mean duration of 7 years 7 months. Their national curriculum levels ranged from 1C.8 to 3.8.

The study took place in an independent day school for children and young adults aged 4-19 years diagnosed with autism. Experiment 1 provided a fuller overview of the setting which was identical for this experiment (see page 107). The school’s Ethics Committee and the University of Kent’s Ethics Committee approved the study. Signed, informed consent was obtained from participants’ parents prior to commencing data collection.

Materials. A set of contrived two-dimensional stimuli were used to test for FIN and a different set was used for the teaching sequences within the MEI procedure. Examples of all the stimuli used are shown in Appendix E. There were multiple exemplars of each of the stimuli within each set (e.g. stimuli of different sizes, colours and fonts). Individualised sets of stimuli were specific to each participant. Each participant used a different set of stimuli to the stimuli used in previous experiments.

Procedure. The procedure replicated the experimental sequence in Experiment 7. To summarise the procedure, initial tact probes were conducted to provide the materials for each set of stimuli. Participants were tested for FIN by teaching them to match a set of stimuli and then testing for untaught listener and untaught speaker behaviours. This initial test for FIN was conducted a second time to control for practice effects. This second test for FIN used the same stimuli as the first test for FIN and was preceded by a MTS session. Participants J and K completed a third test for FIN prior to the implementation of the MEI intervention. The MEI intervention was then implemented. The intervention phase consisted of MEI across four behaviours with a novel set of stimuli. Once the mastery criteria were met across all four behaviours the intervention phase was complete.

Subsequently, participants were tested for FIN using the same stimuli as in the initial pre-MEI test for FIN. A MTS session was presented prior to the test for untaught behaviours. See Experiment 7 for specific details regarding the experimental procedure (page 159). The diagram in Figure 30 illustrates this procedure.

Design. As in Experiment 7, a delayed multiple probe design (Horner & Baer, 1978) was used to test for the acquisition of FIN. This involved all the participants receiving initial tact probes, the MTS procedure and tests for untaught behaviours in a delayed format. Participants were assigned to the intervention phase in random order. For example, Participant I was exposed to MEI while Participant M was tested for FIN.

Once Participant I had completed the intervention phase (MEI), Participant M entered the intervention phase while Participant J was tested for FIN. This sequence continued for all participants in order to isolate whether MEI induced FIN.

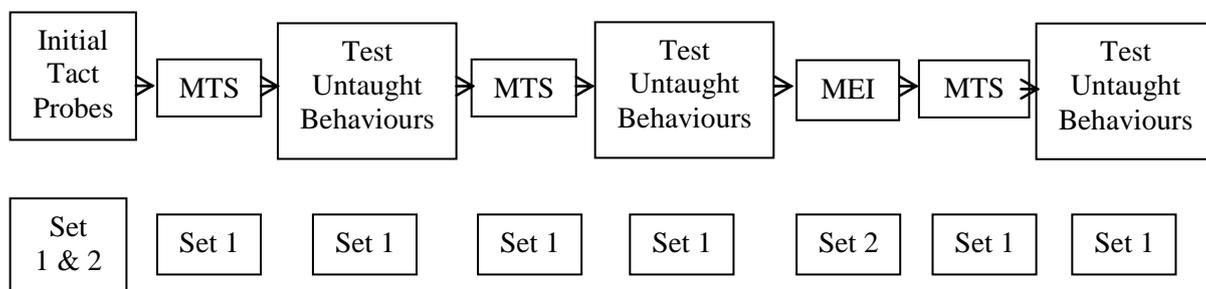


Figure 30: Experimental procedure for Experiment 9.

Inter-observer agreement. Inter-observer agreement was conducted by the author of the current work and a second trained independent observer for 38% of all sessions (probe and MEI sessions). The TPRA (Teacher Performance Rate/Accuracy; Ingham & Greer, 1992; Ross, Singer-Dudek, & Greer, 2005) was utilised to collect IOA and procedural fidelity data. The TPRA measures the accuracy of the presentation of the antecedent and consequence as well as participant responses. There was 100% accuracy regarding the presentation of the antecedent, therefore minimising procedural fidelity as an extraneous variable. The following formula was used to establish percentage of agreement across both observers: $\text{number of agreements} / (\text{number of agreements} + \text{number of disagreements}) \times 100 = \% \text{ of agreement}$ (Cooper et al., 2007). The inter-observer agreement was 99% across all sessions (range 98-100%).

Results

The results of the study are shown in Figure 31. Correct responses of untaught listener and speaker behaviours are shown. The pre-MEI results are shown to the left of the broken vertical line and post-MEI results (final test for FIN) to the right of the broken vertical line.

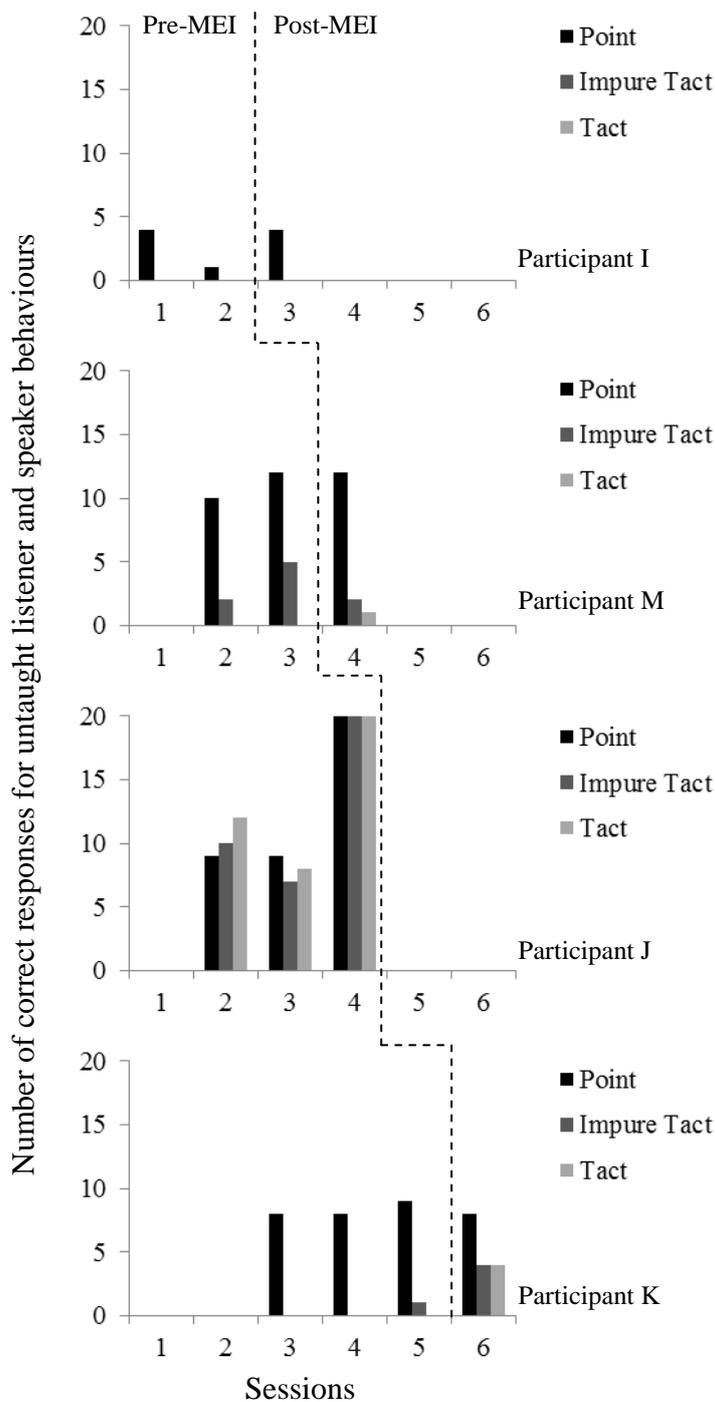


Figure 31: Results for Experiment 9: Number of correct responses for the untaught listener and speaker behaviour. Note Participant J did not receive the Post-MEI test.

Participant I scored 0/20 for all tests for untaught speaker behaviour pre- and post-MEI. He scored 4/20 and 1/20 for untaught listener behaviour pre-MEI. Following the MEI intervention he scored 4/20 for untaught listener behaviour. No gains were shown for the untaught listener or untaught speaker behaviour.

Participant M scored 10/20 and 12/20 for untaught listener behaviour pre-MEI. Following the MEI intervention he scored 12/20 for untaught listener behaviour. For untaught speaker behaviour he scored 2/20 and 5/20 for the impure tacts and 0/20 for the pure tacts in both pre-MEI tests for FIN. Post-MEI he scored 2/20 for impure tacts and 1/20 for pure tacts. No gains were shown for the untaught listener or untaught speaker behaviour.

Participant J met the mastery criteria for FIN pre-MEI on the third test for FIN. He scored 9/20, 10/20 and 12/20 for untaught listener and untaught speaker (impure tacts and pure tacts) behaviours on the first test for FIN. These scores were at a similar level for the second test for FIN (9/20, 7/20 and 8/20 respectively). For the third test for FIN he scored 20/20 across all three areas meeting the mastery criteria for FIN.

Three tests for FIN were conducted for Participant K prior to the implementation of the MEI procedure. He scored 8/20, 8/20 and 9/20 for untaught listener behaviour for these three tests. He scored 0/20 for untaught speaker behaviours for the first two tests and only scored 1/20 for the impure tacts for the third test. Post-MEI his listener score remained at 8/20 and he made minimal gains with untaught speaker behaviour scoring 4/20 for the impure tacts and the pure tacts.

To summarise, three participants (Participants I, M and K) did not meet the mastery criteria for FIN post-MEI intervention. Participant J met the criteria for FIN prior to the MEI intervention being implemented (on the third test for FIN).

Figure 32 shows the MEI graphs (independent variable) for each participant and Table 38 shows the number of learn units presented to each participant and the number of days required to complete the intervention.

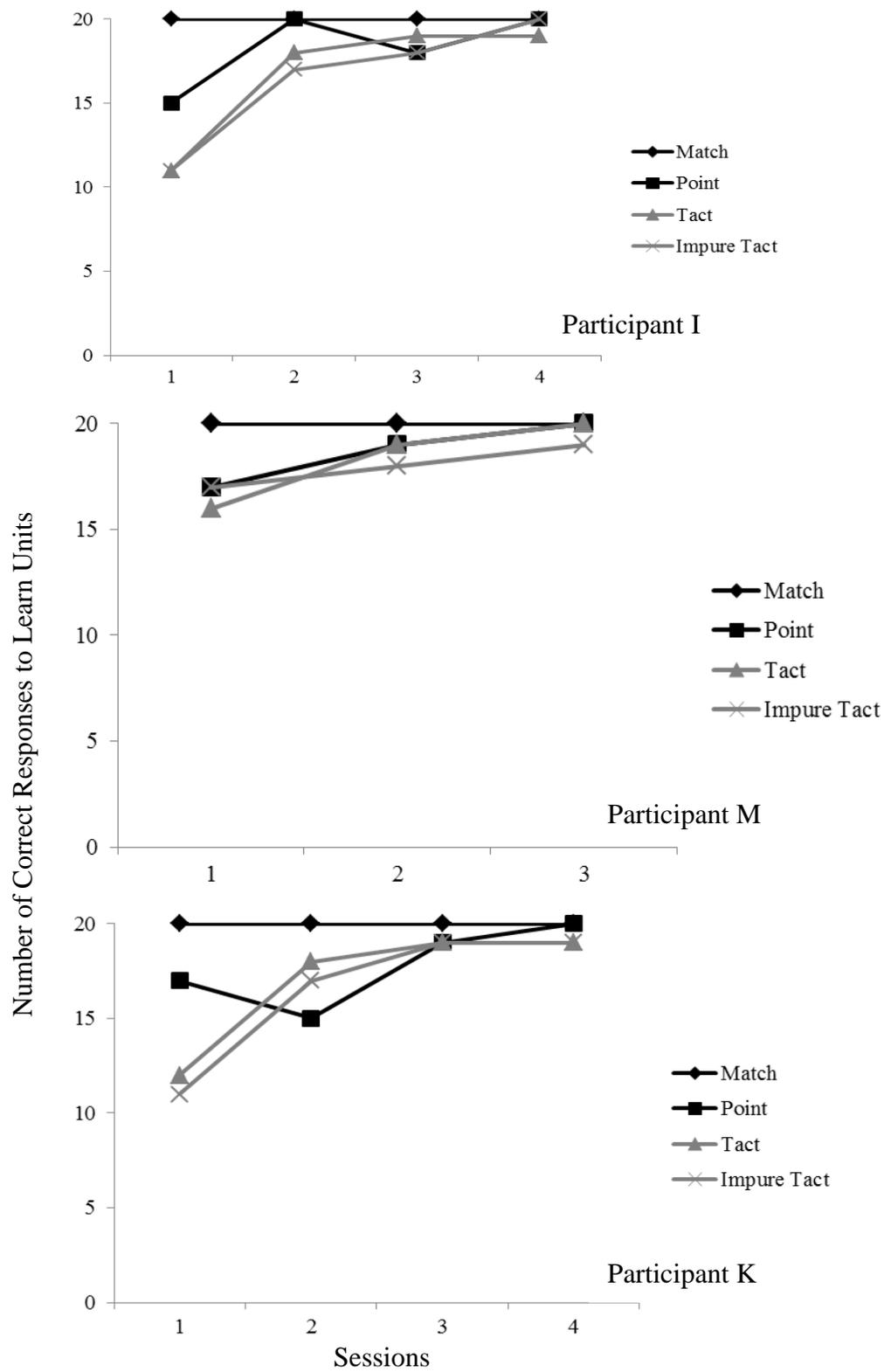


Figure 32: The results for the MEI procedure for Participants I, M and K.

Table 38

Number of learn units presented during MEI procedure and duration of procedure for each participant

Participants	Number of learn units presented during MEI procedure	Duration of MEI (Days)
I	320	7 (including weekend)
M	240	7 (including weekend)
J	N/A	N/A
K	320	5 (including weekend)

Discussion

Four participants were selected for Experiment 9. They were selected based on meeting the established criteria for FBN which appears to be a prerequisite to FIN. In contrast to the other experiments, the outcomes in regard to FIN for these participants showed an overall minimal number of emergent untaught behaviours pre- and post-MEI. Of the four participants, one met the criteria for FIN (Participant J). This participant met the criteria for FIN pre-MEI on the third test for FIN. Minimal emergent behaviour was shown for the remaining three participants, though untaught speaker behaviour did emerge for one participant post-MEI (Participant K).

While these findings are inconclusive, in terms of FBN being a definitive prerequisite for FIN, it remains possible that FBN is foundational to FIN with additional prerequisites or co-requisites.

General Discussion

Figure 33 provides a summary of all the experiments with children and young adults diagnosed with autism (Experiments 1, 2, 6-9). The number of participants who met the criteria for each of the sub-components of naming on the first test (includes data from Experiments 1, 2 and 6) is compared to the number of participants who met the criteria for each of the sub-components of naming on the final test (includes data from Experiments 6-9). There were thirteen participants in total. The seven participants in

Experiment 6 (Chapter 8) who did not demonstrate the prerequisite skills to be part of this series of experiments were not included in this analysis.

A clear increase in the number of participants meeting the criteria for sub-components of naming in the final test compared to the first test is illustrated in Figure 33. One participant (Participant A) met the criteria for FIN on the first test (in Experiment 6) compared to seven participants meeting the criteria for FIN on the final test.

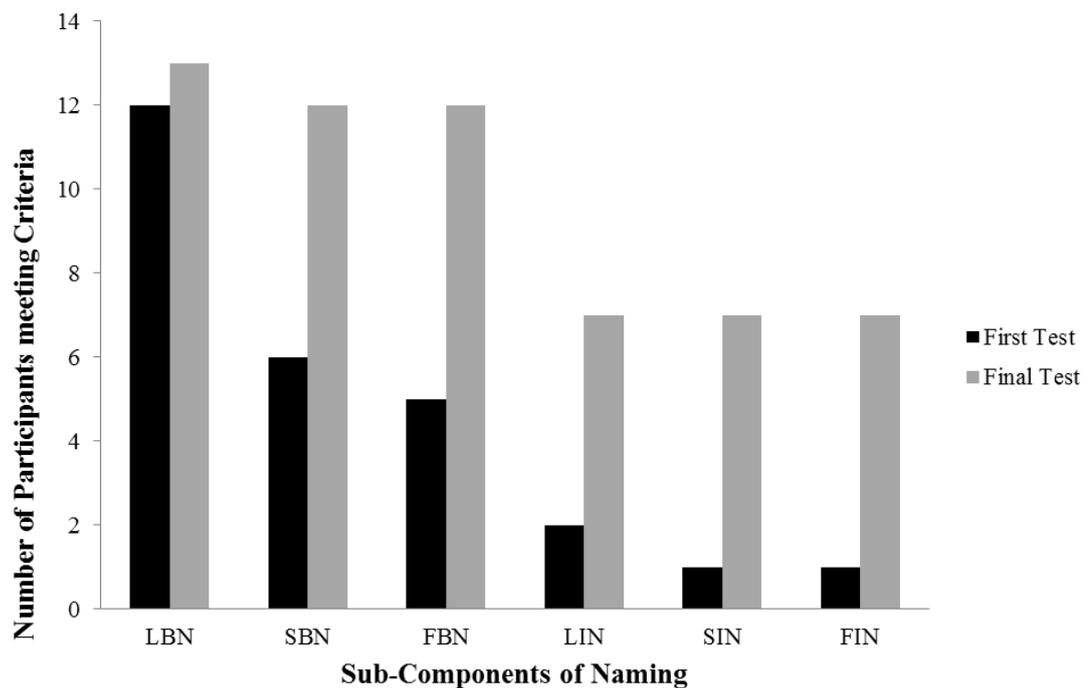


Figure 33: The number of participants who met the criteria for each of the sub-components of naming on the first test compared to the final test.

Figure 34 provides an overview of the final results of these thirteen participants.

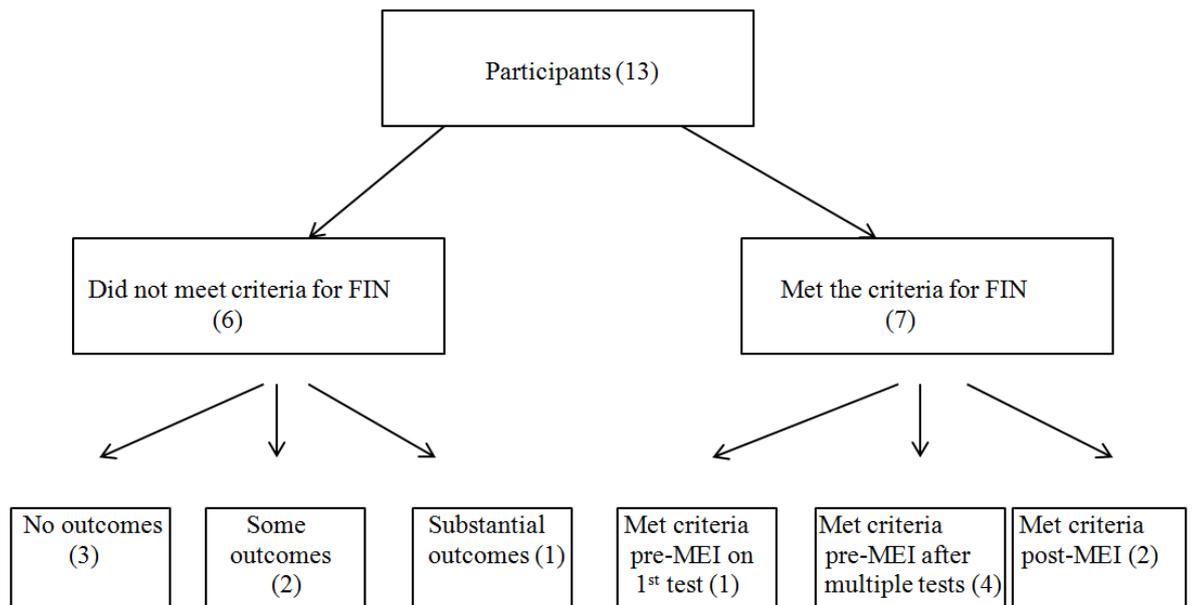


Figure 34: An overview of the results for thirteen participants.

Figure 34 shows that 6/13 participants did not meet the experimental criteria for FIN throughout this series of experiments. Multiple tests for FIN were conducted and MEI was implemented, but these participants did not meet the experimental criteria for FIN. Of these six participants, however, one did generate substantial outcomes with untaught behaviour and two produced some outcomes with untaught behaviour. It is recommended that these participants are tested again. It has already been shown that multiple testing, with the additional MTS procedure, has been successful in supporting individuals to meet the criteria for FIN so it is a plausible step to continue to test individuals who make gains in untaught behaviour following each test. The two participants who produced no outcomes with untaught behaviour, despite repeated testing with the additional MTS sessions *and* receiving the MEI procedure, possibly lacked further prerequisite or co-requisite behavioural cusps. These prerequisite and co-requisite behavioural cusps need to be the curricular focus for these individuals rather than spending time conducting additional tests for FIN or implementing more sets of MEI.

Figure 34 also shows that 7/13 participants did meet the experimental criteria for FIN, but only two of these were following the intervention phase (MEI). Four participants met the criteria for FIN following a series of tests for FIN (with preceding MTS sessions). One participant met the criteria for FIN when tested for the first time, pre-MEI.

Table 39 provides an updated summary of the results table shown in Experiment 6 (Table 29 in Experiment 6 (Chapter 8), see page 156). The results are updated for each of the participants from Experiments 7, 8 and 9. Compared to Table 29 in Experiment 6, gains are clearly demonstrated. These data will be analysed in detail using a case-by-case format in Chapter 10.

Table 39

Updated Participant Scores for each Test for Naming

Participant	Age	LBN	SBN	FBN	LIN	SIN	FIN
A	16	20/20	18/20	YES	18/20	17/20 & 16/20	YES
B	12	19/20	19/20	YES	19/20	20/20 & 20/20	YES
C	11	20/20	16/20	YES	20/20	16/20 & 16/20	YES
D	7	20/20	20/20	YES	16/20	20/20 & 20/20	YES
E	7	20/20	17/20	YES	19/20	16/20 & 16/20	YES
F	19	20/20	20/20	YES	20/20	20/20 & 19/20	YES
G	15	20/20	20/20	YES	14/20	12/20 & 13/20	NO
H	12	20/20	17/20	YES	5/20	2/20 & 3/20	NO
I	17	18/20	16/20	YES	5/20	0/10 & 0/10	NO
J	16	20/20	20/20	YES	20/20	20/20 & 20/20	YES
K	12	20/20	19/20	YES	8/20	4/20 & 4/20	NO
L	17	20/20	4/20	NO	1/20	0/10 & 0/10	NO
M	18	20/20	17/20	YES	12/20	5/20 & 1/10	NO

Summary

This series of experiments with older children and young adults diagnosed with autism has provided inconclusive results, but also raised some interesting questions. It cannot be stated that MEI induces FBN or FIN with older children and young adults diagnosed with autism based on the results of these experiments. Untaught behaviour has emerged, however, for a number of participants in these studies. For some

participants, sufficient untaught behaviour has emerged to demonstrate that the experimental criteria of FBN or FIN have been met. Most of the untaught behaviour has been demonstrated due to repeated testing with an additional MTS procedure prior to each test, however, rather than due to the implementation of the MEI procedure.

In addition, it has been shown that FBN is possibly a prerequisite for FIN, but there are potentially other prerequisites and co-requisites for FIN as well. This point will be covered in much further detail in the discussion chapter of this thesis (Chapter 11).

This chapter concludes the experimental section of this body of work. The next chapter provides a case by case analysis of each of the participants who has been included in the experiments thus far. This allows a more detailed analysis to take place across experiments.

Chapter 10

Case Studies

The purpose of this chapter is to independently evaluate the performances of each participant allowing for a case-by-case detailed analysis within and across all experiments. Twenty participants were included in this series of experiments aimed to induce Full Incidental Naming (FIN) using Multiple Exemplar Instruction (MEI). This section will review their data across the experiments. In order to simplify the interpretation of results across these experiments, the participants were assigned the same identification codes as in Experiments 6, 7, 8 and 9. The participants were grouped according to outcomes:

- One participant (Participant A) met the mastery criteria for FIN pre-MEI on the first test for FIN.
- Two participants (Participants D and E) met the mastery criteria for FIN post-MEI.
- Four participants (Participants B, C, F and J) met the mastery criteria for FIN, having previously not met the mastery criteria after being exposed to the pre-MEI tests for FIN, without the MEI intervention.
- Five participants (Participants G, H, I, K and M) did not meet the criteria for FIN pre- or post-MEI.
- Eight participants (Participants L, N-T) did not meet the criteria for FIN, but they subsequently demonstrated that they did not have the newly-identified pre- or co-requisite skills.

Structurally, this chapter consists of six sub-sections. The first five sections include case-by-case analyses of the results according to one of the five outcomes described above. Graphs summarising the data for each participant are presented with each case. The data show the tests for FIN (untaught listener behaviour and untaught

speaker behaviour) across experiments. Data generated from other tests (e.g. FBN) are not presented on these graphs. These five sub-sections are followed by a final summary section of the chapter.

Outcome 1: Mastery Criteria for FIN Met on First Test for FIN

Of the twenty participants who took part in the current series of experiments, one participant (Participant A) met the mastery criteria for FIN on the first test (in Experiment 6, Chapter 8).

Participant A. Table 40 provides an overview of the participant characteristics. This includes information about Participant A’s age (reported in years (y) and months (m)), gender, number of years as a pupil in the school (reported in years (y) and months (m)) and national curriculum levels for speaking and listening (see Appendix B for an explanation of these levels). Additional speech and language therapy test scores (see Appendix C for an explanation of these test results) are presented in Table 41. A ‘-’ on Table 41 denotes that the participant was not tested.

Table 40

Participant A’s Characteristics

Participant	Age	Gender	Duration in Current Setting	Level of Learning Disability	National Curriculum Levels Achieved	
					Eng (Speaking)	Eng(Listening)
A	15y, 3m	Male	2y, 7m	Moderate	3.4	3.4

Table 41

Speech and Language Therapy Test Scores for Participant A

Participant	DLS Score			TALC Score			
	2-word level	3-word level	4-word level	Level 1 Naming	Level 2 Describing	Level 3 Re-telling	Level 4 Justifying
A	-	-	-			94%	72%

Figure 35 shows the overall results for Participant A from Experiment 6. As part of Experiment 6, the participant was tested for FIN on one occasion and Participant A met the mastery criteria for FIN.

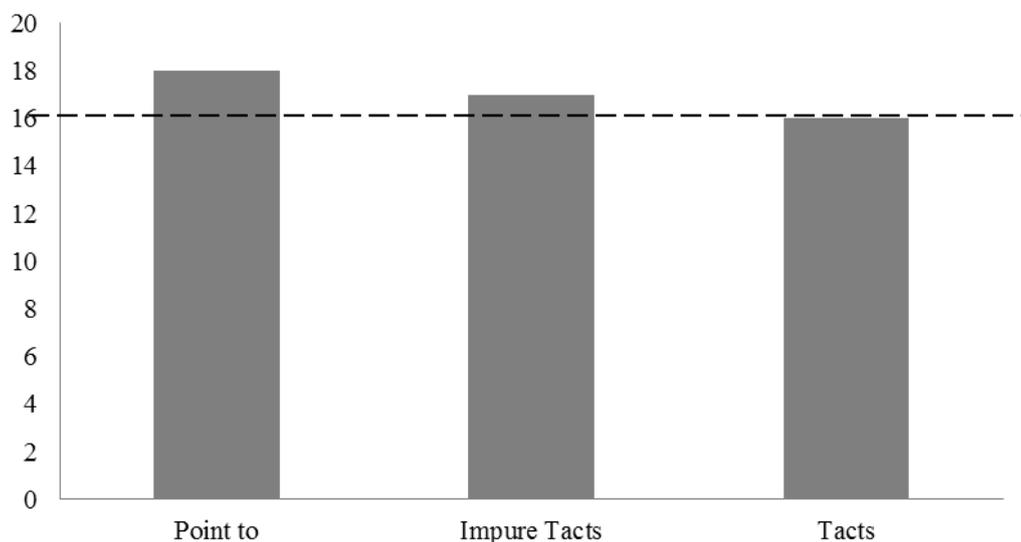


Figure 35: Results for Participant A: Number of correct responses for untaught listener behaviour (point to) and speaker behaviour (impure tacts and tacts).

Interestingly, Participant A did not meet the experimental criterion for Speaker Bidirectional Naming (SBN) in Experiment 6 (following two tests for SBN). He met the criterion for Listener Bidirectional Naming (LBN), but did not meet the criteria for Full Bidirectional Naming (FBN) as he had not met the criterion for SBN. Participant A was the only participant throughout the study to meet the criteria for FIN, but not FBN. He participated in Experiment 8 (Chapter 9) in which participants were tested for the effects of MEI on SBN. During this experiment he met the experimental criterion for SBN (and therefore FBN) prior to the implementation of the MEI procedure (on the third test for SBN). Across both experiments, Participant A required five tests for SBN before meeting the mastery criterion.

Outcome 2: Mastery Criteria for FIN Met Post-MEI

Two participants (Participants D and E) met the mastery criteria for FIN post-MEI.

Participant D. Table 42 provides an overview of the participant characteristics. This includes information about Participant D’s age (reported in years (y) and months (m)), gender, number of years as a pupil in the school (reported in years (y) and months (m)) and national curriculum levels for speaking and listening (see Appendix B for an explanation of these levels). Additional speech and language therapy test scores (see Appendix C for an explanation of these test results) are presented in Table 43. A ‘-’ on Table 43 denotes that the participant was not tested.

Table 42

Participant D’s Characteristics

Participant	Age	Gender	Duration in Current Setting	Level of Learning Disability	National Curriculum Levels Achieved	
					Eng (Speaking)	Eng(Listening)
D	7y, 3m	Male	1y, 7m	Moderate	P7.2	P7.2

Table 43

Speech and Language Therapy Test Scores for Participant D

Participant	DLS Score			TALC Score			
	2-word level	3-word level	4-word level	Level 1 Naming	Level 2 Describing	Level 3 Re-telling	Level 4 Justifying
D			68%	100%	61%	65%	36%

Figure 36 shows the overall results for Participant D from Experiments 1, 6 and 7. The data to the left of the first solid vertical line are from Experiment 1. The data for Tests 1, 2, 3 and 4 are from Experiment 1. As part of Experiment 1, the participant was tested for FIN on 4 occasions with only the first test including the preceding match-to-sample (MTS) procedure (this was a defining feature of Experiment 1). The first 3 tests

were conducted pre-MEI and the fourth test was conducted post-MEI. No gains were made during the pre-MEI tests for FIN. Marginal gains were demonstrated in the post-MEI test for FIN. One explanation for this is related to the limited exposure the participant had to hearing the names of and seeing the stimuli. The participant only heard the names of the stimuli during the initial MTS session (prior to Test 1). Criterion was met on the MTS session after 20 trials therefore the participant only heard the names of each stimulus, while looking at the stimulus, 4 times each.

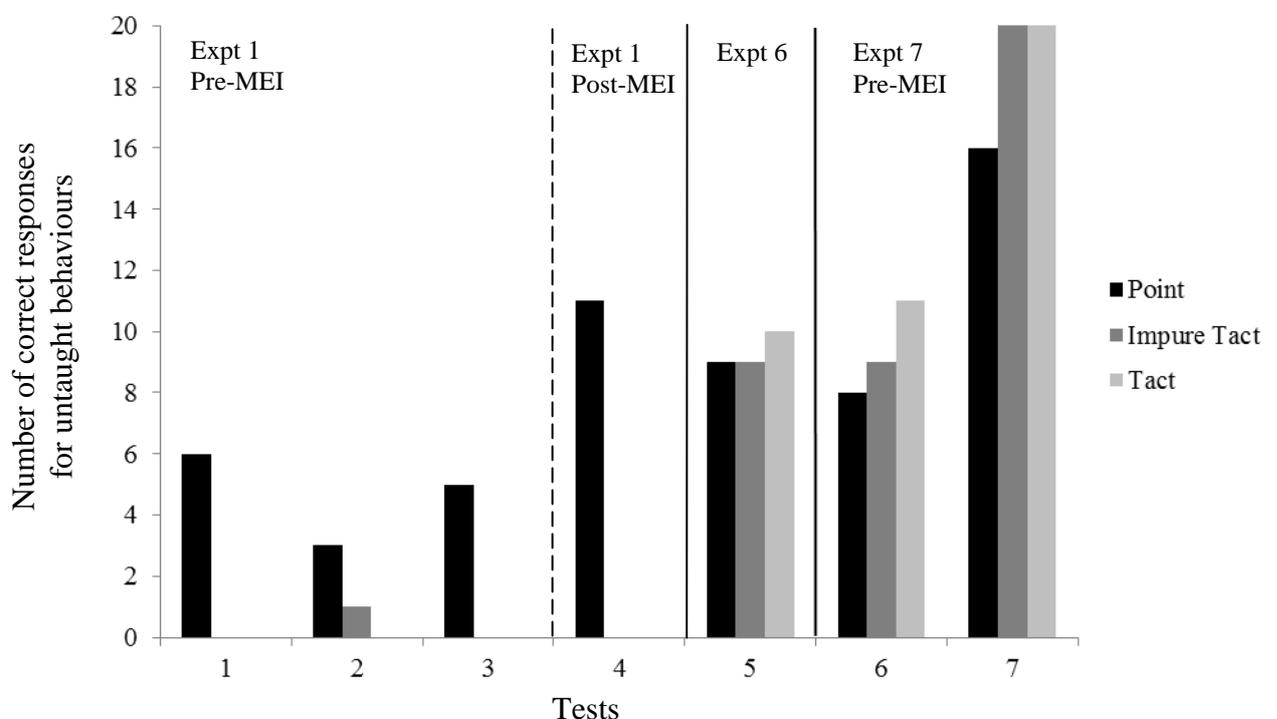


Figure 36: Results for Participant D: Number of correct responses for untaught listener and speaker behaviour.

The next set of data (Test 5) showed the results from Experiment 6. In this experiment, the participant was tested for FIN with a novel set of stimuli. The mastery criteria were not met. The data to the right of the next solid vertical line (Tests 6 and 7) are from Experiment 7. The participant met the criteria for FIN following the second test with the same stimuli with an additional MTS session prior to each test.

One interesting aspect about the results for Participant D is that when the data are sequenced in this format the gains made post-MEI are far removed from the actual MEI procedure. To clarify, the passage of time since the implementation of the MEI procedure was elongated compared to the other participants. In that time frame the participant showed increasing gains on the tests for FIN and eventually achieved mastery. The interfacing of these two variables makes it difficult to discern what was responsible for the gains and the mastery of FIN (the MEI or the multiple tests).

Participant E. Table 44 provides an overview of the participant characteristics. This includes information about Participant E’s age (reported in years (y) and months (m)), gender, number of years as a pupil in the school (reported in years (y) and months (m)) and national curriculum levels for speaking and listening (see Appendix B for an explanation of these levels). Additional speech and language therapy test scores (see Appendix C for an explanation of these test results) are presented in Table 45. A ‘-’ on Table 45 denotes that the participant was not tested.

Table 44

Participant E’s Characteristics

Participant	Age	Gender	Duration in Current Setting	Level of Learning Disability	National Curriculum Levels Achieved	
					Eng (Speaking)	Eng(Listening)
E	6y, 9m	Male	1y, 7m	Moderate	P5.2	P4.8

Table 45

Speech and Language Therapy Test Scores for Participant E

Participant	DLS Score			TALC Score			
	2-word level	3-word level	4-word level	Level 1 Naming	Level 2 Describing	Level 3 Re-telling	Level 4 Justifying
E	72%	54%	31%	-	-	-	-

Figure 37 shows the overall results for Participant E from Experiments 1, 6 and 7. The data show the tests for FIN (untaught listener behaviour and untaught speaker behaviour) across these three experiments. Solid vertical lines divide the data from the different experiments. Dotted vertical lines show data from within experiments pre- and post-MEI. The tests have been re-numbered to show contiguity across all of the experiments. The data for Tests 1, 2 and 3 were from Experiment 1. As part of Experiment 1, the participant was tested for FIN on 3 occasions with only the first test including the MTS procedure (this was a defining feature of Experiment 1). The first 2 tests were conducted pre-MEI and the third test was conducted post-MEI. No gains were made from pre- to post-MEI. In Experiment 6, Test 4 shows where the participant was tested for FIN again, but with a novel set of stimuli. The data for Tests 5 and 6 were from Experiment 7. The data showed that the criterion for Listener Incidental Naming (LIN) was met in Test 6. The data in Test 7 (post-MEI) showed that the mastery criteria were met for FIN. Participant E showed appreciable gains after each test for FIN. Because the data showed ascending trends across all phases it is difficult to discern whether the increases were attributable to the repeated testing or the MEI procedure.

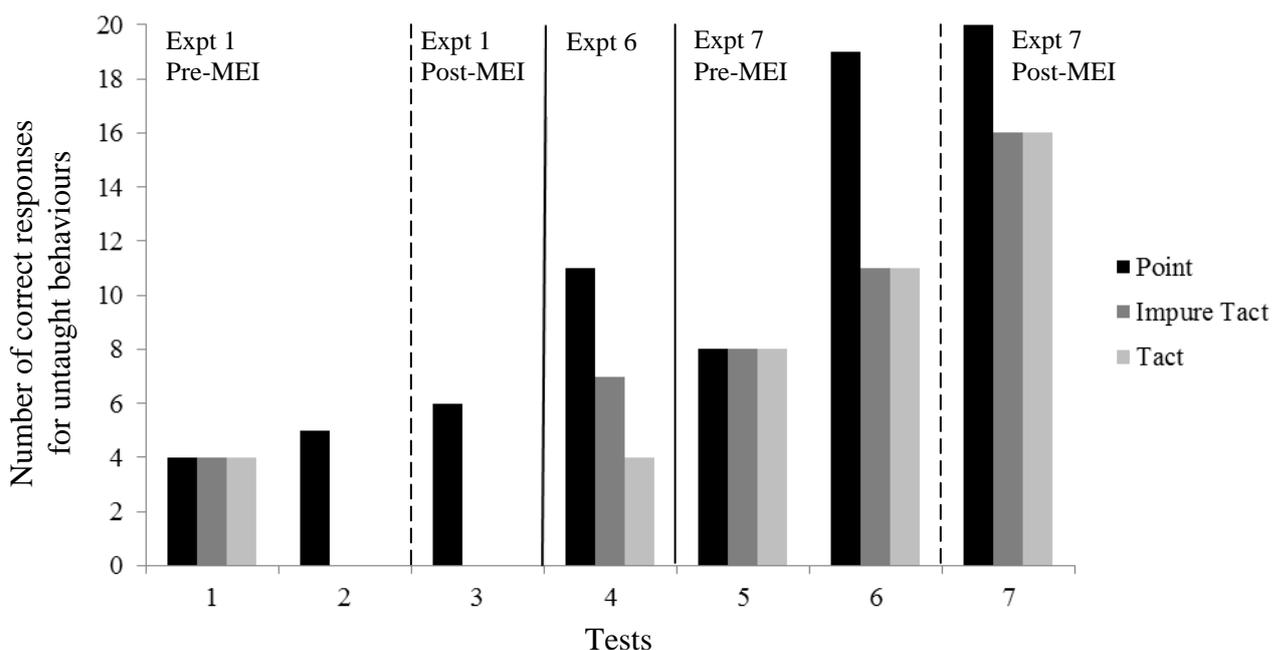


Figure 37: Results for Participant E: Number of correct responses for untaught listener and speaker behaviour.

Outcome 3: Mastery Criteria for FIN Met Pre-MEI after Multiple Tests (with MTS)

Four participants (Participants B, C, F & J) met the mastery criteria for FIN, but without the MEI intervention. Thus, the only element of the experiment that these participants were exposed to was the tests for FIN with preceding MTS sessions. Therefore, it may be surmised that the tests and the MTS procedures served as a specific type of language experience necessary to induce FIN. Each test was preceded by a MTS procedure in which the participant was exposed to the names of the stimuli and in the test the experimenter provided the names of items when teaching listener behaviour. This occurrence of multiple exposures of the names of items may have created another type of modified MEI experience. Alternatively, the initial test data may have produced false negative results indicating the participant already acquired the behavioural cusp, but the test did not indicate it. On that note, the final test data may have produced false positive results indicating the participant did not have the behavioural cusp, but the test indicated it. The participant may have scored higher in each test due to practice effects.

Participant B. Table 46 provides an overview of the participant characteristics. This includes information about Participant B's age (reported in years (y) and months (m)), gender, number of years as a pupil in the school (reported in years (y) and months (m)) and national curriculum levels for speaking and listening (see Appendix B for an explanation of these levels). Additional speech and language therapy test scores (see Appendix C for an explanation of these test results) are presented in Table 47. A '-' on Table 47 denotes that the participant was not tested.

Table 46

Participant B's Characteristics

Participant	Age	Gender	Duration in Current Setting	Level of Learning Disability	National Curriculum Levels Achieved	
					Eng (Speaking)	Eng(Listening)
B	12y, 0m	Male	0y, 6m	Moderate	P6.6	P6.6

Table 47

Speech and Language Therapy Test Scores for Participant B

Participant	DLS Score			TALC Score			
	2- word level	3-word level	4- word level	Level 1 Naming	Level 2 Describing	Level 3 Re-telling	Level 4 Justifying
B	88%	81%	47%	100%	61%	35%	N/A

Figure 38 shows the overall results for Participant B from Experiments 2 and 6. The results to the left of the solid vertical line are from Experiment 2. These data show that Participant B met the mastery criteria for FIN on the fourth test. All 4 of these tests included the MTS procedure prior to the test for untaught behaviours. The data to the right of the solid vertical line are from Experiment 6. These data show that Participant B continued to meet the mastery criteria for FIN with a novel set of stimuli.

Overall, ascending trends were consistently shown across all of the tests for FIN in Experiment 2 until mastery was reached in the fourth test. The results of the fourth test were potentially accurate because these results were confirmed by another test for FIN in Experiment 6 utilising stimuli that were separate and unique from stimuli previously used. Seemingly the data generated by Participant B indicated that the effects from multiple tests served as a type of unintended intervention which apparently induced FIN.

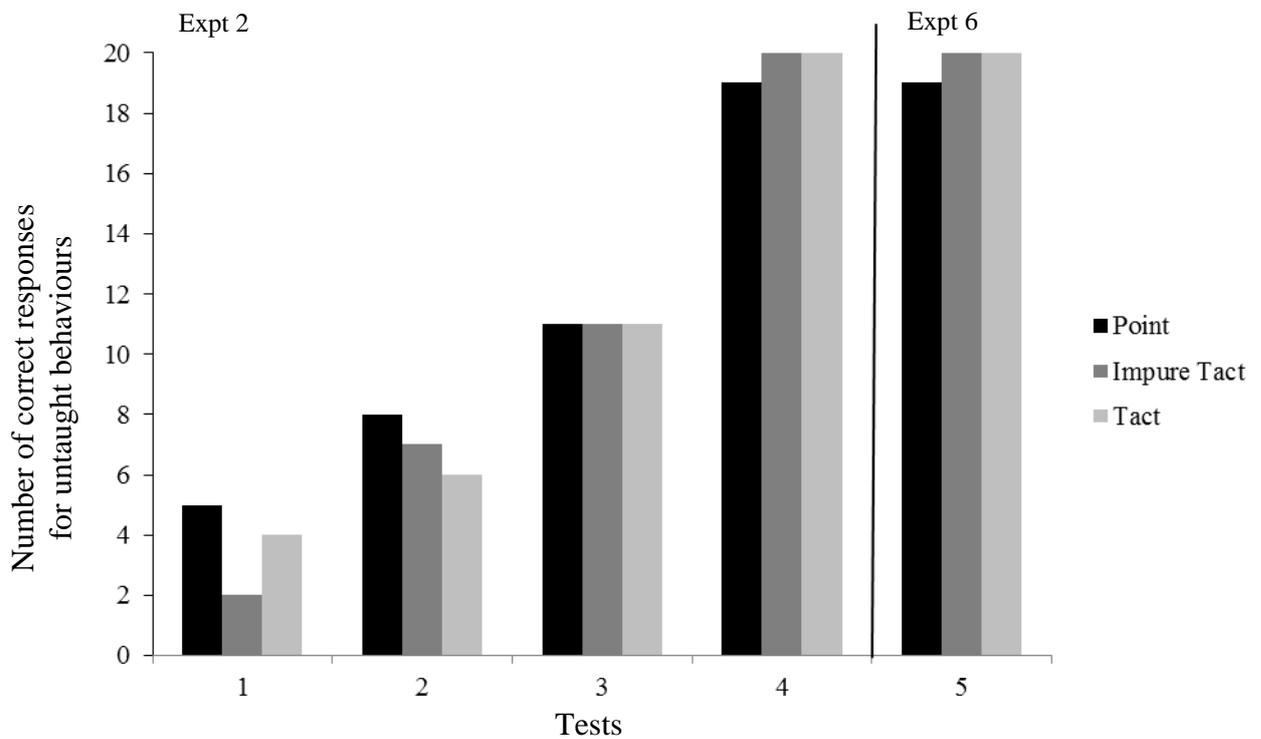


Figure 38: Results for Participant B: Number of correct responses for untaught listener and speaker behaviour (tests for FIN only).

Interestingly, Participant B was also tested for Full Bidirectional Naming (FBN) in Experiment 6 and he did not meet the criteria for this test. These data were not displayed in Figure 38, but were shown in Table 27 in Experiment 6 (Chapter 8). He met the criterion for Listener Bidirectional Naming (LBN), but did not meet the criterion for Speaker Bidirectional Naming (SBN). He was tested again for SBN (with a novel set of stimuli) and met the criterion, ultimately meeting the criteria for FBN (these data are shown in Table 28 in Experiment 6). The errors in the original test for SBN, however, were linked to issues with data collection sensitivity. For example, approximations of the names were counted as incorrect responses, e.g. “mop” for “moop” or “kock” for “kong.” This will be discussed further in Chapter 12 (Limitations of the Current Research) and Chapter 13 (Recommendations for Future Research).

Participant C. Table 48 provides an overview of the participant characteristics. This includes information about Participant C’s age (reported in years (y) and months (m)), gender, number of years as a pupil in the school (reported in years (y) and months

(m)) and national curriculum levels for speaking and listening (see Appendix B for an explanation of these levels). Additional speech and language therapy test scores (see Appendix C for an explanation of these test results) are presented in Table 49. A ‘-’ on Table 49 denotes that the participant was not tested.

Table 48

Participant C’s Characteristics

Participant	Age	Gender	Duration in Current Setting	Level of Learning Disability	National Curriculum Levels Achieved	
					Eng (Speaking)	Eng(Listening)
C	10y, 9m	Male	4y, 0m	Moderate	2C.4	2C.4

Table 49

Speech and Language Therapy Test Scores for Participant C

Participant	DLS Score			TALC Score			
	2-word level	3-word level	4-word level	Level 1 Naming	Level 2 Describing	Level 3 Re-telling	Level 4 Justifying
C		100%	72%	100%	100%	88%	61%

Figure 39 shows the overall results (tests for FIN only) for Participant C from Experiments 6 and 7. The data to the left of the solid vertical line are from Experiment 6 when an initial test for FIN was conducted and the mastery criteria were not met. The criterion for Listener Incidental Naming (LIN) was met at this point. For untaught speaker behaviour the participant consistently tacted the stimuli, but they were not correct responses. For example, he named “chob” as “mob,” “pidge” as “podge” and “gand” as “godge.” This pattern of responding mimics the pattern of responding of Participant B.

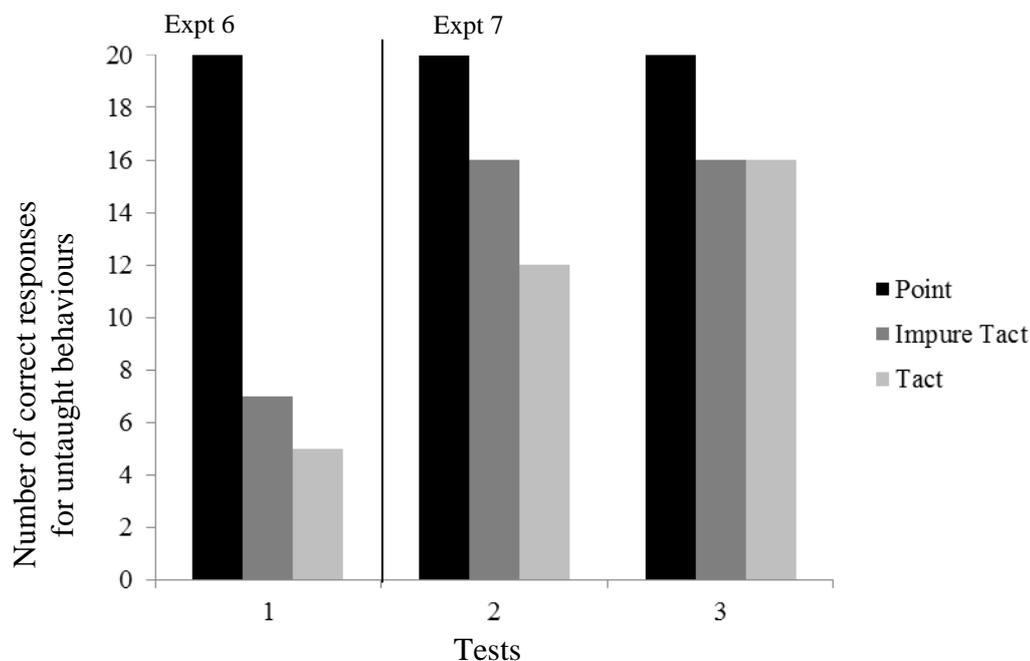


Figure 39: Results for Participant C: Number of correct responses for untaught listener and speaker behaviour.

The data to the right of the solid vertical line were from Experiment 7 where the mastery criteria were initially not met for FIN (Test 2) with a novel set of stimuli. Gains were made with untaught speaker behaviour, compared to the results from Experiment 6 (Test 1). In Experiment 7, the criterion was met for impure tacts, but the participant made consistent errors with two of the stimuli for the pure tacts. The participant tacted “mip” as “yip” and “cag” as “greg.” A second test for FIN was conducted (Test 3) and the mastery criteria were met (though the participant still consistently tacted “mip” as “yip” throughout). Over the course of the 3 tests the participant did produce increasingly consistent responses across all of the untaught behaviours. Again, data collection sensitivity played a role in under-identifying the subtleties in their responses.

Participant F. Table 50 provides an overview of the participant characteristics. This includes information about Participant F’s age (reported in years (y) and months (m)), gender, number of years as a pupil in the school (reported in years (y) and months (m)) and national curriculum levels for speaking and listening (see Appendix B for an

explanation of these levels). Speech and language therapy test scores were not available for Participant F.

Table 50

Participant F's Characteristics

Participant	Age	Gender	Duration in Current Setting	Level of Learning Disability	National Curriculum Levels Achieved	
					Eng (Speaking)	Eng(Listening)
F	18y, 11m	Female	7y, 0m	Severe	3.6	3.6

Figure 40 illustrates the overall results for Participant F from Experiments 6 and 7. The data to the left of the solid line were from Experiment 6 when an initial test for FIN was conducted and the mastery criteria were not met. The data to the right of the solid line were from Experiment 7. A test for FIN (Test 2) was conducted with a novel set of stimuli and the mastery criteria were not met. The participant did produce increased correct responses to emergent behaviour across all three behaviours. However, in this test, the participant emitted consistent incorrect responses for 2 of the stimuli across untaught listener and speaker behaviours. When the test was conducted again (Test 3), the mastery criteria for FIN were met. To clarify, this participant was not exposed to any MEI throughout this series of experiments. Therefore, the increases in correct emergent responses and mastery of the test for FIN were potentially the result of the testing experience and the preceding MTS procedures.

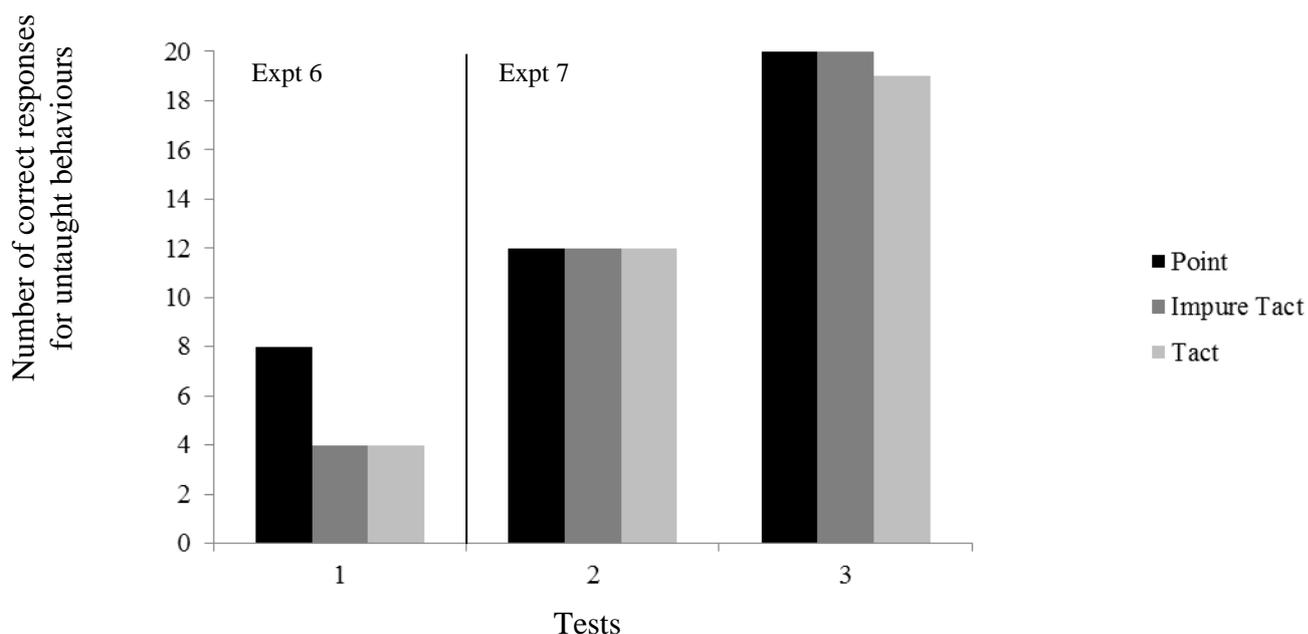


Figure 40: Results for Participant F: Number of correct responses for untaught listener and speaker behaviour.

Participant J. Table 51 provides an overview of the participant characteristics.

This includes information about Participant J's age (reported in years (y) and months (m)), gender, number of years as a pupil in the school (reported in years (y) and months (m)) and national curriculum levels for speaking and listening (see Appendix B for an explanation of these levels). Additional speech and language therapy test scores (see Appendix C for an explanation of these test results) are presented in Table 52. A '-' on Table 52 denotes that the participant was not tested.

Table 51

Participant J's Characteristics

Participant	Age	Gender	Duration in Current Setting	Level of Learning Disability	National Curriculum Levels Achieved	
					Eng (Speaking)	Eng(Listening)
J	15y, 10m	Male	10y, 2m	Moderate	2A.4	2A.4

Table 52

Speech and Language Therapy Test Scores for Participant J

Participant	DLS Score			TALC Score			
	2-word level	3-word level	4-word level	Level 1 Naming	Level 2 Describing	Level 3 Re-telling	Level 4 Justifying
J	-	-	-			100%	72%

Figure 41 shows the overall results for Participant J from Experiments 6 and 9. The data to the left of the solid vertical line are from Experiment 6 when an initial test for FIN was conducted and the mastery criteria were not met. The data to the right of the solid vertical line are from Experiment 9. Novel stimuli were used for the 3 tests in Experiment 9. Each of the tests in Experiment 9 showed higher correct responses to the test conducted in Experiment 6. The participant had notable attention problems during Test 3. He was re-directed on several occasions and this may have impacted the results. The mastery criteria for FIN were met on the third test in this experiment (Test 4).

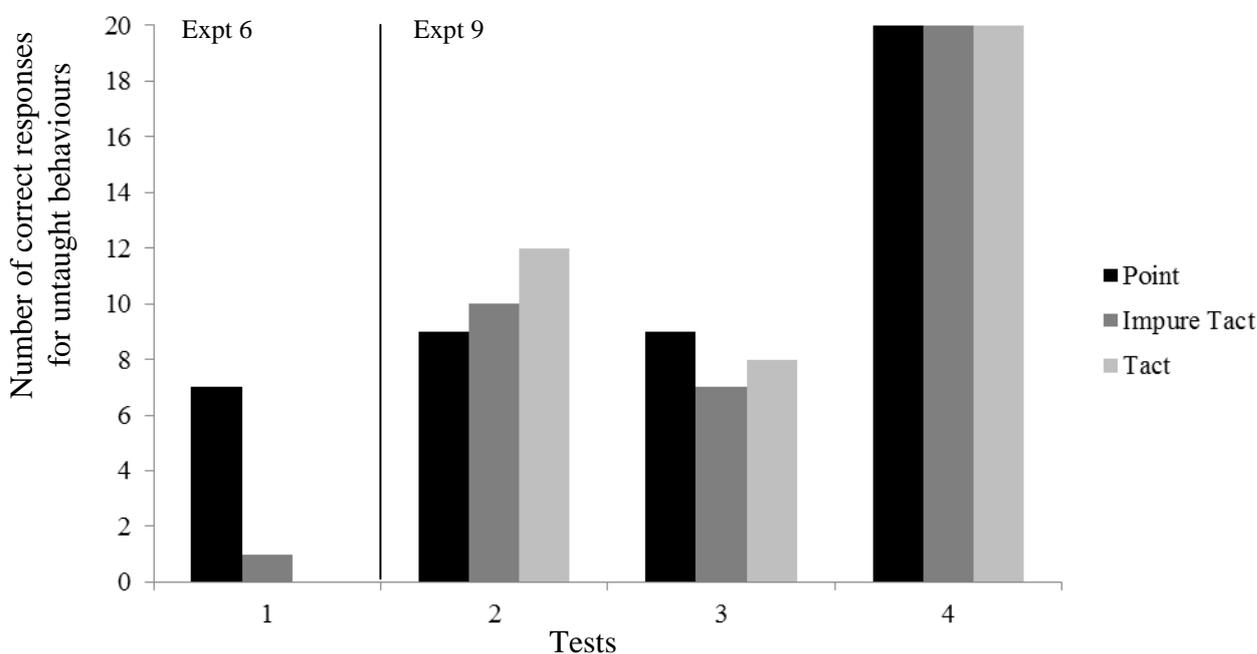


Figure 41: Results for Participant J: Number of correct responses for untaught listener and speaker behaviour.

The results from the case studies with Participants B, C, F and J provided evidence for two recommendations regarding the test for FIN. Firstly, several of the

participants showed results that increased consistently without the need for MEI and their responses increased seemingly as a function of testing (with the preceding MTS procedure). It is important to note that the combination of the MTS sessions with the experience of the test may be responsible for the increases in correct responses. The beneficial nature of the MTS sessions presented prior to each test for FIN provided the participant with the opportunity to hear the names of the stimuli again. The tests for the untaught listener and speaker behaviours are still tests for untaught behaviours. Furthermore, it was determined that conducting a minimum of two pre-MEI tests for FIN may be important to establish whether FIN is actually present.

Outcome 4: Mastery Criteria for FIN Not Met (Participants Met Criteria for FBN)

Participants G, H, I, K and M did not meet the mastery criteria for FIN throughout the series of experiments. Each participant met the criteria for Full Bidirectional Naming (FBN) in Experiment 6 and the MTS procedure was implemented prior to each test for FIN. These participants appeared to meet prerequisites in order to benefit from the MEI intervention, yet the mastery criteria for FIN pre- or post-MEI were not met. This suggests that FBN may not be a pre- or co-requisite for FIN. Or, there may be additional components of naming that need to be considered when FBN is present. Furthermore, additional unidentified prerequisites or co-requisites may need consideration.

Participant G. Table 53 provides an overview of the participant characteristics. This includes information about Participant G's age (reported in years (y) and months (m)), gender, number of years as a pupil in the school (reported in years (y) and months (m)) and national curriculum levels for speaking and listening (see Appendix B for an explanation of these levels). Additional speech and language therapy test scores (see Appendix C for an explanation of these test results) are presented in Table 54.

Table 53

Participant G's Characteristics

Participant	Age	Gender	Duration in Current Setting	Level of Learning Disability	National Curriculum Levels Achieved	
					Eng (Speaking)	Eng(Listening)
G	14y, 9m	Male	2y, 7m	Severe	2C.4	2C.4

Table 54

Speech and Language Therapy Test Scores for Participant G

Participant	DLS Score			TALC Score			
	2-word level	3-word level	4-word level	Level 1 Naming	Level 2 Describing	Level 3 Re-telling	Level 4 Justifying
G		90%	68%	100%	83%	71%	44%

Figure 42 shows the overall results for Participant G from Experiments 6 and 7. The data to the left of solid vertical line are from Experiment 6 when an initial test for FIN was conducted (Test 1) and the mastery criteria were not met. The data to the right of the solid vertical line are from Experiment 7. Tests 2 and 3 are the tests for FIN prior to the implementation of the MEI procedure. Test 4, after the dotted line, is also from Experiment 7, but post-MEI. The same stimuli were used in Tests 2, 3 and 4 and the MTS procedure was implemented prior to each test for FIN. The data show that significant gains were made in Test 4. Participant G emitted consistently accurate responses for 3 of the stimuli and consistently emitted incorrect responses for two of the stimuli. Gains were certainly made in terms of acquiring names of three of the stimuli without direct teaching. This participant's responses were consistently low across the first three tests (Tests 1-3), but he subsequently scored close to criteria levels in the post-MEI test for FIN.

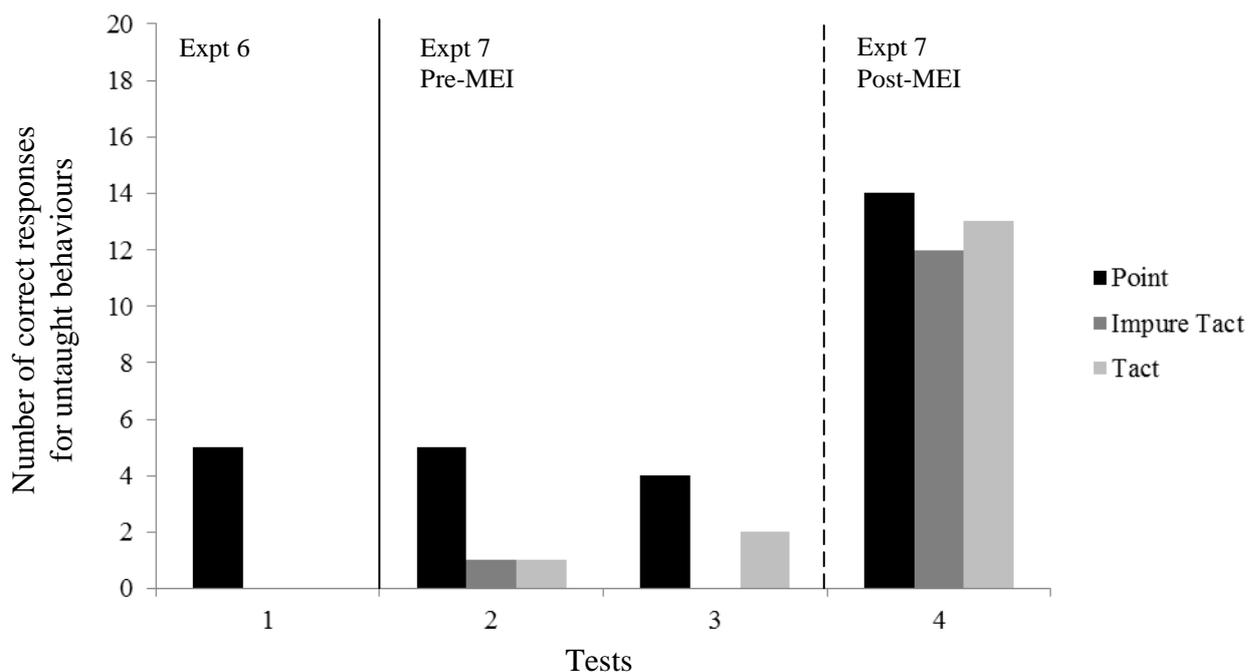


Figure 42: Results for Participant G: Number of correct responses for untaught listener and speaker behaviour.

Participant H. Table 55 provides an overview of the participant characteristics. This includes information about Participant H’s age (reported in years (y) and months (m)), gender, number of years as a pupil in the school (reported in years (y) and months (m)) and national curriculum levels for speaking and listening (see Appendix B for an explanation of these levels). Additional speech and language therapy test scores (see Appendix C for an explanation of these test results) are presented in Table 56. A ‘-’ on Table 56 denotes that the participant was not tested.

Table 55

Participant H’s Characteristics

Participant	Age	Gender	Duration in Current Setting	Level of Learning Disability	National Curriculum Levels Achieved	
					Eng (Speaking)	Eng(Listening)
H	12y, 3m	Male	7y, 8m	Severe	2C.6	2C.2

Table 56

Speech and Language Therapy Test Scores for Participant H

Participant	DLS Score			TALC Score			
	2-word level	3-word level	4-word level	Level 1 Naming	Level 2 Describing	Level 3 Re-telling	Level 4 Justifying
H	-	-	-	100%	88%	82%	27%

Figure 43 shows the overall results for Participant H from Experiments 6 and 7.

The data to the left of the solid vertical line (Test 1) are from Experiment 6 when an initial test for FIN was conducted and the mastery criteria were not met. The data to the right of the solid vertical line are from Experiment 7 (Tests 2-4).

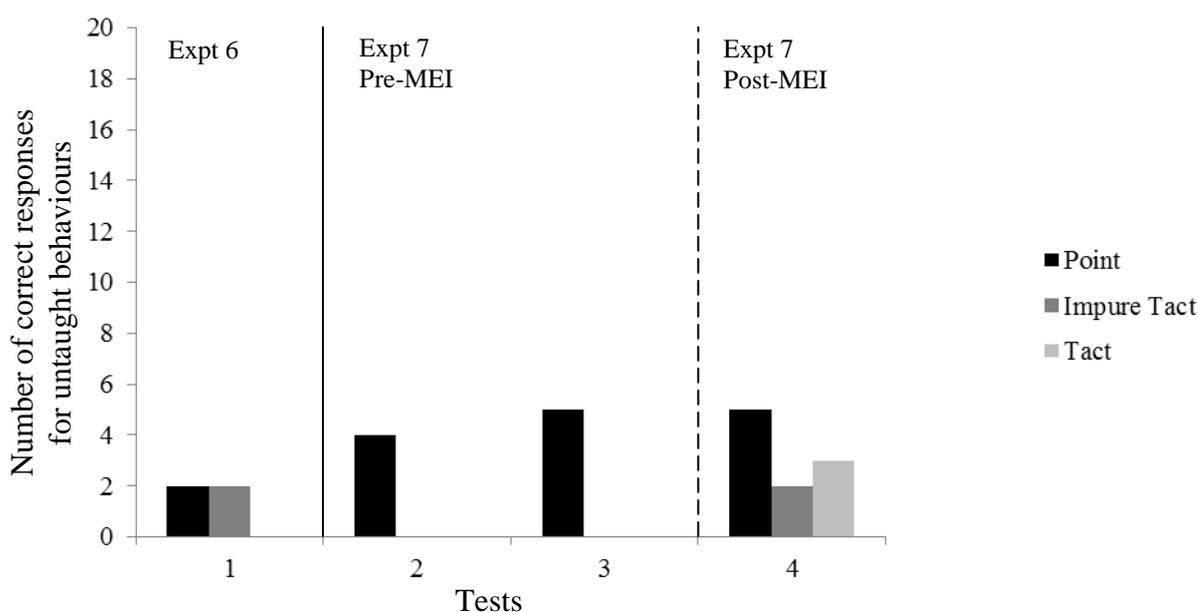


Figure 43: Results for Participant H: Number of correct responses for untaught listener and speaker behaviour.

Tests 2 and 3 are the tests for FIN prior to the MEI procedure being implemented. Test 4 is also from Experiment 7, but post-MEI. The same stimuli were used in Tests 2, 3 and 4 and the MTS procedure was implemented prior to each test for FIN. This participant’s data were consistently low across all the tests for FIN even MTS

procedures prior to each test for FIN. His performance may have been undermined by his extremely low scores in the first test for FIN.

Participant I. Table 57 provides an overview of the participant characteristics. This includes information about Participant I’s age (reported in years (y) and months (m)), gender, number of years as a pupil in the school (reported in years (y) and months (m)) and national curriculum levels for speaking and listening (see Appendix B for an explanation of these levels). Additional speech and language therapy test scores (see Appendix C for an explanation of these test results) are presented in Table 58. A ‘-’ on Table 58 denotes that the participant was not tested.

Table 57

Participant I’s Characteristics

Participant	Age	Gender	Duration in Current Setting	Level of Learning Disability	National Curriculum Levels Achieved	
					Eng (Speaking)	Eng(Listening)
I	16y, 10m	Male	5y, 2m	Severe	3.8	3.8

Table 58

Speech and Language Therapy Test Scores for Participant I

Participant	DLS Score			TALC Score			
	2-word level	3-word level	4-word level	Level 1 Naming	Level 2 Describing	Level 3 Re-telling	Level 4 Justifying
I	-	-	-		94%	94%	97%

Figure 44 shows the overall results for Participant I from Experiments 6 and 9. The data to the left of the solid vertical line are from Experiment 6 when an initial test for FIN was conducted and the mastery criteria were not met. The data to the right of the solid vertical line are from Experiment 9. Tests 2 and 3 are the tests for FIN prior to the MEI procedure being implemented. Test 4, after the dotted vertical line, is also from Experiment 9, but post-MEI. The same stimuli were used in Tests 2, 3 and 4 and the

MTS procedure was implemented prior to each test for FIN. Similar to Participant H, Participant I scored consistently low on all the tests for FIN despite meeting the mastery criteria for Full Bidirectional Naming (FBN) in Experiment 8.

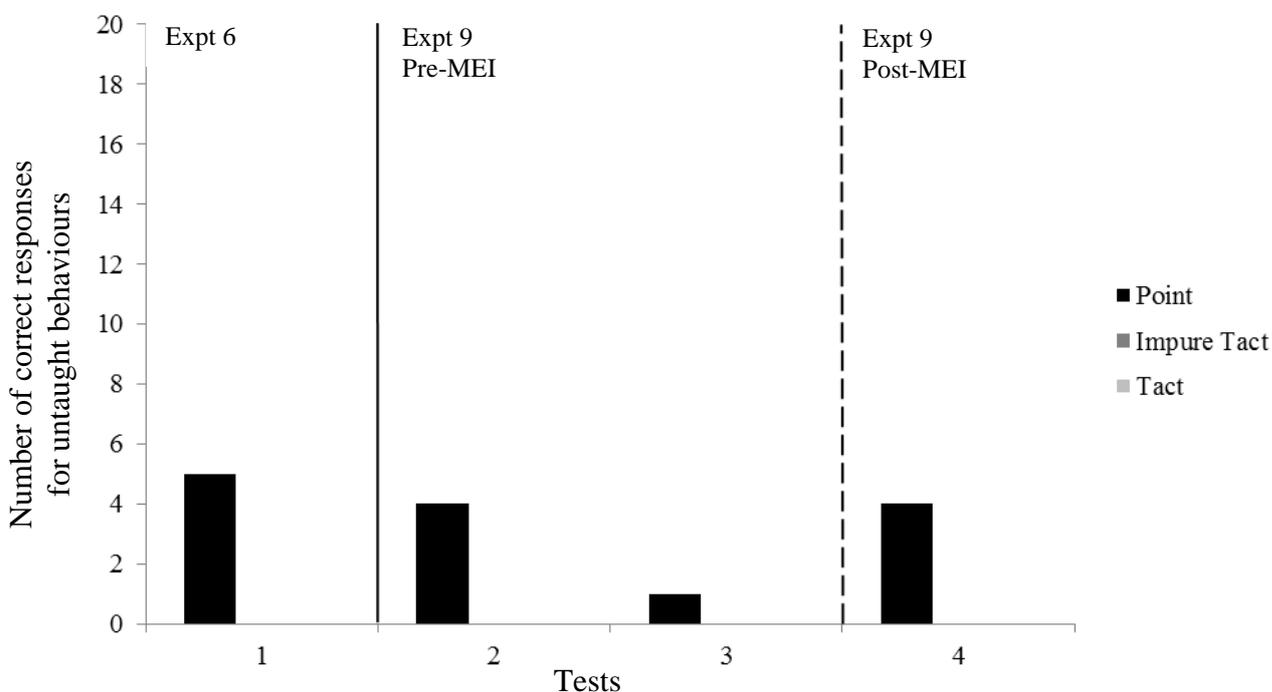


Figure 44: Results for Participant I: Number of correct responses for untaught listener and speaker behaviour.

Participant I created his own names for the stimuli, based on what the contrived stimuli looked like. If the stimulus looked like a letter of the alphabet he would name it as such, for example he named “desh” as “p.” He described some stimuli as “squiggle” or “wobbly line.” He also described some stimuli in more detail, for example “bip” was named as “the bumper of a car with the two lights.” It is notable that Participant I was 17 years old therefore his instructional history was well-established. He appeared to respond to the stimuli according to the fluent skills in his repertoire; he named the items according to their similarity to objects familiar to him. Similar stimuli were used with the bidirectional naming tests and he was able to tact those correctly following direct teaching. It would be interesting to test for FIN again with either non-contrived stimuli or contrived picture stimuli.

Participant G's, Participant H's and Participant I's responses were consistently low across the first three tests (Tests 1-3). Participant H and Participant I continued to generate low scores on the test post-MEI. Participant G, however, scored close to criteria levels in the post-MEI test for FIN. This discrepancy makes it difficult to identify some of the factors that have contributed to the scores on the final test of FIN.

Participant K. Table 59 provides an overview of the participant characteristics. This includes information about Participant K's age (reported in years (y) and months (m)), gender, number of years as a pupil in the school (reported in years (y) and months (m)) and national curriculum levels for speaking and listening (see Appendix B for an explanation of these levels). Additional speech and language therapy test scores (see Appendix C for an explanation of these test results) are presented in Table 60. A '-' on Table 60 denotes that the participant was not tested.

Table 59

Participant K's Characteristics

Participant	Age	Gender	Duration in Current Setting	Level of Learning Disability	National Curriculum Levels Achieved	
					Eng (Speaking)	Eng(Listening)
K	11y, 10m	Male	4y, 2m	Moderate	1C.8	1C.8

Table 60

Speech and Language Therapy Test Scores for Participant K

Participant	DLS Score			TALC Score			
	2-word level	3-word level	4-word level	Level 1 Naming	Level 2 Describing	Level 3 Re-telling	Level 4 Justifying
K	-	-	-	100%	88%	100%	72%

Figure 45 shows the overall results for Participant K from Experiments 6 and 9. The data to the left of the solid vertical line were from Experiment 6 when an initial test for FIN (Test 1) was conducted and the mastery criteria were not met. The data to the

right of the solid vertical line are from Experiment 9. Tests 2, 3 and 4 were the tests for FIN prior to the MEI procedure being implemented. Test 5, to the right of the dotted line, was also from Experiment 9, but post-MEI. The same stimuli were used in Tests 2, 3, 4 and 5 and the MTS procedure was implemented prior to each test for FIN.

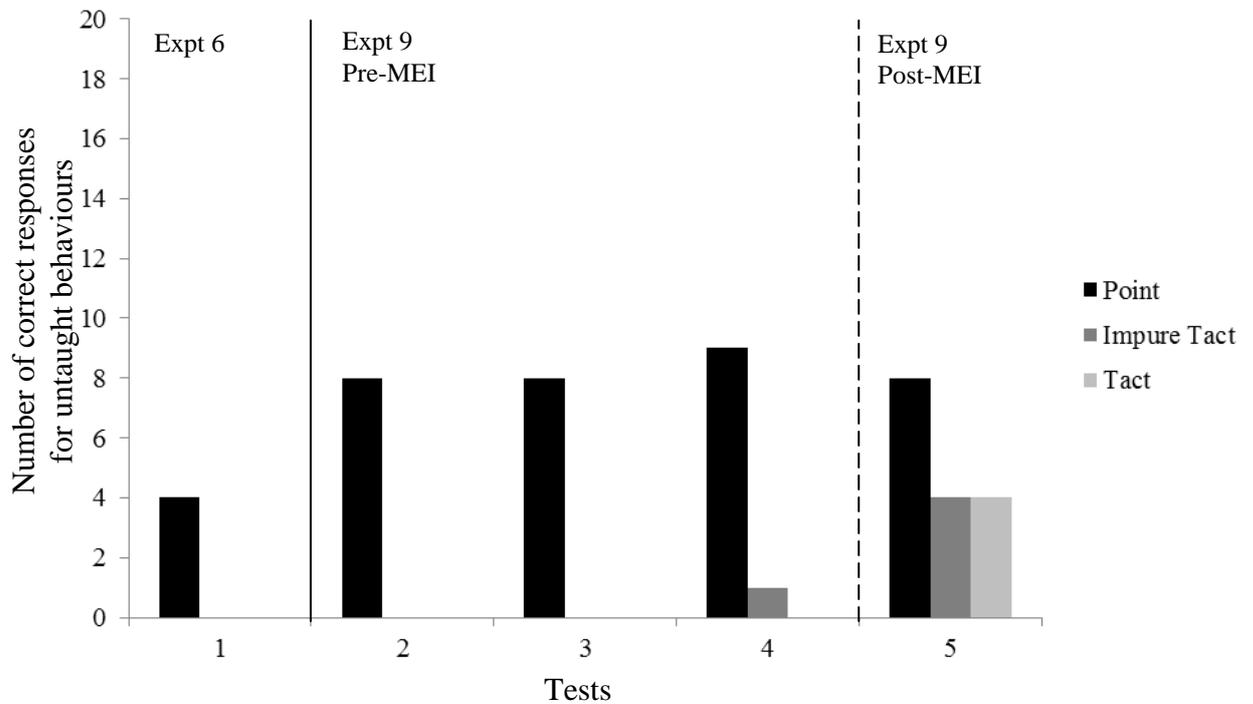


Figure 45: Results for Participant K: Number of correct responses for untaught listener and speaker behaviour.

Similar to Participant I, this participant also created his own names for the stimuli. For example he consistently named “dud” as “wheel,” “koop” as “cabinet” and “gill” as “tape measure.” The names he created had some level of correspondence with the stimuli. Both Participant I and Participant K had established instructional histories and were fluent speakers. This may have inhibited their acquisition of new names of contrived stimuli. Rather than associating the names of what they heard and the symbols being presented they appeared to associate the symbols with what they had learned previously.

Participant M. Table 61 provides an overview of the participant characteristics. This includes information about Participant M’s age (reported in years (y) and months (m)), gender, number of years as a pupil in the school (reported in years (y) and months

(m)) and national curriculum levels for speaking and listening (see Appendix B for an explanation of these levels). Speech and language therapy test scores were not available for Participant M.

Table 61

Participant M's Characteristics

Participant	Age	Gender	Duration in Current Setting	Level of Learning Disability	National Curriculum Levels Achieved	
					Eng (Speaking)	Eng(Listening)
M	18y, 0m	Male	10y, 3m	Moderate	3.6	3.6

Figure 46 shows the overall results for Participant M from Experiments 6 and 9. The data to the left of the solid vertical line are from Experiment 6 when an initial test for FIN was conducted and the mastery criteria were not met. The data to the right of the solid vertical line are from Experiment 9. Tests 2 and 3 are the tests for FIN prior to the MEI procedure being implemented. Test 4, to the right of the dotted vertical line, is also from Experiment 9, but post-MEI. The same stimuli were used in Tests 2, 3 and 4 and additional MTS sessions were implemented prior to each test for FIN.

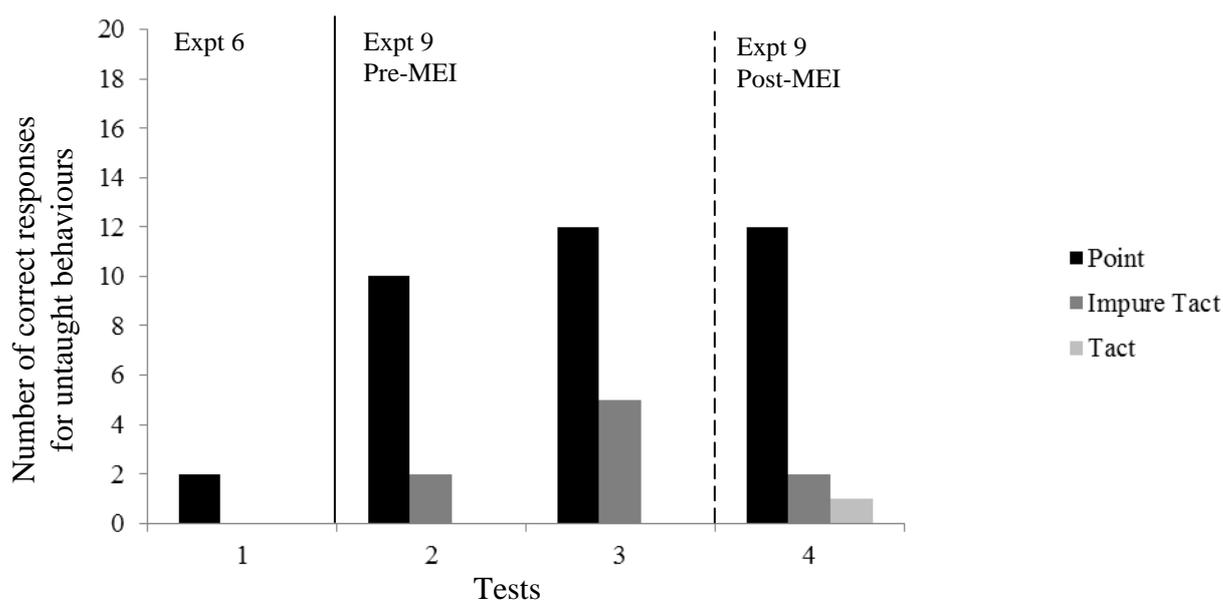


Figure 46: Results for Participant M: Number of correct responses for untaught listener and speaker behaviour.

Outcome 5: Mastery Criteria for FIN and FBN Not Met

Participants L and N-T did not meet the mastery criteria for FIN in Experiments 1 or 2 post-MEI. When these participants were tested for the different sub-components of naming in Experiment 6, Participants N-T did not have the pre-determined prerequisites to be tested for Full Bidirectional Naming. To clarify, these participants did not meet the criterion for five novel tacts within 120 learn units in Experiment 6 (Chapter 8) during the test for LBN. In order to be tested for LBN, participants were required to meet criterion on five novel tacts. Without this criterion met, untaught listener behaviour (LBN) could not be tested. Additional tactics, prompts or strategies were required in order to support these participants to meet this criterion. This factor, related to prerequisite behavioural cusps, is discussed further in Chapter 12.

Participant L did meet the criterion for LBN in Experiment 6 (Chapter 8), but did not meet the mastery criteria for FBN. Based on the results of Experiment 6, Participant L was selected for Experiment 8. In this experiment MEI was used to attempt to induce FBN, but MEI did not serve to produce criteria levels of responding for FBN.

Summary

Figure 47 summarises the results for all twenty participants described within this chapter. Upon a cursory review, case-by-case inspection of this series of experiments has yielded varying results. Figure 47 identifies eight different outcomes generated from the twenty participants. Figure 47 shows that 7/20 participants met the criteria for FIN. Of the seven participants who did meet the criteria for FIN, one participant (Participant A) met the criteria pre-MEI on the first test for FIN, four participants (Participants B, C, F & J) met the criteria pre-MEI after multiple tests for FIN with a MTS procedure preceding each test, and two participants (Participants D & E) met the criteria for FIN post-MEI.

Figure 47 shows that 13/20 participants did not meet the criteria for FIN. Ten of these 13 participants did not demonstrate any outcomes in terms of untaught behaviours. Of these ten participants, seven did not meet the criterion for LBN (Participants N-T), one participant met the criterion for LBN, but not FBN (Participant L) and two participants met the criteria for FBN (Participants I & M). The three additional participants who did not meet the criteria for FBN also produced varied outcomes: two generated some emergent verbal behaviour (Participants H & K) and one produced substantial outcomes post-MEI (Participant G).

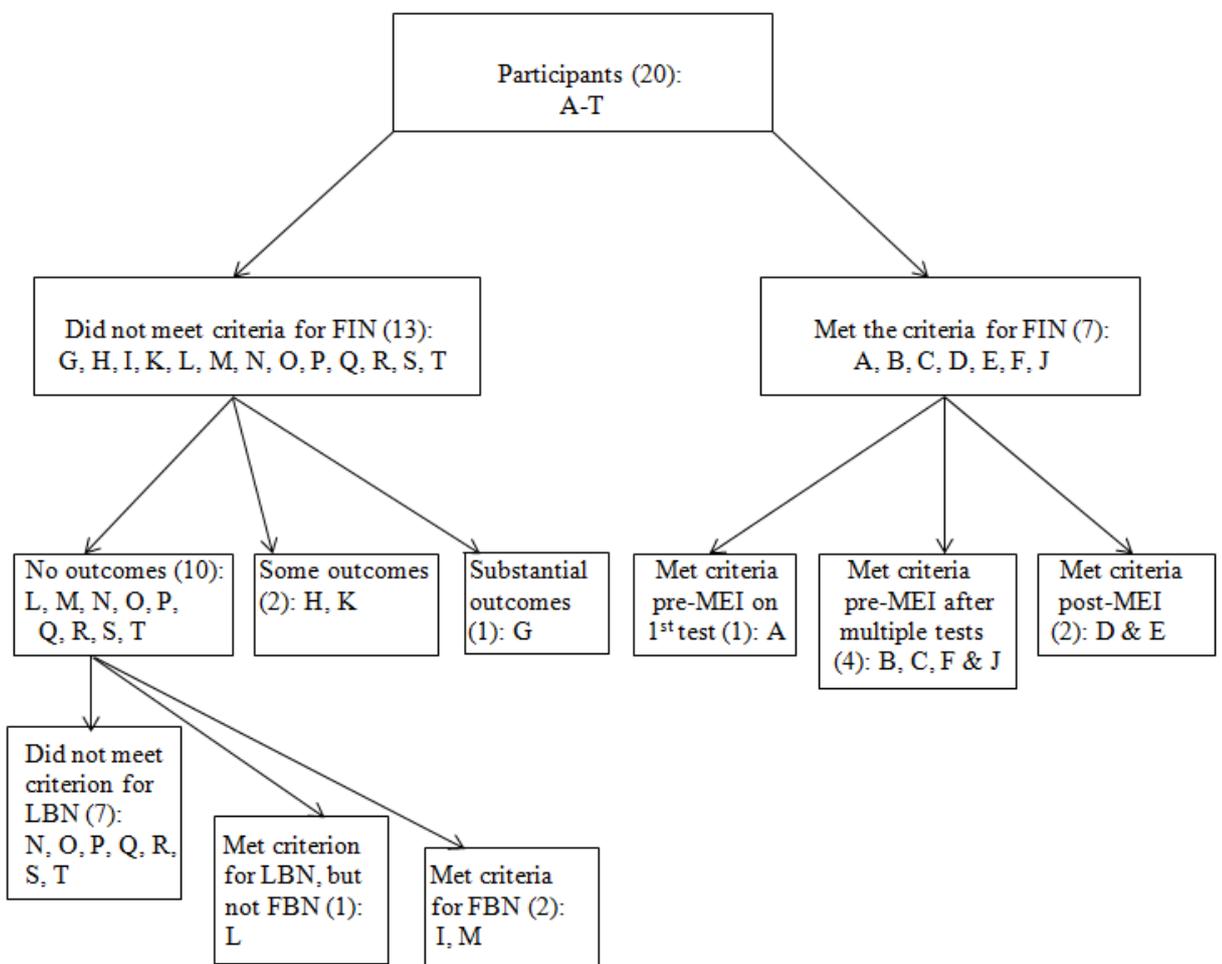


Figure 47: An overview of the results for all twenty participants. The letters denote each of the participants.

Although these outcomes were varied, there were some notable patterns that emerged. Initially, all twenty participants showed evidence of meeting the prerequisite

behavioural cusps identified by the VBBDT pre-reader pyramid (Greer & Ross, 2008) for the inducement of FIN. However, the results showed that only seven participants met the criteria for FIN by the end of the experimental series. Thus, this highlights the possibility that there were additional prerequisites or behavioural cusps that needed to be identified. To begin to analyse what these prerequisites or behavioural cusps may be, it is essential to first analyse the participants who did meet the criteria for FIN. Table 61 provides a summary of all of the participants who met the criteria for FIN and it also identifies the experimental procedures they were exposed to that may have been responsible for the inducement of FIN.

Table 62

Summary of participants who met criteria for FIN and the experimental procedures they were exposed to

Participant	Single Test	Multiple Testing	Multiple Testing & MTS	MEI
A	✓			
B			✓	
C			✓	
D		✓	✓	✓
E		✓	✓	✓
F			✓	
J			✓	

Table 62 shows that no participant met FIN via the combination of multiple testing (i.e. multiple testing without the preceding MTS procedure beyond the initial test) and MEI (based on published research). This is an important distinction because the use of multiple testing and MEI reflects the most recent research for inducing FIN.

Two participants (Participants D & E) met the criteria for FIN via the experimental combination of multiple testing (without the preceding MTS procedure beyond the initial test), multiple testing (with the preceding MTS procedure) and MEI. It is important to note that these participants did not meet the criteria for FIN prior to the implementation of multiple testing (with the preceding MTS procedure).

Four participants (Participants B, C, F & J) met criteria for FIN following multiple testing (with the preceding MTS procedure), but without MEI. Apparently this multiple testing experience alone was sufficient to induce FIN. Because the multiple testing experiences included a preceding MTS procedure it also contained elements of MEI (hearing names of items while stimuli were presented). Thus the fact that participants did meet the criteria for FIN is not so far-reaching.

One participant met criteria for FIN after the first test (Participant A). The first test for FIN is always preceded by a MTS procedure to allow the participant to hear the names of the novel stimuli while attending to the stimuli (the incidental language experience).

Since it appears that the experimental procedures containing multiple testing preceded by MTS experiences had an impact on the outcomes, it is important to analyse that procedure (multiple testing plus MTS) as an intervention in itself for inducing FIN. Fourteen out of the 20 participants in the study were exposed to multiple tests preceded by MTS experiences. Table 63 provides a summary of these 14 participants and shows whether a correspondence existed with the inducement of FIN.

Table 63

Summary of participants who were exposed to multiple tests preceded by MTS

Participant	FIN
B	✓
C	✓
D	✓
E	✓
F	✓
G	X
H	X
I	X
J	✓
K	X
M	X
R	X
S	X
T	X

Of the 14 participants who were exposed to multiple tests preceded by MTS experiences, 6 met the criteria for FIN. This provides evidence that those 6 participants did have the necessary prerequisites to benefit from the multiple tests preceded by MTS as an intervention for the inducement of FIN without needing MEI. Even though Participants D and E did not meet the criteria for FIN until multiple testing with MTS was implemented, we are unable to determine whether it was the multiple testing with MTS that induced FIN, or whether the previous exposure to MEI induced FIN. Regardless of how FIN was induced, these two participants had the prerequisites for the inducement for FIN.

Eight participants who were exposed to multiple testing with MTS did not acquire FIN. These participants demonstrated the minimal prerequisite behavioural cusps as outlined by the VBDT pre-reader pyramid (Greer and Ross, 2008). Because they had the same experimental experiences as six other participants, but they did not meet the criteria for FIN it is plausible that they were missing additional prerequisites to benefit from these experimental experiences. More information is needed about what these prerequisite behavioural cusps might be for these individuals. These elements will be investigated in more detail in the discussion chapters (Chapters 11-13). What is evident is that many of the participants did master FIN. However, the mastery may have been the result of multiple tests, the MEI procedure or a combination of the two. This means that specific or sufficient enough language experiences may induce untaught behaviour.

This chapter concludes the experimental chapters of this thesis (Chapters 6-10). This chapter is followed by three discussion chapters. The first discussion chapter (Chapter 11) provides a general discussion of the full thesis including the major findings. Chapter 12 describes the limitations of the current body of work and Chapter 13 provides recommendations for future research.

Chapter 11

General Discussion

A review of the literature on naming⁸ yielded some ambiguities related to differences in how researchers in the field defined naming. These differences provided some evidence that potentially there are several sub-components of naming rather than one specific phenomenon. This body of work included a series of experiments conducted to systematically replicate published research on Multiple Exemplar Instruction (MEI) and naming, but with a different group of participants consisting of only older children and young adults diagnosed with autism. All of the published research on MEI and naming had involved younger children (aged 2-6 years) with and without a diagnosis of autism (e.g. Fiorile & Greer, 2007; Gilic & Greer, 2011; Greer, Corwin, & Buttigieg, 2011a; Greer, Stolfi, Chavez-Brown, & Rivera-Valdes, 2005b; Greer, Stolfi, & Pistoljevic, 2007). Because of the potential benefits of MEI to older children and young people diagnosed with autism, the initial purpose of the current body of work was to conduct a series of scientifically sound and well controlled systematic studies with an older group of children and young adults diagnosed with autism.

MEI was the intervention used most frequently in the published research on inducing naming (e.g. Fiorile & Greer, 2007; Gilic & Greer, 2011; Greer et al., 2005b, 2007, 2011a). The findings of the current body of work did not support the findings of similar previously published research on the use of MEI to induce naming.

Structurally, this chapter consists of five major sections. The first section provides a summary of the experimental purpose and dependent variables and this is followed by a summary of the methods and results of all nine experiments. These two sections serve as a reminder to the reader of the main focus and findings of the current

⁸ As a reminder to the reader, when describing all of the sub-components of naming as one phenomenon then the term 'naming' is used. Refer to Figure 6 in Chapter 4 (page 70).

body of work. The third section provides a summary of the major findings of this current research. The findings were not as predicted (that MEI would induce FIN), thus an analysis of the differences between the published studies on MEI and naming (Fiorile & Greer, 2007; Gilic & Greer, 2011; Greer et al., 2005b, 2007, 2011a) and the current research is provided. The purpose of this fourth section is to provide possible explanations as to why the results were not as expected. Finally, a summary of the chapter is provided.

Experimental Purpose and Dependent Variables

The initial focus of this body of work was to *induce* Full Incidental Naming (FIN) in older children and young adults diagnosed with autism. Because the results of the initial experiments were not as expected, some variations to the experimental procedures were implemented. These modifications were implemented after the results of one experiment were analysed and before the next experiment commenced. An analysis of the results of the initial experiments also raised additional questions about the *measurement* of FIN (whether it was present or not). The overall focus of this body of work was therefore not only to induce FIN in older children and young adults diagnosed with autism, but also to analyse how FIN is measured.

FIN is defined as the emergence of untaught speaker behaviour and untaught listener behaviour following an incidental experience where the name of a novel item is provided, but without direct teaching or direct reinforcement. To clarify, an individual is required to utilise that novel name as a listener (e.g. hear the name of an item and point to it) and as a speaker (e.g. tact the item) to demonstrate emergent verbal behaviour, specifically FIN. While the main focus of this work was FIN, each of the six sub-components of naming was addressed across the series of experiments. These sub-components were Listener Bidirectional Naming (LBN), Speaker Bidirectional Naming (SBN), Full Bidirectional Naming (FBN), Listener Incidental Naming (LIN), Speaker

Incidental Naming (SIN) and Full Incidental Naming (FIN). The dependent variable in each of the studies was at least one of these sub-components of naming and the independent variable was MEI.

Four experiments focused on inducing FIN using MEI with older children and young adults diagnosed with autism (Experiments 1, 2, 7 and 9), three experiments focused on testing neuro-typical fully verbal adults for FIN (Experiments 3, 4 and 5), one experiment focused on inducing FBN using MEI with older children and young adults diagnosed with autism (Experiment 8) and one focused on testing for the presence of the different sub-components of naming with older children and young adults diagnosed with autism (Experiment 6).

Summary of Methods and Results

Table 64 provides an overview of the series of experiments included in this body of work. Specific parts of the procedure were altered in some experiments on the basis of the results of preceding experiments. Table 63 highlights some of the differences and modifications between experiments.

The second column in Table 64 provides a description of the participants and it is apparent that most of the experiments were with older children and young adults diagnosed with autism, but three experiments were with neuro-typical fully verbal adults. The third column states whether FBN was present for the participants as this was a key part of the research in terms of being a potential prerequisite for FIN. The next two columns describe the independent variable and dependent variable in each study. The next column shows whether an additional match-to-sample (MTS) procedure was conducted prior to each test for FIN. The final column states the focus of each experiment: to induce a sub-component of naming or to measure a sub-component of naming.

Table 64

Characteristics of each experiment in the experimental sequence (IV = Independent Variable; DV = Dependent Variable; MTS = Match-to-Sample)

Expt	Description of Participants	Participants met criteria for FBN?	IV	DV	MTS prior to each test for FIN?	Focus of Experiment
1	Older children & young adults diagnosed with autism	No	MEI	FIN	No	Induce FIN
2	Older children & young adults diagnosed with autism	No	MEI	FIN	Yes	Induce FIN
3	Neuro-typical & fully verbal adults	N/A	N/A	FIN	N/A	Measure FIN
4	Neuro-typical & fully verbal adults	N/A	N/A	FIN	Yes	Measure FIN
5	Neuro-typical & fully verbal adults	N/A	N/A	FIN	Yes	Measure FIN
6	Older children & young adults diagnosed with autism	N/A	N/A	LBN SBN FBN LIN SIN FIN	Yes	Measure LBN, SBN, FBN, LIN, SIN & FIN
7	Older children & young adults diagnosed with autism	Yes	MEI	FIN	Yes	Induce FIN
8	Older children & young adults diagnosed with autism	No	MEI	FBN	Yes	Induce FBN
9	Older children & young adults diagnosed with autism	Yes	MEI	FIN	Yes	Induce FIN

Solely contrived stimuli were used throughout the series of experiments. The use of contrived stimuli ensured that the participants had no previous experience of the selected stimuli. It also ensured that they were not exposed to the stimuli at all during the series of experiments. It was also deemed important that the contrived stimuli in the current series of experiments could be easily pronounced and that there was a clear distinction between the names of the stimuli within each set of stimuli.

The overarching purpose of the entire corpus of experiments was to determine whether MEI induced FIN. It is evident from Table 63, however, that a number of the experiments focused on the measurement of FIN rather than the inducement of FIN and that some experiments focused on different sub-components of naming, not solely FIN. One column also specifies whether the participants met the criteria for FBN (a suggested prerequisite for FIN) or not. This was because it was suggested during this series of experiments that FBN may be an additional prerequisite for FIN and this was tested in later experiments. Each of the participants with a diagnosis of autism across *all* experiments showed evidence of the suggested prerequisites for the inducement of FIN, as described in the Verbal Behaviour Development Theory (VBBDT; Greer & Keohane, 2005; Greer & Ross, 2008; Greer & Speckman, 2009), e.g. echoic-to-tact repertoire, independent mands and transformation of establishing operations across mands and tacts. Thus, it was predicted, based on the VBBDT, that the participants would meet the criteria for FIN following the MEI procedure. The following descriptions of each of the experiments provide some clarification on the purpose of each experiment and the analysis that took place to provide the rationale for the succeeding experiment.

Experiment 1. The purpose of Experiment 1 was to replicate previously published research demonstrating that the MEI procedure induces FIN, but exclusively with older children and young adults diagnosed with autism. Even though the previously published research on MEI and naming focused on younger children with

and without disabilities, there was nothing inherent in the procedures used that made them exclusive only to that group of participants. Thus, based on previously published research findings, it was expected that MEI would induce FIN with older children and young adults diagnosed with autism. Greer et al. (2011a) was the most recent study specifically on MEI and FIN. In their study they used two tests for FIN prior to the implementation of the MEI procedure and this was also one of the intentional design features of Experiment 1. The rationale for conducting two tests for FIN pre-MEI was based on minimising the chances of the pre-intervention test yielding false positive scores or false negative results. Thus, in Experiment 1 at least two tests for FIN were conducted prior to the implementation of the MEI procedure. The procedure for Experiment 1 included two to five tests for FIN (only the first test was preceded by the MTS procedure), the MEI procedure with novel stimuli and a follow-up test for FIN with the same stimuli as the initial tests. The procedure is shown in Figure 48. Figure 48 shows only two initial tests for FIN, but each participant received between two and five pre-MEI tests for FIN.

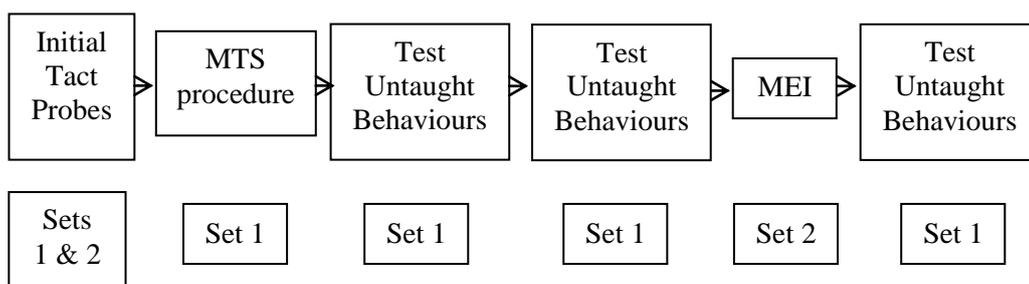


Figure 48: Experimental procedure for Experiment 1.

Figure 48 shows that an initial MTS procedure was conducted with each participant to expose them to the names of the novel stimuli. The purpose of the procedure was to mimic an incidental learning experience that is generally part of neuro-typical children’s experiential history. Following completion of this MTS procedure each participant was tested for untaught behaviours. To clarify, a test was

conducted to determine whether the participant pointed to the stimuli after hearing the name of each stimulus (untaught listener behaviour) and whether the participant tacted the stimuli (untaught speaker behaviour). If the predetermined criterion of 16/20 correct responses for each untaught behaviour was met then the criteria for FIN were met. If the criteria for FIN were not met a second test for untaught behaviours was conducted (and for some participants a third, fourth and fifth test). Assuming the criteria for FIN were still not met a MEI procedure was implemented with a different set of stimuli. This MEI procedure involved randomly rotating matching stimuli, pointing to stimuli and tacting stimuli (with and without a vocal antecedent). Once the criteria for this MEI procedure were met then a final test for untaught behaviours was conducted with the original stimuli utilised in the first and second test for untaught behaviours (the initial tests for FIN). To clarify, this final test for untaught behaviours was a further test for FIN. It was expected that the participants would meet the criteria for FIN in this final test following the implementation of the MEI procedure.

However, the participants did not meet the criteria for FIN nor were gains made in terms of emergent verbal behaviour (the participants' scores in the final test for FIN were not notably different to their scores in the initial tests). One reason that may account for these unexpected findings was the limited exposure to the names of the stimuli and the passage of time between this initial exposure and subsequent testing for emergent verbal behaviour. To clarify, the only time the names of the test stimuli were heard was in the MTS procedure at the outset and the time that elapsed between the initial exposure to this procedure and the final test for FIN was lengthy. After the initial exposure to the names of the stimuli, a second test for FIN was conducted (without hearing the names of the stimuli in an initial MTS procedure) and a MEI procedure using different stimuli was subsequently implemented. The duration of this MEI procedure was between 1 and 3 days across all participants. Once the criteria were met

on the MEI procedure used in this experiment then a final test for FIN was conducted (without the initial MTS procedure again). The criteria for the final test for FIN were that the participants demonstrated emergent listener and emergent speaker behaviour with names of stimuli they had been exposed to in the MTS procedure up to 5 days earlier. To address the potential impact of the delay between initially hearing the names of stimuli in Set 1 and being tested after an MEI procedure as long as 5 days later, an additional MTS procedure was conducted prior to each test for FIN in the subsequent experiments.

Experiment 2. Experiment 2 included an additional MTS procedure prior to *each* test for FIN (pre- and post-MEI). The procedure for Experiment 2 is shown in Figure 49. The additional MTS procedures prior to each test for untaught behaviours are highlighted in Figure 49. As with Figure 48, only two pre-MEI tests for FIN are illustrated, but each participant received at least two pre-MEI tests for FIN (up to four tests). This additional exposure to the names of the items provided during the MTS procedure minimised the passage of time as a possible extraneous variable in all of the tests for FIN. The remainder of the procedure for Experiment 2 was the same as in Experiment 1.

Following an analysis of the results of Experiment 1, it was hypothesised that the time that elapsed between the initial exposure to the names of the stimuli and subsequent testing was lengthy and this impacted the results. If the analysis of the results of Experiment 1 was accurate then this modification in Experiment 2 (where participants were exposed to the names of the stimuli in each MTS procedure prior to *each* test for untaught behaviours) should have allowed the 4 participants to meet the criteria for FIN following the MEI procedure. Instead, 3 of the participants (Participants 1-3) did not show any gains in untaught behaviours and 1 of these participants (Participant 3) did not even meet the criteria on the MEI intervention. One participant

did meet the criteria for FIN *prior* to the MEI procedure being implemented (Participant 4). These results indicated that there may have been more than one unaccounted-for extraneous variable which raised additional questions about both the MEI procedure and the test for FIN.

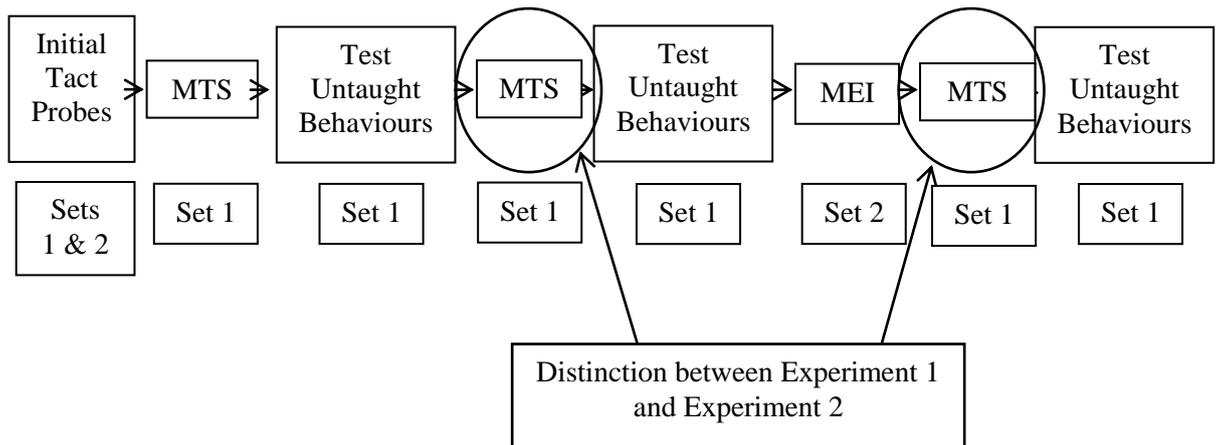


Figure 49: Experimental procedure for Experiment 2.

The MEI procedure. The lack of emergent untaught behaviour for 3 of the 4 participants may be explained by additional prerequisites necessary for the participants to benefit from MEI (prerequisites beyond those described on the VBBDT pre-reader pyramid (Greer & Ross, 2008)). For example, according to the pyramid, the only evidence of emergent behaviour that appears to be required prior to testing for and inducing FIN is the transformation of establishing operations across mands and tacts (which involves learning a new mand and using that same word as a tact with no further direct teaching and vice versa). Potentially, the presence of further emergent behaviour, such as untaught speaker behaviour following listener training and untaught listener behaviour following speaker training, is also required prior to testing for and inducing FIN. This emergence of untaught speaker behaviour and untaught listener behaviour is synonymous with Full Bidirectional Naming (FBN).

Because three of the four participants in Experiment 2 did not show any gains in untaught behaviours following an incidental language experience (the MTS procedure), it may be that *bidirectional* naming is also a prerequisite for *incidental* naming. More specifically, it was suggested that the different sub-components of naming may be prerequisites to FIN. A fuller analysis of the prerequisite sub-components of naming was addressed in Experiment 6 which will be addressed later in this chapter.

The test for FIN. Because one of the participants in Experiment 2 demonstrated FIN on the fourth pre-MEI test for FIN, without receiving the MEI intervention, this raised a second question regarding the *measurement* used to test for the presence or absence of FIN. More specifically, these data revealed that either the first, second and third tests for FIN produced false negative scores (the participant had naming, but the tests did not provide evidence for this) or the final test for FIN generated false positive results (the participant did not have naming, but the test suggested he did). Alternatively, FIN may have been induced via this multiple testing as the participant was exposed to the MTS procedure on four occasions as it preceded each test for FIN. To clarify, for the first test for FIN, naming was not present, but the scores gradually increased for this participant as each test was conducted (Tests 2, 3 and 4). Each test was preceded by a MTS procedure so it is unknown whether each repetition of the MTS procedure alongside the test for FIN gradually induced naming or whether the first test produced a false negative score, or whether the final test generated a false positive result.

In order to determine whether the test for FIN was an appropriate test for the presence or absence of FIN, administering the test on individuals who already had evidence of FIN was an appropriate next step to evaluate the validity of the test. Thus, a participant group of neuro-typical fully verbal adults who had evidence of FIN were selected for the next set of experiments. It was expected that the results would show a

correspondence between the score on the test for FIN and the individual's level of verbal functioning. To clarify, it was expected that individuals who already demonstrated FIN, by being neuro-typical and fully verbal adults, would meet the criteria for the test for FIN.

Experiment 3. The purpose of this experiment was to determine if eight neuro-typical fully verbal adults met the criteria for FIN when exposed to the test for FIN recommended by the VBDT and the published research on MEI and FIN (Gilic & Greer, 2011; Greer et al., 2005b, 2007, 2011a). To clarify, it was predicted that the participants would score at least 16/20 correct responses when tested for untaught listener behaviour and at least 16/20 correct responses for each of the tests for untaught speaker behaviour (16/20 for pure tacts and 16/20 for impure tacts) following the MTS procedure. If each of the adult participants met these criteria then the criteria for FIN were met. Thus, a correspondence was demonstrated between the scores generated from the test for FIN and the verbal functioning of neuro-typical fully verbal adults. This correspondence provided evidence for the validity of the test for FIN in terms of it confirming the presence of FIN. Participants were only tested for FIN and were not exposed to the MEI procedure. The procedure for Experiment 3 is shown in Figure 50.

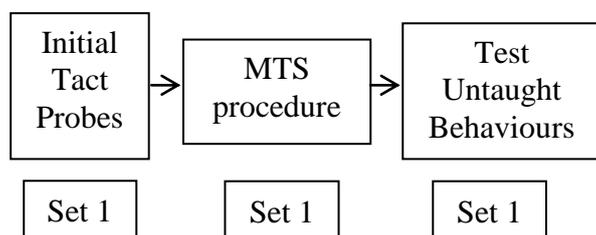


Figure 50: Procedure for Experiment 3.

Because of the participants' levels of verbal functioning, it was predicted each participant would meet the criteria for FIN; however the results showed only four of the

eight participants met these criteria (Participants 1, 2, 4 & 8). This brings to light the limitations regarding the use of the test to determine the presence of FIN because clearly the participants had established histories of demonstrating FIN, but they did not meet the criteria for FIN with this test. One of the concerns emanating from this limitation was whether the test was designed for early language learners and not appropriate for individuals with extensive histories of complex verbal behaviour.

If the test for FIN is not an appropriate measure for neuro-typical adults then the results may generate false negative scores (the individual demonstrates FIN by being a fully verbal and neuro-typical adult, but does not meet the criteria for FIN with contrived stimuli). This may also have implications for results related to younger children due to the fact that it is nearly impossible to account for a person's history of coming in contact with language and environmental events. If this is the case then the results of the test for FIN may yield false negative scores. In order to initially respond to these concerns (false negative scores) multiple tests for FIN for each participant may need to be conducted. These multiple tests will either provide corroborating or refuting evidence for determining whether FIN was present. Thus, providing each participant with a second test for FIN and analysing the consistency between the two tests was the rationale for Experiment 4.

Experiment 4. In Experiment 4 two tests for FIN (including a MTS procedure for each test) with the same stimuli were conducted with eight more neuro-typical fully verbal adults. The rationale for this experiment was to ensure that the results of the first test for FIN did not generate false negative scores. To clarify, it was predicted that if a participant did not meet the criteria for FIN on the first test then they would meet the criteria on the second test. The procedure for Experiment 4 is shown in Figure 51.

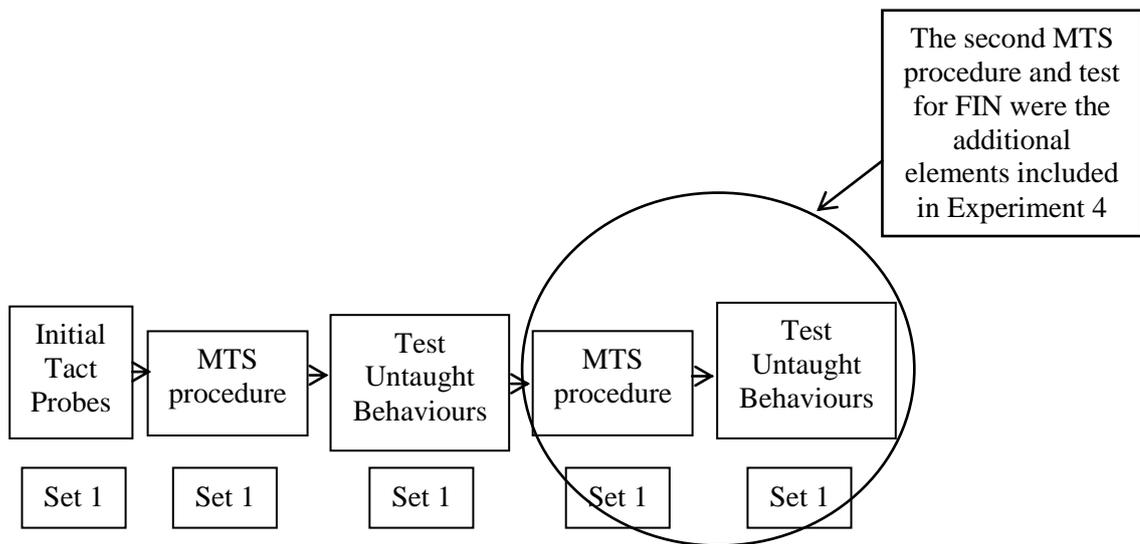


Figure 51: Procedure for Experiment 4.

The results of Experiment 4 showed that one participant met the criteria for FIN on the first test for FIN (Participant 6), one participant did not meet the criteria for FIN on the first or second test for FIN (Participant 1) and six participants did not meet the criteria for FIN on the first test, but they met the criteria for FIN on the second test (Participants 2-5, 7 & 8). In total, seven participants did not meet the criteria for FIN on the first test confirming the analysis in Experiment 3 that false negative scores were produced with these tests for FIN. To clarify, these seven individuals demonstrated FIN by being fully verbal and neuro-typical, but they did not meet the criteria for the test for FIN with contrived stimuli. When these seven participants were tested for FIN a second time, six participants met the criteria for FIN. These results supported the hypothesis that more than one test for FIN may need to be conducted before concluding whether FIN is present or not. What is not accounted for, however, is that one neuro-typical fully verbal participant did not meet the criteria for FIN on the first or second test for FIN. A fuller analysis of these results showed that gains were made in the untaught behaviours for this participant. This participant met the criterion for Listener Incidental Naming (LIN) in both tests. The score increased from 4/10 to 16/20 for the impure tacts (criterion level), but only from 3/10 to 12/20 for the pure tacts which did not meet the

criteria for FIN. Such an increase in the test results between the first and second test for FIN potentially suggested that a third test for FIN should be conducted before it is concluded whether FIN is present or not.

As shown in Figure 49, both tests for FIN included a MTS procedure prior to the test for emergent listener and speaker behaviours. These results indicated once the participants were exposed to a second MTS procedure the results of the second test for FIN were commensurate with their levels of verbal functioning. This finding had implications for administering the test for FIN (multiple exposures) for children and young adults diagnosed with autism who were participants in this body of work. This finding suggested that at least two tests for FIN were necessary prior to the implementation of a procedure to induce FIN (if the criteria were not met on the first test for FIN). The finding also confirmed the use of the additional MTS procedure prior to each test for emergent listener and speaker behaviour (as per Experiment 2). One of the remaining questions in Experiment 4 was whether the exposure to the same stimuli twice in Test 1 and in Test 2 (and in both initial MTS procedures) was an operative variable.

Experiment 5. To address this remaining question, Experiment 5 included a second MTS procedure and test for FIN with different stimuli. The procedure was identical to the procedure in Experiment 4, where two MTS procedures and tests for FIN were conducted with eight more neuro-typical fully verbal adults, but different stimuli were used for each MTS procedure and test. Figure 52 shows the procedure for Experiment 5.

The results of Experiment 5 showed that two participants (Participants 1 & 7) did not meet the criteria for FIN on either test, but both participants made gains in each of the untaught behaviours; three participants (Participants 2, 3 & 4) met the criteria for FIN on the first test, and therefore a second test for FIN was not conducted; and three

participants (Participants 5, 6 & 8) did not meet the criteria for FIN on the first test, but they met the criteria on the second test. Because the results of Experiment 5 showed that fewer participants met the criteria for FIN (six in total, compared to seven in Experiment 4), using different stimuli for the second MTS procedure and test for FIN was not a necessary component of the experimental procedure. Thus, all future experiments that included older children and young adults diagnosed with autism used more than one test for FIN with an additional MTS procedure and the same stimuli (as per Experiment 4).

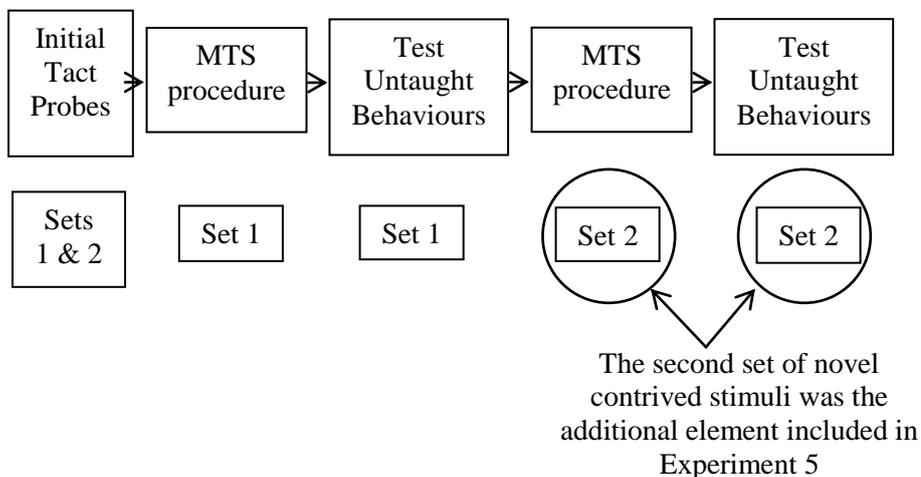


Figure 52: Procedure for Experiment 5.

Experiment 6. Experiment 6 was conducted simultaneously with Experiments 3-5. Experiment 6 addressed the question raised in the analysis of the results of Experiment 2 regarding prerequisite behavioural cusps, specifically whether the sub-components of naming were prerequisites for FIN. Twenty older children and young adults diagnosed with autism took part in the study and each was tested for the suggested six sub-components of naming (Listener Bidirectional Naming (LBN), Speaker Bidirectional Naming (SBN), Full Bidirectional Naming (FBN), Listener Incidental Naming (LIN), Speaker Incidental Naming (SIN) and Full Incidental Naming (FIN)). Three tests were conducted in Experiment 6 (test for Listener Bidirectional

Naming, test for Speaker Bidirectional Naming and test for FIN) and the procedures for each of these tests are shown in Figures 53, 54 and 55. Only three tests were conducted as the results of these three tests determined if the six sub-components of naming were present or not for each participant. To clarify, if a participant met the criteria for LBN and SBN then FBN was shown to be present (an additional test was not required). Furthermore, the test for FIN tested for both LIN and SIN.

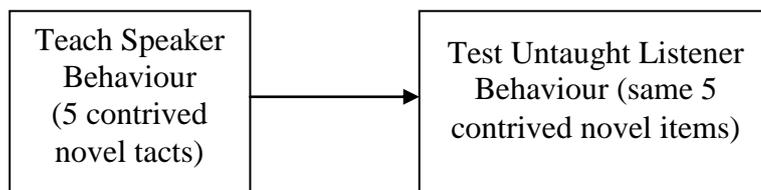


Figure 53: Procedure for Experiment 6 (Test for Listener Bidirectional Naming).

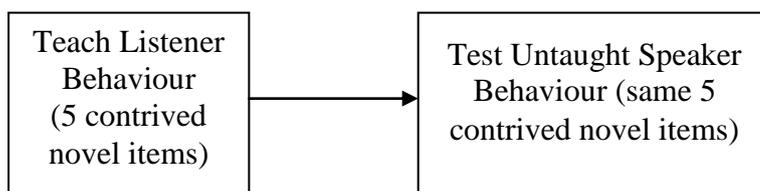


Figure 54: Procedure for Experiment 6 (Test for Speaker Bidirectional Naming).

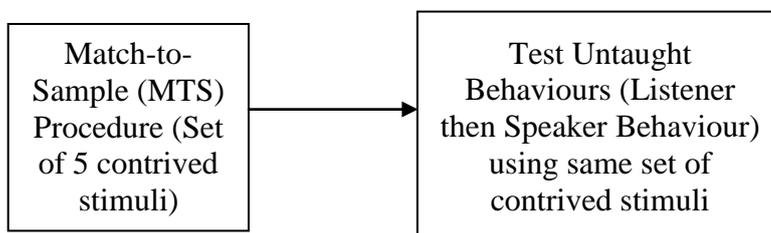


Figure 55: Procedure for Experiment 6 (Test for Full Incidental Naming).

It was predicted the results would show that listener naming is a prerequisite for speaker naming and bidirectional naming is a prerequisite for incidental naming. This

implies that all individuals who would test positive for speaker naming would also show criterion results for listener naming. This prediction is based on research by Petursdottir and Carr (2011) who recommended that speaker behaviour is taught prior to listener behaviour because listener behaviour is more likely to emerge following speaker training (compared to speaker behaviour emerging following listener training). This recommendation links directly to the research summarised in Chapter 3 where the same assumption was made related to listener and speaker training. Petursdottir and Carr (2011) did not posit that listener behaviour is a prerequisite for speaker behaviour, but their curricular sequence implied that listener behaviour is more likely to emerge than speaker behaviour.

In Experiment 6, participants were tested for each of the sub-components of naming. Thirteen participants met the criterion for LBN and 7 of these 13 participants met the criterion for SBN and therefore also the criteria for FBN (see Table 28 in Chapter 8, page 154). These data add to the evidence that the presence of listener naming correlates with the presence of speaker naming and this relation could act as a prerequisite. In addition, of the seven participants who met the criteria for FBN (listener and speaker behaviour), one of those participants met the criteria for FIN. Participant A met the criteria for FIN, but not FBN. Therefore while FBN appears to be a foundational behavioural cusp, it may not be a *reliable* indicator for the presence of FIN. Following additional tests for FBN, however, Participant A did finally meet the criteria for FBN following three additional tests for FBN (see case studies in Chapter 10, page 191). MEI was not implemented to induce FBN for this participant.

It is a reasonable argument that FBN is a foundational behavioural cusp than FIN because for FBN to be present two sets of responses are taught and two emerge. For FIN, no responses are taught per se (the matching is already mastered), thus two responses emerge without any direct teaching. This phenomenon appears to be more

complex than FBN, supporting the notion that FBN is a prerequisite for FIN. This assumption, that FBN is a prerequisite for FIN, provided the basis for selecting the participants for Experiment 7.

Experiment 7. The results of Experiments 3, 4, 5 and 6 were used to drive the composition of Experiments 7-9 regarding the test for FIN and the participants showing evidence for potential prerequisite sub-components of naming:

- The analysis of Experiments 3, 4 and 5 provided the recommendation that at least two tests for FIN (with a MTS procedure prior to each test) should be conducted prior to implementing MEI to induce FIN. This procedure was in place in Experiment 2, but the results of Experiments 3, 4 and 5 (fully verbal neuro-typical adults required two MTS procedures and tests for FIN to meet the criteria for FIN) affirmed that the second test for FIN may be necessary to fully analyse FIN. Two tests for FIN decreased the probability of the first test for FIN generating false negative results.
- The results of Experiment 6 suggested that the participants should demonstrate evidence of FBN prior to implementing procedures to induce FIN.

The six participants who met the criteria for FBN but not FIN in Experiment 6 were selected for Experiment 7. This experiment was a partial replication of Experiment 2 (MEI was used to induce FIN), but these participants showed reliable evidence of having the sub-component of naming (FBN), meaning that they met the criteria for FBN. Therefore, it was predicted that these participants would meet the criteria for FIN following the MEI procedure. This expectation was based on the assumption established in Experiment 6 identifying FBN as a possible prerequisite for FIN.

Table 65 (a sub-section of Table 64) illustrates the main distinction (highlighted on the table) between Experiment 2 and Experiment 7. To clarify, the participants in

Experiment 7 demonstrated the suggested prerequisite behavioural cusp of FBN in order to be selected for the experiment.

Table 65

Characteristics of Experiments 2 and 7 (IV = Independent Variable; DV = Dependent Variable; MTS = Match-to-Sample)

Expt	Description of Participants	Participants demonstrated FBN?	IV	DV	MTS prior to each test for FIN?	Focus of Expt
Expt 2	Older children & young adults diagnosed with autism	No	MEI	FIN	Yes	Induce FIN
Expt 7	Older children & young adults diagnosed with autism	Yes	MEI	FIN	Yes	Induce FIN

The procedure for Experiment 7 is shown in Figure 56. As previously stated, the procedure for Experiment 7 paralleled the procedure of Experiment 2.

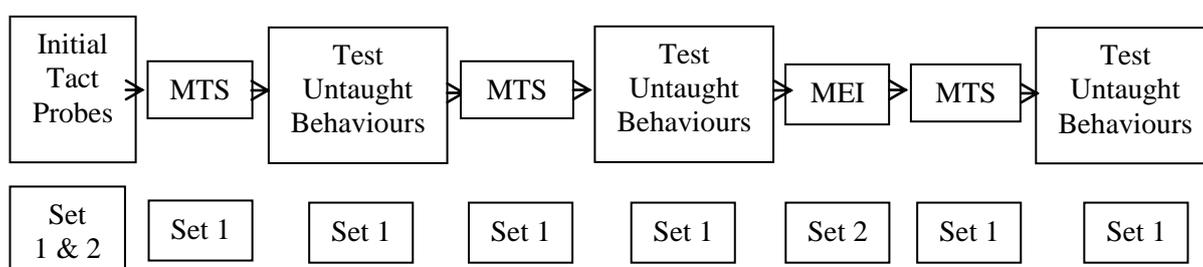


Figure 56: Experimental procedure for Experiment 7.

Four out of the six participants in Experiment 7 met the criteria for FIN (Participants 1 and 3-5). In contrast to the predicted results, only one participant met the criteria for FIN post-MEI (Participant 3). Three participants met the mastery criteria for FIN prior to the MEI intervention (Participants 1, 4 and 5) and the two remaining

participants did not meet the mastery criteria for FIN pre- or post-MEI (Participants 2 & 6), though one participant made gains with untaught listener and speaker behaviour post-MEI (Participant 6). The results indicated that repeated MTS procedures and testing, rather than the MEI procedure, led to the criteria for FIN being met by three of the six participants. This finding relates to the results produced by Participant 4 in Experiment 2 (see page 219) who also demonstrated FIN prior to the implementation of MEI, but following repeated MTS procedures and testing.

Experiment 8. Experiment 8 evaluated the effects of MEI on the induction of Speaker Bidirectional Naming (SBN) in six older children and young adults diagnosed with autism. The rationale for this experiment was based on the findings from the literature review in Chapter 5; four studies demonstrated the effectiveness of MEI to induce FIN (Gilic & Greer, 2011; Greer et al., 2005b, 2007, 2011a) and one study demonstrated the effectiveness of MEI to induce LBN (Fiorile & Greer, 2007). In Chapter 5 it was highlighted that there is no research demonstrating the effectiveness of MEI to induce the remaining sub-components of naming (SBN, FBN, LIN and SIN). Furthermore, it was hypothesised that LBN was a prerequisite for SBN based on the results of Experiment 6 where 13 participants met the criterion for LBN and 7 of these 13 participants met the criterion for SBN. It was suggested in Experiment 6 that these data add to the evidence that the presence of listener naming correlates with the presence of speaker naming and therefore listener naming could act as a prerequisite for speaker naming.

In review, having isolated a group of six participants in Experiment 6 who met the criterion for LBN, but not SBN, there was an opportunity to test whether MEI induced SBN. Based on the existing prerequisites (LBN) of each of the participants, it was predicted that the participants would show gains for SBN. Figure 57 shows the procedure for Experiment 8.

As Figure 57 shows, each participant was initially tested for SBN. If the criterion was not met then a MEI procedure was implemented with a different set of stimuli. Once the criteria were met on this MEI procedure then the participants were tested for SBN again with the same contrived stimuli used in the initial test for SBN.

Despite each of the six participants meeting the criterion for LBN in Experiment 6, the outcomes for these participants in Experiment 8 showed large variation in their response to the test for SBN (one met the criterion for SBN post-MEI (Participant 2), four met the criterion for SBN pre-MEI (Participants 1, 3, 4 & 5) and one did not meet the criterion for SBN pre- or post-MEI (Participant 6)). However, the fact that five out of the six participants met the criterion for SBN provides some support to the hypothesis for LBN being a prerequisite for SBN (and therefore FBN).

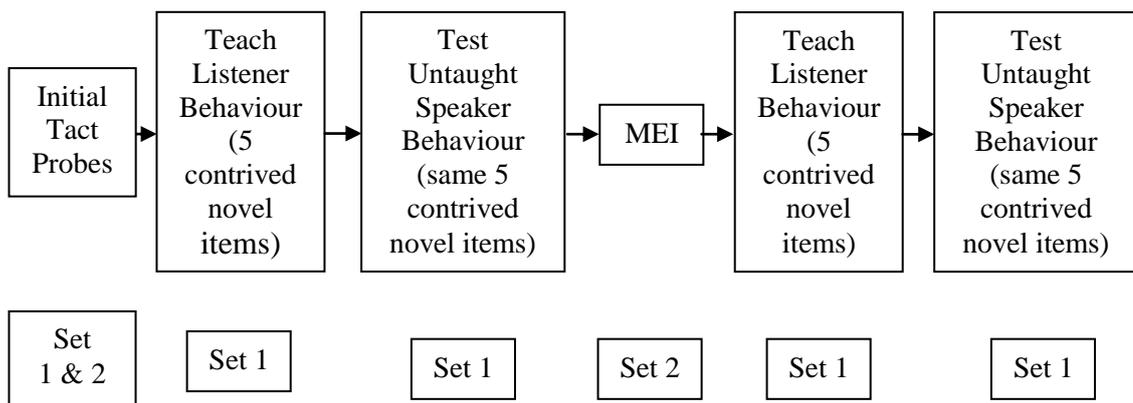


Figure 57: Experimental procedure for Experiment 8.

Four of these five participants met the criteria for SBN *pre*-MEI. To clarify, the MEI procedure was not required to induce this sub-component of naming (SBN) for these four participants. These results are similar to the results produced in Experiment 7 where four out of the six participants met the criteria for FIN, but three of these four met the criteria *pre*-MEI. In contrast, Participant 2 in Experiment 8 met the criteria for SBN *post*-MEI. It should be noted that Participant 2 exhibited an ascending trend *pre*-MEI, therefore it is possible that this participant would have met the criteria for SBN without

ever being exposed to MEI by conducting additional teach/test procedures rather than implementing the MEI procedure. These teach/test procedures provided additional opportunities for exposure to hearing the names of the items and seeing those stimuli. This type of language experience may have been enough for these participants to acquire SBN. The remaining participant in the study (Participant 6) made minimal gains with the untaught behaviours pre-MEI and post-MEI (his data were very similar across the experiment). Collectively, the results in Experiment 8 did not show any distinctive patterns within or between participants.

These outcomes are similar in nature to the studies described in Chapter 3 (see page 25). The research summarised in this chapter showed a high level of variability in the results. It was shown that:

- For some individuals listener behaviour emerged following speaker training.
- For some individuals speaker behaviour emerged following listener training.
- For some individuals both listener and speaker behaviour emerged following speaker or listener training.
- For other individuals neither listener nor speaker behaviour emerged following the corresponding speaker or listener training.

The importance of testing each individual for emergent verbal behaviour was emphasised in Chapter 3 and the results from Experiment 8 support that recommendation. At this point, based on published research as well as the research reported within this work, it is difficult to predict which individuals may or may not have the different sub-components of naming. It is therefore important that each individual is tested for the sub-components and the results of these individual tests should drive how curricular sequences are written for each individual. At this point, it is not possible to predict which individual will meet the criteria for which sub-component of naming.

Experiment 9. Four of the participants in Experiment 8 who met the criteria for FBN, but had not met the criteria for FIN in Experiment 6, were selected for Experiment 9. Experiment 9 tested whether MEI induced FIN in participants who had met the criteria for FBN. Experiment 9 followed the same experimental procedure as Experiment 7 where the MEI procedure was implemented with the aim of inducing FIN. The procedure for Experiment 9 is shown in Figure 58.

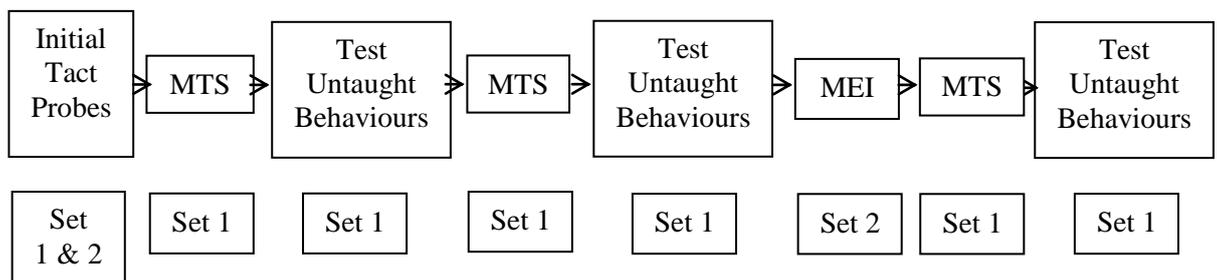


Figure 58: Experimental procedure for Experiment 9.

Thus, the rationale behind Experiment 9 was to replicate Experiment 7 in that all of the participants in Experiment 9 now had the proposed prerequisites for inducing FIN. This replication would serve to either confirm the results found in Experiment 7 (MEI did not consistently induce FIN) or to support the existing published research on MEI and FIN (MEI did consistently induce FIN).

The outcomes for the participants in Experiment 9 showed minimal emergent untaught behaviours. Of the four participants, Participant 3 met the criteria for FIN, but *prior* to the MEI procedure being implemented. The data for this participant were consistent with the previous findings in this body of work where more participants met the criteria for FIN following repeated MTS procedures and testing rather than post-MEI.

General findings. The general findings from this series of experiments can be summarised as follows:

- Overall, more participants had met the criteria for FIN by the end of this series of experiments compared to their starting points, but it is not known what was specifically responsible for the inducement of FIN.
- The majority of participants across *all* experiments who met the criteria for one of the sub-components of naming met the criteria following repeated testing with an additional MTS procedure prior to each test, rather than from the MEI procedure.
- MEI did not consistently induce FIN in this series of experiments.

Because the expected results were incongruent with the actual results it is important to identify specific factors that might provide an explanation for this discrepancy in the results. Some of the factors related to this phenomenon included systematically isolating:

- Whether there are further potential prerequisites for FIN including additional prerequisite behavioural cusps (the remaining sub-components of naming) or whether more specification is required regarding the prerequisite behavioural cusps on the VBDT pre-reader pyramid (namely echoic-to-tact and transformation of establishing operations across mands and tacts).
- The additional MTS procedure prior to each test for FIN.
- Exposure to the test for FIN (the number of times it is administered).
- The cumulative effect of MEI across experiments.

These factors will be analysed in more detail in Chapter 12. The next section of this chapter describes the major findings of the entire body of work, including findings from the experimental work and contributions from the literature review.

Major Findings

The purpose of this research project was to test the effectiveness of Multiple Exemplar Instruction (MEI) to induce Full Incidental Naming (FIN) with a group of older children and young adults with a diagnosis of autism. To date four published studies (Gilic & Greer, 2011; Greer et al., 2005b, 2007, 2011a) specifically demonstrated the effectiveness of MEI in inducing FIN, but each of the studies were with younger participants (2-6 years) and none of the studies had participant pools exclusively with a diagnosis of autism. Collectively, this body of work included a thorough review of the relevant literature on naming and nine experiments on naming. It yielded three major findings:

1. Naming is a generic term that describes several sub-components and it is important that researchers clearly specify the sub-component researched.
2. The repetition of the test for FIN, with the additional MTS procedure prior to each test, potentially led to the inducement of FIN.
3. MEI did not reliably induce naming in older children and young adults diagnosed with autism.

Each of these major findings is described fully and analysed within this subsection of this chapter, followed by a final summary of the major findings. Factors that may have impacted the results are subsequently analysed in the next chapter.

First major finding: Identification of the sub-components of naming. The *first* major finding related to theoretical implications that arose from the literature review (see Chapter 4, page 43) and was subsequently tested in one of the experimental chapters (see Experiment 6 in Chapter 8, page 144). A review of the literature on naming revealed that although researchers referred to naming as the dependent variable under examination, the behaviours measured as dependent variables clearly differed,

sufficiently enough, to suggest there may be several component behaviours of a phenomenon being referred to as naming. Identifying several different types of emergent responding under the umbrella of naming without distinguishing the differences between these types may serve as a point of confusion for consumers of the behaviour analytic literature and other researchers in behaviour analysis. This confusion may also be a barrier to a fuller understanding of the naming phenomenon. This is a point of empirical concern in the basic and applied literature that was addressed in Chapter 4.

In review, Lowe, Horne, Harris, and Randle (2002) showed that young children pointed to items following direct teaching of speaker behaviour (demonstrated untaught listener behaviour or Listener Bidirectional Naming (LBN)), whereas Horne, Hughes, and Lowe (2006) revealed that some young children tacted items following direct teaching of listener behaviour (demonstrated untaught speaker behaviour or Speaker Bidirectional Naming (SBN)). Both reports described outcomes related to the dependent variable as naming, yet each report described different behaviours as the dependent variables under investigation. This ambiguity supports the need for clearer specification of the outcome to ensure a thoroughgoing understanding of all aspects of the naming phenomenon.

To clarify, one concern that emerged from reviewing the relevant literature was the generalised use of the term naming. In this use, naming was referred to as one phenomenon while measuring different dependent variables in different studies. This confusion was compounded by further research on naming measuring behaviours that were different from the behaviours measured in the two studies described above. For example, Greer, Stolfi, Chavez-Brown, and Rivera-Valdes (2005b) induced untaught speaker behaviour without direct teaching (Speaker Incidental Naming (SIN) and

referred to this as the phenomenon of naming. These researchers measured LBN, SBN and SIN as dependent variables, but referred to each of them as naming.

In an attempt to organise the different behaviours referred to as dependent variables in the naming literature and to suggest there may be sub-components of a phenomenon called naming, the following six potential sub-components of naming were identified and organised in Chapter 4 and were used as separate and unique dependent variables in Experiment 6 (Chapter 8):

1. Listener Bidirectional Naming (LBN)
2. Speaker Bidirectional Naming (SBN)
3. Full Bidirectional Naming (FBN)
4. Listener Incidental Naming (LIN)
5. Speaker Incidental Naming (SIN)
6. Full Incidental Naming (FIN).

In Experiment 6, twenty older children and young adults diagnosed with autism were tested for each of the sub-components of naming to determine if there were any correlations in these test results and whether one sub-component of naming could be considered a prerequisite for another.

It may be that referring to all of these different dependent variables as naming is acceptable; however a hallmark of any science is the precision of language. Therefore clear definitions of behavioural phenomenon should yield more valuable information for future experimental research. This is why identifying these sub-components of naming was important and why each of these sub-components were tested for in Experiment 6.

Second major finding: Repeating the test for FIN, with the additional MTS procedure prior to each test, potentially led to the inducement of FIN. The *second* major finding of this body of work related to the test for FIN. There were three aspects to this major finding and these will be addressed separately:

1. It was recommended that the test for FIN was preceded by an additional MTS procedure prior to each test for FIN.
2. It was concluded that at least two tests for FIN should be conducted prior to implementing MEI.
3. Participants met the criteria for FIN following repeated testing with a MTS procedure preceding each test.

Test for FIN preceded by a MTS procedure. First, it was recommended during this series of experiments that *each* test for FIN include a MTS procedure. All the published research on MEI and FIN (Gilic & Greer, 2011; Greer et al., 2005b, 2007, 2011a) included a MTS procedure prior to the *initial* test for FIN, but not for subsequent tests for FIN. To clarify, all subsequent tests for FIN (pre-MEI and post-MEI) in the published research did not include an additional MTS procedure.

This finding emanated from the first five experiments described in this thesis. The results of Experiment 1 were not as expected (participants did not meet the criteria for FIN following the MEI procedure). There was a considerable span of time between exposure to the names in the initial MTS procedure and the post-MEI test for FIN. An adjustment was made in Experiment 2 in which the MTS procedure was implemented prior to *each* test for FIN. Running an additional MTS procedure did not compromise the fidelity of the experimental sequence because participants still had the opportunity to demonstrate the acquisition of names of new items incidentally in the test for FIN. This adaptation to the experimental procedure addressed the potential issue of the length of time between initial exposure to stimuli and the final test for emergent language.

Conducting additional tests prior to implementing MEI. The second issue related to the test for FIN was the recommendation that at least two tests should be conducted prior to implementing MEI. Only one test for FIN was conducted pre-MEI in the majority of the published literature to determine if FIN was present (e.g. Gilic &

Greer, 2011; Greer et al., 2005b, 2007). With only one pre-MEI test for FIN and one post-MEI test for FIN the chances of those tests producing false positive or false negative data was far greater than when several tests are conducted.

The results of the experiments with adults (Experiments 3-5 in Chapter 8) confirmed the requirement for two tests for FIN prior to the implementation of MEI to induce FIN. These experiments included the additional MTS procedure prior to each test for untaught behaviours. When fully verbal neuro-typical adults were only exposed to one test for FIN, only 50% met the criteria for FIN. These results were somewhat unexpected because it was assumed that neuro-typical adults with fluent verbal behaviour would meet the criteria for FIN on the first test. In fact, unexpectedly low correct responses were shown on the first test. It was therefore concluded that for neuro-typical adults with well-established verbal behaviour, relying solely on one test to determine the presence of FIN is questionable. It was therefore concluded that at least two tests for FIN should be conducted prior to implementing the MEI procedure.

It is not a clear conclusion, however, that each test should include a MTS procedure. For example, Greer et al. (2011a) conducted two tests for FIN prior to implementing MEI and the second test (and the post-MEI test) did not include the additional MTS procedure, yet emergent language was produced post-MEI suggesting that the additional MTS procedure may not be essential to the success of the multiple test procedure. This is addressed further in Chapter 13 where recommendations are made for future research.

The criteria for FIN were met following repeated testing. The third aspect of this major finding related to more participants in the current research meeting the criteria for FIN via repeated testing rather than via the MEI procedure. These results were shown in Experiments 2, 7 and 9. Of the six participants diagnosed with autism who met the criteria for FIN in these experiments, two met the criteria post-MEI and

four met the criteria pre-MEI (following multiple testing with the MTS procedure prior to each test for FIN). It is possible that these repeated procedures may have served as a relevant language experience sufficient for the induction of FIN. The test did include exposure to picture stimuli and language associated with those stimuli in an intensive fashion (twenty trials presented in a short amount of time). The test required repeated exposure of these stimuli. This major finding is discussed in more detail in the chapter on recommendations (Chapter 13).

What is unclear is whether the second test for FIN showed that an individual had naming (and the first test was a false negative) or whether naming had now been induced (and the first test was in fact accurate). If FIN had been induced (by repeating the MTS procedure as well as the test for FIN) then individuals who met the criteria for FIN pre-MEI may have just needed more intensive and more explicit language experiences, not necessarily the random rotation of MEI. This finding contradicts the findings of Greer et al. (2007), however, who showed that it was the random rotation of the MEI that induced FIN, not the intensity of the language experience. Greer et al. (2007) did not, however, include an additional MTS procedure prior to each test for FIN.

From a relational frame theory (RFT) perspective, these results could be explained by the multiple exemplar training that was included within the MTS procedure. As mentioned in Chapter 4 (page 50), RFT suggests that language develops via relational frames and one type of relational frame may include the bidirectional relationship between speaking and listening. RFT states that this bidirectional relationship between speaking and listening (along with other types of bidirectional relationships) is established through an appropriate history of multiple exemplar training. Multiple exemplars of stimuli were used as part of the MTS procedure and participants were exposed to these stimuli repeatedly. RFT would suggest that the

repeated MTS lead to the inducement of a component of naming due to the repeated MTS incorporating multiple exemplar training.

Third major finding: MEI did not induce naming for older children and young adults diagnosed with autism. The *third* major finding related to MEI not inducing FIN for older children and young adults diagnosed with autism. The results of the series of experiments in this body of work were not congruent with published findings on MEI and naming. Previous research demonstrated that MEI induced FIN and LBN with younger children with and without disabilities. In contrast, Lechago, Carr, Kisamore, and Grow (2015) showed that MEI was not reliably effective in producing emergent verbal behaviour between listener and intraverbal categorisation behaviours. The current body of work provides some support for the findings of Lechago et al. (2015). Both the work by Lechago et al. (2015) and the current body of work focused on inducing emergent verbal behaviour via MEI, though the dependent variables did differ. To clarify, Lechago et al. (2015) tested for the effects of MEI on emergent verbal behaviour, but this was not specifically naming or a sub-component of naming.

To summarise the current research, 20 older children and young adults diagnosed with autism were involved in Experiments 1, 2, 6, 7 and 9 and only 2 of these 20 participants met the mastery criteria for FIN post-MEI. MEI therefore did not consistently induce FIN in older children and young adults diagnosed with autism.

The outcomes of the two participants who did meet the criteria for FIN post-MEI were analysed in Chapter 10. It was suggested here that Participant E was demonstrating ascending trends pre-MEI and could possibly have met the criteria for FIN pre-MEI if the participant had been provided with an additional test (due to the MTS procedure being implemented prior to the test for FIN). Participant D met the criteria for FIN following repeated testing with the MTS procedure, but it could not be

ruled out whether MEI was a contributing factor as Participant D was exposed to MEI in an earlier experiment.

The final section of this chapter reviews the differences between the published studies on MEI and naming and the current research to provide possible explanations for this third major finding (MEI did not induce naming for older children and young adults diagnosed with autism).

Analysis of the Differences between the Published Studies on MEI and Naming and the Current Research

An analysis of the differences between the published studies on MEI and naming (Fiorile & Greer, 2007; Gilic & Greer, 2011; Greer et al., 2005b, 2007) and the current research may provide possible explanations for why the current results were incongruent with the published research. These differences between the published studies on MEI and naming were raised in Chapter 5 and are summarised again in Table 66. Table 66 also provides an overview of the differences between the current body of work (the experiments on MEI and naming) and the published research on MEI and naming. To clarify, Table 66 does not include the experiments that focused on the tests for naming (Experiments 3-6), but the experiments that focused on MEI and naming (Experiments 1-2 and 7-9). Table 66 illustrates that general themes (the column headings) have emerged which may provide explanations for the difference between the expected results and the actual results.

Table 66

Summary of the variations in procedures used in the studies on MEI and naming

Study	Age and diagnosis of Participants	DV	Stimuli	Second test for naming pre-MEI	Additional test for naming with novel set of stimuli	MTS prior to each test for FIN	Inclusion of additional set of MEI
Current Body of Work	5-18 years Autism	FBN & FIN	Contrived	Yes	No	Yes (Expts 2-9)	No
Greer et al. (2005b)	2.5-4 years Language or developmental delays	FIN	Contrived and non-contrived 2D stimuli	No	Yes	No	No
Fiorile & Greer (2007)	2-2.4 years Autism	LBN	Contrived 3D stimuli	No	No	No	Yes
Greer et al. (2007)	3-5 years Speech delay or Pervasive Developmental Disorder or language and cognitive delays	FIN	Non-contrived 2D stimuli	No	No	No	Yes
Gilic & Greer (2011)	2 years Neuro-typical (from upper middle class professional families)	FIN	Non-contrived 3D stimuli	No	No	No	No
Greer et al. (2011a)	2-6 years 2 children with Autism & 2 neuro-typical children	FIN	Contrived and non-contrived 2D & 3D stimuli	Yes	Yes	No	Yes

Some factors that may have impacted the results of the current body of work are related to the published empirical work on MEI and naming and possible extraneous variables:

1. Age and diagnosis of the participants.
2. Type of stimuli used.
3. Inclusion of an additional test for FIN pre-MEI
4. The use of an additional test for FIN post-MEI.
5. Inclusion of a MTS procedure prior to each test for FIN.
6. Inclusion of an additional set of MEI to induce FIN

Each of these themes is addressed individually within this sub-section of the chapter.

Age and diagnosis of participants. As shown in Table 66, all of the published studies on MEI and naming included participants aged 2-6 years and two of the studies included children diagnosed with autism. All of the participants in the current body of work were older than the participants in the published research and all had a diagnosis of autism.

Including older children and young adults diagnosed with autism in this research track was important because it served to validate the scope and establish a utility of the VBDT and its associated protocols. Practitioners require specific evidence for the population they are working with before determining the time and effort they will allocate to any procedure that may not generate the same results for the populations they serve. However, if procedures are designed to facilitate an individual's acquisition of new skills faster and to allow an individual to learn in new and different ways then the effort will result in a more efficient method of instruction for these individuals.

The previously published results on MEI and naming focused on different participant groups compared to the current series of experiments. Because language

development for children diagnosed with autism is such an important factor to minimising the effects of autism, this work has been predicated on attempting to find answers to questions related to individuals diagnosed with autism. In addition, the published research on the inducement of naming primarily focused on children under the age of seven. Including participants who were older was also an important variable in the present study. With the exception of participants in Experiments 3-5 (neuro-typical adults), the age of the participants in the current work ranged from 5 to 19 years. It is generally accepted that individuals diagnosed with autism are less observant of the environment than neuro-typical individuals thus it is understandable that interventions successful for one group may not be successful for the other.

It is important that a behaviour analytic account of all language acquisition exists including emergent verbal behaviour for neuro-typical individuals. It is also important to determine if that account is possibly different for individuals who have been exposed to less language interactions (Hart & Risley, 1995). The differences that may occur in outcomes for individuals in certain age groups are not necessarily due to age per se, but potentially due to differences in instructional history, histories of reinforcement and conditioned reinforcers (Du, Broto, & Greer, 2015). Thus, accounting for these characteristics may be valuable within a thoroughgoing account of emergent behaviour. MEI is designed to recapture missing early learning experiences of participants (Nuzzolo-Gomez & Greer, 2004) and this may not have the same effect on learners with a more established history of basic verbal behaviour.

Type of stimuli used. Solely contrived stimuli were used across all nine experiments conducted within the current research project. The use of contrived stimuli ensured that the participants had no previous or current experience with the selected stimuli. Not all of the published studies on MEI and naming used contrived stimuli. The choice of stimuli may have impacted the results of the published studies in terms of not

controlling for the exposure to stimuli during the experimental sequence. Using non-contrived stimuli could have led to false positive results because the participants may have had some familiarity with the stimuli.

Inclusion of an additional test for FIN pre-MEI. The only published study to include an additional test for FIN pre-MEI was conducted by Greer et al. (2011a). All the remaining studies on MEI and FIN utilised one pre-MEI test (Gilic & Greer, 2011; Greer et al., 2005b, 2007). Utilising one pre-MEI test for FIN may have generated false negative results pre-MEI in these published studies. Lechago et al. (2015) also highlighted this concern in their work. Lechago et al. (2015) suggested that there may have been potentially confounding variables in place for the research on MEI and emergent verbal behaviour (e.g. Greer et al., 2005b; Greer, Yuan, & Gautreaux, 2005c; Nuzzolo-Gomez & Greer, 2004). They noted that participants were tested only once during baseline before the MEI procedure was implemented which means that practice effects could be a confounding variable. They recommended that multiple tests were conducted during baseline conditions to help control for practice effects.

As demonstrated in Experiment 3 (Chapter 7), a more robust test for FIN involved a sequence of two tests. In Experiment 3 fully verbal neuro-typical adults were tested for FIN and the results showed that only 50% of these participants met the criteria for FIN on the first test. A second test for FIN confirmed or negated the results of the first test and therefore provided a more vigorous test for FIN.

The use of two tests does not come without potential concerns such as testing effects. A variety of research has shown that test scores will improve if tests are repeated (e.g. Benedict & Zgaljardik, 2010; Hausknecht, Trevor, & Farr, 2002). Improved test results are not necessarily an issue when the target is to induce naming. The test does provide a type of naming experience: a visual stimulus accompanied by a corresponding auditory stimulus. However, this experience may not be intensive enough

to induce naming in some individuals thus, requiring an intensive procedure (e.g. MEI) to induce naming.

In this instance, improved test results are only a concern if the results are generating false positive or false negative scores. False positive or false negative scores relate to test scores changing, but not the presence of the behavioural cusp. Furthermore, improved test results could also be considered a concern if there is a procedure in place (such as MEI) that aims to induce the behavioural cusp. If repeated testing leads to improved scores on a test for a behavioural cusp then it is unclear whether the procedure has led to this change or the repeated testing. This issue is particularly significant with the current body of work as a MTS procedure was implemented prior to each test for FIN. This is the focus for a sub-section later in this chapter.

Additional post-MEI test for FIN with novel set of stimuli. A further distinction between this body of work and some of the published research on MEI and naming was the administration of a further post-MEI test for FIN with novel stimuli. This second post-MEI test for FIN was only administered if participants met the criteria for FIN on the first post-MEI test for FIN. This additional post-MEI test for FIN with novel stimuli was part of the experimental procedure in the studies by Greer et al. (2005b) and Greer et al. (2011a) as shown in Table 66 (page 253). An additional test post-MEI either confirms or negates the first test post-MEI and reduces the reliance of one test to determine whether an entire behavioural cusp has been induced.

To illustrate, a procedure including an additional post-MEI test for FIN with novel stimuli is shown in Figure 59.

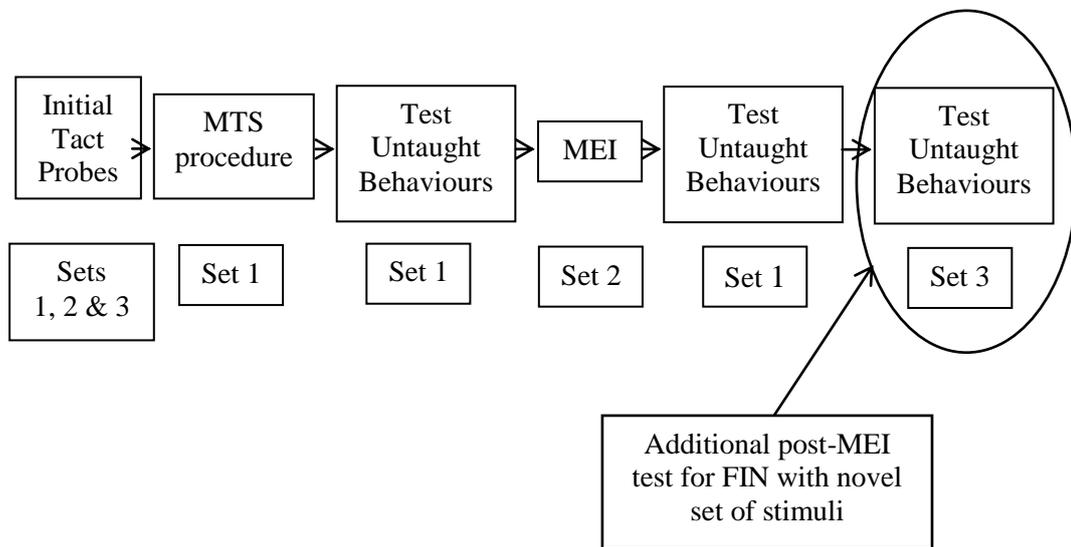


Figure 59: An experimental procedure for testing the effect of MEI on FIN with an additional post-MEI test for FIN with a novel set of stimuli (Set 3).

The current body of research did not include an additional post-MEI test for FIN with a novel set of stimuli. This is mainly due to participants not meeting the experimental criteria for FIN post-MEI on the first test. There was only one instance of an additional post-MEI test for FIN with novel stimuli utilised across the current series of experiments. This was due to an unplanned event of the experimental sequence. Participant B (described in the Case Studies of Chapter 10) met the criteria for FIN in Experiment 2 (Chapter 6) and he met the criteria for FIN again in Experiment 6 (Chapter 8) and this was with a novel set of stimuli. This occurrence was serendipitous because Participant B met the criteria for FIN early in the experimental sequence (Experiment 2) so there was an opportunity for an additional test for FIN in a later experiment (Experiment 6).

Conducting two post-MEI tests for FIN could have provided validation to the results of the first post-MEI test for FIN in the current body of work. However, the results of Experiment 5 (Chapter 7), in which fully verbal neuro-typical adults were tested for FIN using two tests with novel stimuli, showed that a second test for FIN with novel stimuli reduced the likelihood of the FIN criteria being met. It is difficult to determine whether the lack of an additional test for FIN post-MEI in the current body of

work served as a limitation, or whether its inclusion would have generated false negative results.

MTS procedure prior to each test for FIN. The current body of work included a MTS procedure prior to each test for FIN. This MTS procedure eliminated the confounding variable of time between the initial exposure to the names of the test stimuli and the post-MEI test for FIN. None of the published research on MEI and FIN included this MTS procedure prior to *each* test for FIN. In the current body of work, it is not known whether the tests for FIN produced false positive scores or whether FIN was induced via repeated testing. It is quite plausible that repeated testing with the preceding MTS procedure provided an experience that was sufficient for the emergence of untaught language. One recommendation includes conducting further research isolating whether the repeated MTS procedures were responsible for the inducement of FIN. This issue is addressed further in Chapter 13 where recommendations for future research are made.

Inclusion of additional set of MEI. Two of the published studies on MEI and FIN included a second set of MEI if participants did not meet the criteria for FIN post-MEI (Greer et al., 2007, 2011a). To clarify, if participants did not meet the criteria for FIN post-MEI then they were exposed to a second set of MEI (with a novel set of stimuli) until the criteria for MEI were met again. Participants were subsequently re-tested for FIN using Set 1 stimuli. The current body of research did not include this repeated MEI procedure.

The rationale for not including this second MEI set in the current series of experiments was related to the fact the scores on the post-MEI test for FIN were mainly too low to warrant a further extensive MEI procedure. The scores on the post-MEI test for FIN showed minimal gains, thus little evidence was provided that the participants benefitted from the MEI procedure. No evidence was provided that the participants

were generating emergent verbal behaviour. Therefore, the inclusion of an additional set of MEI would have potentially produced minimal gains. At this point more emphasis should be placed on identifying the missing prerequisite behavioural cusps rather than exposing the individual to additional MEI sessions.

One exception to the above argument was Participant G (see case studies in Chapter 10, page 205). Participant G made gains in the post-MEI test for FIN and this participant may have made further gains if an additional set of MEI was provided. It may be justified that if a participant makes substantial gains in the post-MEI test for FIN (compared to the pre-MEI test for FIN) then a second set of MEI is desirable.

Conversely, it is possible that running multiple sessions of MEI is warranted for all participants who do not meet the criteria for FIN post-MEI. It may be that multiple sessions of MEI create enough of an intensive experience to induce FIN (more of an enriched experience) therefore the failure to include additional sets of MEI may be a limitation for this body of work.

Summary

In summary, the overall focus of this body of work was to induce FIN in older children and young adults diagnosed with autism and to analyse how FIN is measured. A total of nine experiments were conducted. Four of these experiments focused on inducing FIN using MEI with older children and young adults diagnosed with autism, three experiments focused on testing neuro-typical fully verbal adults for FIN, one experiment focused on inducing FBN using MEI with older children and young adults diagnosed with autism and one focused on testing for the presence of the different sub-components of naming with older children and young adults diagnosed with autism.

The results of the experiments with the neuro-typical fully verbal adults served to provide evidence for the modification of the experimental procedures in the experiments with older children and young adults diagnosed with autism. To clarify, the

results of these experiments with the adults supported the use of two tests for FIN to be conducted prior to implementing MEI to induce FIN for all further experiments within this body of work.

The results of this series of experiments which focused on older children and young adults diagnosed with autism were not congruent with the published findings with younger children with and without disabilities. Thus, the major findings were related to:

1. The identification of several sub-components of naming
2. Issues surrounding the test for FIN (the requirement for a MTS procedure prior to each test for FIN, the requirement for at least two tests for FIN prior to implementing MEI and the subsequent finding that repeated testing led to participants meeting the criteria for FIN).
3. The lack of evidence to support that MEI induced FIN for this group of participants.

There were, however, several potential factors that may have impacted the results of the current body of work and these were reviewed. These factors were all related to the differences between the published research on MEI and naming and the current body of work. These potential factors impacting the results of the current body of work may also serve as limitations. These and further limitations of the current research are described in detail in Chapter 12.

Chapter 12

Limitations of the Current Research

Five limitations of the current body of work are discussed in this chapter. First, it was potentially a limitation of the current research that it did not include an initial direct replication of the original published work. Second, limited data were collected on participant characteristics. Third, the lack of sensitivity of the data collection procedures is a limitation of the current body of work. A fourth limitation emanates from an analysis of the criteria levels that were set for the current research. Finally, the use of unsequenced trials may have extinguished emergent behaviour due to the lack of reinforcement. Each of these limitations will be analysed in subsequent sub-sections of this chapter.

Initial Direct Replication of the Published Research

A limitation of the current body of work is that a direct replication of the published research on Multiple Exemplar Instruction (MEI) and FIN with *younger* children was not conducted. A direct replication of the most recent study on MEI and FIN (Greer, Corwin, & Buttigieg, 2011a) would have allowed the researcher to isolate any extraneous variables in a more systematic manner. Instead, too many variables were analysed simultaneously impacting the results and the subsequent analysis.

Chapter 11 described some of the factors that have impacted the results of the current body of work including procedural differences between the published studies on MEI and naming. The study by Greer et al. (2011a) included additional sets of MEI and a final test for FIN with novel stimuli and these elements were missing from the current body of work. The original purpose of the initial experiment in this body of work was to determine if MEI induced FIN in older children and young adults diagnosed with autism. The lack of a direct replication of the research by Greer et al. (2011a) may have

impacted the analysis on the effectiveness of MEI to induce naming with older children and young adults diagnosed with autism.

Furthermore, an additional test for FIN with novel stimuli post-MEI may have confirmed or negated the results for the two participants who met the criteria for FIN post-MEI (Participant D and Participant E). It may be interesting to conduct an additional test for FIN with novel stimuli with the participants who met the criteria for FIN *pre*-MEI. These data would also confirm or negate the results of the initial test in which criteria for FIN were met.

Participant Characteristics

Limited data were collected on the characteristics of the participants diagnosed with autism. They were all described as having a diagnosis of autism and a learning disability, but the severity of the autism and learning disability were not provided. Some information was given in terms of national curriculum levels and speech and language therapy scores, but more information could have been provided on adaptive behaviour, behavioural problems and co-occurring conditions. These limited data impact the ability to generalise the findings of the thesis.

Sensitivity of Data Collection

The participants involved in the current experiments provided large variations in the incorrect responses across the various experiments. For example, some did not respond at all, some repeated the name of one stimulus throughout all tests for untaught behaviour and some made attempts to respond, but either confused stimuli or mispronounced them. More specifically, some participants responded with an incorrect response that shared several properties with the correct response, for example responding with “moot” for “moop.” In the same example (“moop”) some participants responded with “bozz” or another term without any overlapping properties with the correct response. However, for the purposes of data collection both of these types of

responses was scored as incorrect. Thus, the operational definitions of correct responses did not allow for reporting data that did show successive approximations towards the target response. The data were collected strictly as correct or incorrect unilaterally. Thus, the “moot” approximation for “moop” went undocumented by the researcher resulting in a loss of potentially valuable information. Participant A (see Chapter 10) responded with very close approximations which also led to issues with inter-observer agreement. Inter-observer agreement was 73% for this participant due to the two observers being unclear whether the approximation was a correct or incorrect response. The issue central to this ‘all or nothing’ problem is that two participants could have the same score on one of the experimental tests yet the score may not truly reflect the actual outcomes. To correct this loss of potentially valuable information it is recommended that a data collection option to establish an acceptable range of correct responses, e.g. “Mup” or “mop” is also accepted for “moop,” such that the incorrect responses are scored based on the shared properties of the correct responses. This recommendation will be described in more detail in Chapter 13.

Criteria Level

The criteria levels for the tests for naming in the published research and the current body of work were determined by the researchers and aligned to generally accepted mastery criteria in the field. The criteria levels in the current work may have been too high, thus, producing false negative data and hiding the fact that FIN may have been induced for some participants. Interestingly, Pérez-González, Cereijo-Blanco, and Carnerero (2014) adjusted the criteria levels for Full Bidirectional Naming (FBN) and FIN within their study. Participants were initially required to demonstrate emergent behaviour with 3/3 novel stimuli. Three out of seven participants met these criteria for FBN and of these three participants two met the criteria for FIN with three-dimensional stimuli and none of the participants met the criteria for FIN with two-dimensional

stimuli. By changing the criteria from 3/3 to 2/3, five out of seven participants met the criteria for FBN and of these five participants, four met the criteria for FIN with three-dimensional stimuli and two met the criteria for FIN with two-dimensional stimuli.

Participant G (see Chapter 10) scored considerably higher scores post-MEI compared to pre-MEI, but he did not meet the mastery criteria for FIN. An adjustment to the criteria levels or an analysis of the difference between scores pre-MEI compared to post-MEI may have generated a more accurate account of his level of emergent behaviour. This will be discussed further in Chapter 13 (Recommendations for Future Research).

Unconsequated Trials

The test for FIN involved 60 unconsequated trials (12 for each stimulus) for untaught behaviours. These 60 trials were comprised of 20 trials for untaught listener behaviour and 40 trials for untaught speaker behaviour (20 for impure tacts and 20 for pure tacts). Within the test for FIN, correct responses were not reinforced, incorrect responses were not corrected and the participant was not told that the response was incorrect. This number of unconsequated trials raised the question of whether emergent behaviour was extinguished. For example, Participant K scored a total of 8/20 correct responses for untaught listener behaviour in the initial and second pre-MEI tests for FIN in Experiment 9. A more in-depth analysis revealed that, during the second test for untaught listener behaviour, the first five responses by the participant were all correct. However, over the next 15 trials the participant only scored an additional 3 correct responses. Subsequently the participant scored zero correct responses when tested for untaught speaker behaviour. If the test for FIN was restricted to responding to the different stimuli only once (15 trials distributed across untaught listener behaviour, untaught tacts and untaught impure tacts) then the participant would have entered into

the test for untaught speaker behaviour after achieving 5 correct responses for untaught listener behaviour.

If a participant has not been consequated for 60 untaught probe trials the experience is very different from a participant only exposed to 15 unconsequated probe trials. Thus, it is important to determine whether untaught behaviour was extinguished due to the lack of consequence in the test for FIN. Ironically, these data did suggest that untaught listener behaviour actually emerged following the MTS session. It seems that it was the number of unconsequated trials within the test for FIN that possibly required modification. Thus, after Participant K scored 5/5 correct responses for untaught listener behaviour, this should have sufficed for mastery and the participant should have been tested for untaught speaker behaviour. This is a limitation of the current research and the recommended procedures for inducing untaught behaviour (Greer & Ross, 2008). This limitation is discussed further in the next chapter (Recommendations for Future Research).

Summary

The limitations that were identified across the series of experiments reported in this work were:

1. The lack of an initial direct replication of the most recent published research on MEI and FIN.
2. The limited data on the characteristics of the participants diagnosed with autism.
3. The sensitivity of the data collection.
4. The researcher-established (man-made) criteria level.
5. The use of unconsequated trials which may have extinguished emergent behaviour.

These limitations could explain why the results of the current body of work are incongruent to the results of the published research on MEI and naming. Conversely, these limitations might serve to point out problems with the published research. For example, one variable was highlighted in Chapter 11 with the choice of stimuli (non-contrived in some cases) used in the published research.

As stated at the onset of this chapter, a more useful starting point for this body of research may have been a direct replication of the most recent study on MEI and FIN with a younger group of children. Subsequently, further replications could address one extraneous variable at a time. Recommendations for future research should centre on minimising these limitations by approaching the variables in a more systematic fashion and these recommendations are the focus of Chapter 13.

Chapter 13

Recommendations for Future Research

The major findings of the current research were presented in Chapter 11 and the limitations of this body of work were summarised in Chapter 12. An accumulation of these major findings and limitations means that recommendations can now be made for future research. These recommendations are designed to answer some of the remaining questions related to the research on MEI and naming.

This body of work has produced recommendations for future research related to theoretical underpinnings and specific limitations related to the current body of work and previously published research on MEI and naming (Fiorile & Greer, 2007; Gilic & Greer, 2011; Greer, Corwin, & Buttigieg, 2011a; Greer, Stolfi, Chavez-Brown, & Rivera-Valdes, 2005b; Greer, Stolfi, & Pistoljevic, 2007). Structurally, this final chapter includes eleven sub-sections. The first three sub-sections are related to the theoretical underpinnings. First, recommendations are made about conducting research on the sub-components of naming. The second section includes recommendations about additional specification of the existing behavioural cusps on the VBDT pre-reader pyramid (Greer & Ross, 2008). Third, it is recommended that additional behavioural cusps are added to the VBDT pre-reader pyramid. It is suggested that the six sub-components of naming are added to this pyramid as additional prerequisite behavioural cusps prior to inducing FIN.

The next seven sub-sections include recommendations linked to the current body of work and previously published research on MEI and naming. These include a procedural recommendation for inducing naming, determining the effect of the additional match-to-sample (MTS) session preceding each test for FIN, increasing the sensitivity of data collection, the experimenter's choice of stimuli (and how this relates to the participants' instructional history), the use of unsequated trials, criteria levels

and a recommendation to include an additional “naturalistic” post-test for FIN. Finally, the eleventh sub-section of this chapter provides a summary of all the recommendations from this body of work.

Research on the Sub-Components of Naming

It appeared beneficial to summarise the literature according to the six sub-components of naming: Listener Bidirectional Naming (LBN), Speaker Bidirectional Naming (SBN), Full Bidirectional Naming (FBN), Listener Incidental Naming (LIN), Speaker Incidental Naming (SIN) and Full Incidental Naming (FIN). Organising the sub-components in this fashion and re-analysing the published research on naming, based on this organisation of sub-components, revealed that more research had been conducted on some sub-components of naming compared to others. More specifically, there appeared to be little or no dedicated research on Speaker Bidirectional Naming (SBN) and Listener Incidental Naming (LIN). Instead, most of the research on naming has focused on Listener Bidirectional Naming (LBN) and Full Incidental Naming (FIN). Therefore, future research may need a focus on inducing the newly organised sub-components of naming.

This dearth in the research literature is not an unusual phenomenon in applied research when the research variables are comparatively new to the field. However, it is important to attempt to conceptually define what researchers in the area of naming are discovering in order to facilitate future meaningful research in this area. When measuring and inducing untaught listener or speaker behaviour it is important to empirically determine what has actually been measured or induced. Culling all of these components into one category of naming may mask essential elements that need to be identified for replication and recommendations on how to induce naming with others. It may not be the case that what induces one component of naming will successfully induce other components.

This consideration is essential when conducting research across a variety of individuals with different instructional histories and different behavioural cusps. There may be multiple ways to induce naming or multiple ways to induce different components of naming. Naming has been induced by MEI (e.g. Fiorile & Greer, 2007; Gilic & Greer, 2011; Greer et al., 2005b, 2007, 2011a), an echoic intervention (Longano, 2008), a stimulus-stimulus pairing procedure (Longano, 2008), intensive tact instruction (Pistoljevic, 2008) and auditory matching (Speckman-Collins, Lee Park, & Greer, 2007). Furthermore, sub-components of naming have been demonstrated by teaching speaker behaviour and testing for listener behaviour (e.g. Cuvo & Riva, 1980; Delfs, Conine, Frampton, Shillingsburg, & Robinson, 2014; Keller & Bucher, 1979; Lee, 1981; Lowe et al., 2002; Lowe, Horne, & Hughes, 2005; Miguel & Kobari-Wright, 2013; Pérez-González, Garcia-Conde, & Carnerero, 2011; Sprinkle & Miguel, 2012) and vice versa (e.g. Cuvo & Riva, 1980; Horne et al., 2006). Potentially some of the interventions that have been used to induce certain sub-components of naming may not do so for all individuals. For example, in this body of work the MEI procedure, which several of these researchers used to induce naming in children with and without a diagnosis of autism, did not reliably produce the same results with older children and young adults with a diagnosis of autism. To clarify, the first recommendation for future research is to conduct more research on how to induce the sub-components of naming that have not been included in the published research, e.g. SBN, FBN, LIN and SIN.

More Specification of Prerequisite Behavioural Cusps

The Verbal Behaviour Development Theory (VBDT) was first described in Chapter 4 (see page 51). As stated in Chapter 4, the VBDT evolved from research findings reviewed by Greer and Keohane (2005), Greer and Ross (2008) and Greer and Speckman (2009). Greer and Keohane (2005) identified empirically-validated behavioural cusps which were subsequently organised by Greer and Ross (2008) into

two major verbal behaviour categories: pre-reader and reader/writer. The VBDT is based on a developmental sequence of behavioural cusps related to verbal behaviour and organised in a pyramidal fashion. The VBDT pre-reader pyramid of behavioural cusps is illustrated in Figure 60.

Individuals are tested to determine whether or not certain behavioural cusps are present. Subsequently, if a behavioural cusp is not present, and prerequisite behavioural cusps are in place, then specific protocols and procedures may be implemented to induce that cusp (Greer & Ross, 2008; Greer & Speckman, 2009). Research based on the VBDT has yielded many scientifically-validated protocols that have been valuable to the field of behaviour analysis. For example, the protocol 'Visual Tracking' has been effective in inducing the behavioural cusp 'Conditioned Reinforcement for three-dimensional Objects/Visual Stimuli on Desktop' (Delgado, Greer, Speckman, & Goswami, 2009), the 'Mirror Protocol' has been successful in inducing the behavioural cusp 'generalised imitation' (Du & Greer, 2014) and the 'Listener Emersion' Protocol has induced the behavioural cusp 'listener literacy' (Greer, Chavez-Brown, Nirgudkar, Stolfi, & Rivera-Valdes, 2005a).

For any theory, especially those that are early in development, conducting and expanding research on the fundamental frameworks of the theory is critical. When additional research is conducted it allows the theory to evolve and mature and to become more coherent. The findings from the research may actually support, expand or negate specific elements from the theory leading to possibly a restructuring of the theory.

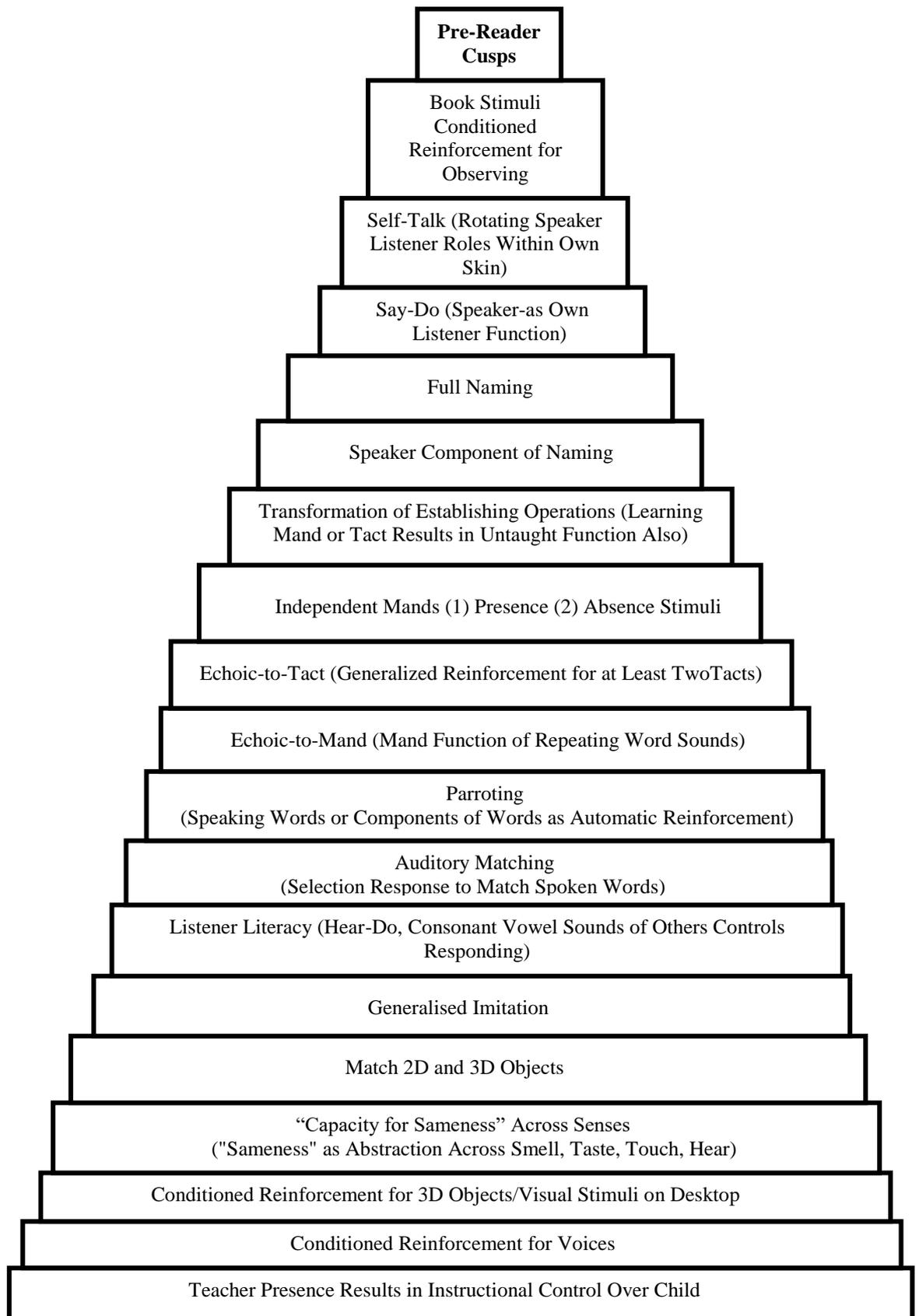


Figure 60: The VBDT pre-reader pyramid (Greer & Ross, 2008).

While there have been a multitude of studies on the topic of verbal behaviour and emergent relations to date (e.g. Barnes, McCullagh, & Keenan, 1990; Catania, Horne, & Lowe, 1989; Hall & Sundberg, 1987; Michael, 1988; Sautter & LeBlanc, 2006), there have been relatively few theories (apart from Relational Frame Theory (Hayes, Barnes-Holmes, & Roche, 2001)) related to the area of verbal behaviour with the purpose of advancing the verbal behaviour theory purported by Skinner (1957).

The VBDT provides procedures to test for the presence of a behavioural cusp along with suggestions from empirical research on how behavioural cusps can be induced when not present. The VBDT also provides guidance on how individuals should be taught depending on the presence or absence of behavioural cusps. For example, a child with FIN can be taught incidentally, without direct teaching, to acquire the names of new items (tacts). In contrast, a child without FIN requires direct teaching in order to acquire new tacts.

The results of this series of experiments showed that individuals with the prerequisites for FIN named in the VBDT did not respond as predicted to the MEI procedure recommended by the theory. This discrepancy suggested that more specification may be required about the prerequisite behavioural cusps for FIN. For example, clarification of the criteria for these prerequisite cusps would potentially provide the additional specification.

The VBDT pre-reader pyramid of behavioural cusps (Greer & Ross, 2008) implies that some higher order behavioural cusps, such as FIN, do require prerequisite behavioural cusps identified at the lower part of the VBDT pre-reader pyramid. For example, this body of work drew from Greer and Ross's (2008) description of the VBDT pre-reader pyramid which identified three essential prerequisites to inducing FIN:

1. Echoic-to-tact.

2. Independent mands.
3. Transformation of establishing operations across mands and tacts.

These behavioural cusps do appear to be prerequisites for FIN because speaker behaviour (specifically tacts) is required in both the MEI procedure and the test for FIN. Therefore it would be improbable for an individual without a history of emitting tacts to both learn to tact (part of the MEI procedure) and acquire the emergence of novel tacts (part of the test for FIN). In addition, it should be noted that the behavioural cusp for the transformation of establishing operations across mands and tacts (see Figure 60) is the first cusp on the VBDT pre-reader pyramid where evidence of *emergent* verbal behaviour is demonstrated. This is essential because FIN is an advanced emergent verbal behaviour. It may be more likely that an individual will meet the criteria for FIN if they have already demonstrated prerequisite emergent verbal behaviour. Furthermore, it may be assumed that *independent* mands are essential to the transformation of establishing operations across mands and tacts.

Each of the participants in the current experiments that utilised MEI to induce naming showed evidence of these three behavioural cusps being present as prerequisites for inducing FIN. Even though each of these individuals met the criteria for the prerequisites to serve as participants in this body of work, only 7 of the 20 participants met the criteria for FIN during this series of experiments. To clarify, all individuals who acquired FIN in the present study also met the criteria for the behavioural cusps: echoic-to-tact, independent mands and transformation of establishing operations across mands and tacts. However, not all of the participants who met the criteria for these three prerequisite behavioural cusps met the criteria for FIN (after the MEI procedure or multiple testing with preceding MTS sessions). As the results of this series of experiments show, it is improbable that an individual will acquire FIN without having these three prerequisite behavioural cusps. The presence of these three prerequisite

behavioural cusps does not, however, reliably predict the presence or inducement of FIN.

The difference between the expected and actual outcomes suggested there may be additional specifications regarding prerequisite behavioural cusps necessary for the inducement of FIN. To clarify, the prerequisite behavioural cusps for FIN (echoic-to-tact, independent mands and transformation of establishing operations across mands and tacts) are clearly prerequisites for FIN, but there are aspects of each that need more specification. For example:

1. More specification about the number of tacts an individual needs to meet the criteria for the echoic-to-tact behavioural cusp.
2. More specification about the number of mands an individual needs to meet the criteria for the independent mands behavioural cusp.
3. More specification about the time it takes to learn a new tact for an individual to meet the criteria for the echoic-to-tact behavioural cusp.
4. More specification about the time it takes to learn a new mand for an individual to meet the criteria for the independent mands behavioural cusp.
5. More specification about the number of tacts that transfer to mands (and vice versa) for an individual to meet the criteria for the transformation of establishing operations across mands and tacts behavioural cusp.

These three prerequisite behavioural cusps are analysed in further detail in the next three sub-sections with recommendations about increasing the specifications for the criteria level for each cusp.

Echoic-to-tact behavioural cusp. Potential additional specifications for the echoic-to-tact behavioural cusp emerged from closer inspection of the results of Experiment 6 in Chapter 8. These data showed that Participants N-T did not acquire the names of novel items in the teaching component of the test for LBN. As part of the test

for LBN, participants were required to learn the names of five novel tacts (speaker behaviour) via direct teaching before being tested for untaught listener behaviour (pointing to the corresponding items).

Participants N-T did not meet the criteria for the five novel tacts following the delivery of 120 learn units. Therefore, a test for untaught listener behaviour could not be conducted for Participants N-T because they did not meet the criterion on the five novel tacts. Specifically, the participants did not respond to tact instruction without requiring additional tactics or prompts to acquire those tacts. Because the tact is a basic verbal behaviour operant that is *directly* taught, the lack of an established history of tacting may indeed serve as a barrier to the acquisition of *emergent* verbal behaviour.

Interestingly, the only mention of the tact operant within the VBDT is for individuals to demonstrate evidence of an echoic-to-tact behavioural cusp for two different tacts (Greer & Ross, 2008). The results of Experiment 6 (Chapter 8) suggested an individual may need evidence of a more robust echoic-to-tact behavioural cusp in order to participate in this series of experiments. The outcomes of Experiment 6 (Chapter 8) suggested individuals need to acquire names of numerous contrived stimuli in an efficient manner (without the need for additional prompts). In other words, if it takes an excessive amount of instructional sessions for the individual to even show progress on acquiring the names of novel contrived tacts it may be potentially difficult for that individual to respond to procedures for inducing FIN.

If the individual does not achieve the acquisition of novel tacts with ease then this skill deficit needs to be targeted before interventions are put in place to induce emergent verbal behaviour. Therefore, a stronger echoic-to-tact behavioural cusp (i.e. evidence of participants having independent and fluent tacts across several environments) may be essential for individuals to benefit from MEI to induce FIN. It is unclear whether the participants in the published MEI studies (e.g. Fiorile & Greer,

2007; Gilic & Greer, 2011; Greer et al., 2005b, 2007, 2011a) had this robust echoic-to-tact behavioural cusp.

Independent mands. The test for FIN includes a measure of untaught speaker behaviour. From a functional standpoint, there are two different types of speaker behaviour, the tact and the mand. Even though the test for FIN does not require the mand operant, having fluent speaker behaviour (numerous mands and tacts) is important. Mands and tacts are typically taught through direct teaching; therefore, if the individual does not acquire speaker components directly it is highly unlikely they will acquire emergent speaker components.

The VBDT states that an individual should show evidence of least two independent mands to meet the criteria for the independent mands behavioural cusp (Greer & Ross, 2008). This may be a minimal standard; however some individuals may require a more stringent criterion for the independent mands behavioural cusp. Providing more specification in terms of the number of mands and the length of time it takes to acquire new mands would provide clearer criteria for the independent mands behavioural cusp. This specification would qualify and quantify how robust the independent mands behavioural cusp should be as a prerequisite behavioural cusp for FIN.

Transformation of establishing operations across mands and tacts. As a reminder, transformation of establishing operations across mands and tacts involves learning a new mand and using that same word as a tact without further direct teaching. It also involves learning a new tact and using that same word as a mand without further direct teaching. If an individual meets the criteria for this behavioural cusp then all newly acquired mands automatically emerge as tacts and all newly acquired tacts automatically emerge as mands. The two separate verbal operants (mands and tacts) do not need to be taught separately.

Similar to the echoic-to-tact behavioural cusp, it is not specified in the VBDT how many mands or tacts need to emerge without direct teaching. It is implied that all mastered mands and tacts should be transferrable across each operant: newly acquired mands will be emitted as tacts and vice versa. The concern, however, is that the individual may only emit two mands or tacts (as per the criteria for the independent mand and echoic-to-tact behavioural cusps) and, even though both of these may have also emerged as the alternate verbal operant, this does not technically demonstrate sufficient transformation of establishing operations across mands and tacts.

More specification and analysis is required in relation to this prerequisite behavioural cusp as well as the echoic-to-tact and independent mand prerequisite behavioural cusps. The outcomes of this series of experiments suggested that individuals demonstrate reliable and consistent transformation of establishing operations across mands and tacts before this prerequisite behavioural cusp is considered established.

Again, to emphasise its importance, the transformation of establishing operations across mands and tacts behavioural cusp is the first on the VBDT pre-reader pyramid in which evidence of emergent verbal behaviour is required. It is therefore advisable to ensure this behavioural cusp is fully established across a number of mands and tacts before attempting to induce further behavioural cusps related to emergent verbal behaviour.

With the identification of more specific criteria for the prerequisite behavioural cusps, Participants N-T did not demonstrate these more refined behavioural cusps to be part of this series of experiments. To clarify, Participants N-T were unable to acquire the names of novel items without additional prompts or tacts which indicated that this specific prerequisite (echoic-to-tact behavioural cusp) was not acquired.

Consideration for providing specific details for each of the behavioural cusps on the VBDT pre-reader pyramid is advisable. These specifications allow for a detailed and more complete analysis regarding whether potential participants are suitable for the inducement of FIN and indeed other behavioural cusps on the VBDT pre-reader pyramid. The analysis of prerequisite behavioural cusps requires more research in order to more clearly specify prerequisites on the VBDT pre-reader pyramid. Identifying all of these potential prerequisites is beyond the scope of this body of work.

Prerequisite Sub-Components of Naming

The current body of work attempted to address some of the issues with broad prerequisites linked to the different sub-components of naming. One perspective for consideration related to how the six sub-components of naming (identified in Chapter 4) can be integrated into the VBDT pre-reader pyramid (see Figure 60). Only two sub-components of naming are currently included in the VBDT pre-reader pyramid (Speaker Incidental Naming (SIN) and FIN), yet four additional sub-components were identified in Chapter 4 (Listener Bidirectional Naming (LBN), Speaker Bidirectional Naming (SBN), Full Bidirectional Naming (FBN) and Listener Incidental Naming (LIN)). Experiment 6 (Chapter 8) was systematically designed to test for each of the six suggested sub-components of naming across 20 participants.

Analysis of the results of Experiment 6 suggested that bidirectional naming (teaching listener behaviour and speaker behaviour emerges without further direct teaching and vice versa) may be a prerequisite to incidental naming (the emergence of listener and speaker behaviour following an incidental language experience). Furthermore, the results of Experiment 6 showed that listener naming (the emergence of listener behaviour following the teaching of speaker behaviour or an incidental language experience) may be a prerequisite to speaker naming (the emergence of speaker

behaviour following the teaching of listener behaviour or an incidental language experience).

It may be beneficial to include the six sub-components of naming on the VBBDT pre-reader pyramid as separate and distinct behavioural cusps. Thus, individuals could be tested systematically for these behavioural cusps before MEI is implemented to induce FIN. To clarify, following the acquisition of transformation of establishing operations across mands and tacts, the next behavioural cusp to target is LBN. This potential behavioural cusp (LBN) is followed by SBN and then FBN. Once FBN is established the next three behavioural cusps could be tested for in a systematic manner: LIN, SIN and FIN.

It is important to be systematic in the testing of the different sub-components of naming and with the implementation of protocols and procedures to induce these different sub-components of naming. This is for two reasons:

1. Earlier sub-components of naming, such as LBN, may be prerequisites to more complex sub-components of naming, such as FBN.
2. Some individuals may never meet the criteria for more advanced sub-components of naming, such as FIN.

It is an inefficient use of resources to spend time conducting protocols where the dependent outcome is not achievable because barriers (prerequisite sub-components) exist. It is much more effective to consider inducing a prerequisite behavioural cusp or sub-component of naming. Even the acquisition of a sub-component of naming could have a positive impact on an individual's life because learning more efficiently and in different ways is now possible. For example, if an individual does not demonstrate emergent verbal behaviour as a prerequisite to FIN then the teacher should not devote considerable time to using protocols and procedures to induce FIN, but rather focus on inducing the missing sub-components. In addition, if an individual does demonstrate

LBN, but not SBN, then the curriculum should be modified with this behavioural cusp in mind to ensure the most efficient form of teaching is taking place. For example, once LBN is demonstrated, the curriculum should mainly consist of speaker targets (such as tacting colours) and the listener response (pointing to the corresponding colours) will emerge following the direct teaching of the speaker targets. To clarify, the presence of one sub-component of naming allows for the reduction in the amount of direct teaching delivered to the individual because some targets emerge without direct teaching.

Accounting for prerequisite behavioural cusps as well as identifying the sub-components of naming is critical to further developing the VBDT. The findings from the series of experiments reported herein provide important information for consideration regarding the structure of the VBDT; however, this is only one half of the analysis. The implications of the current work and how it relates to the published applied research on MEI and FIN are essential considerations for expanding the research base and the practical applications of the theory.

After reviewing the literature on naming as a singular type of phenomenon, it is apparent that there are several sub-components of naming. It is recommended that these sub-components of naming are included within the VBDT pre-reader pyramid of behavioural cusps. It was also suggested in the previous section of this chapter that more specification is required regarding the prerequisite behavioural cusps on the pyramid. Figure 61 illustrates a recommended updated *section* of the VBDT pre-reader pyramid of behavioural cusps. Those behavioural cusps coloured yellow illustrate the ones that require more specification. As stated earlier, providing more specification in terms of the number of mands or tacts in repertoire and the length of time it takes to acquire a new mand or tact would provide clearer criteria for the behavioural cusps that address independent mands and echoic-to-tacts. Clearer criteria and increased specification would qualify and quantify how robust the independent mand or echoic-to-

tact behavioural cusps should be as prerequisite behavioural cusps for FIN. Similarly, more specification regarding transformation of establishing operations across mands and tacts is recommended related to the number of mands that transform to tacts as well as the number of tacts that transform to mands.

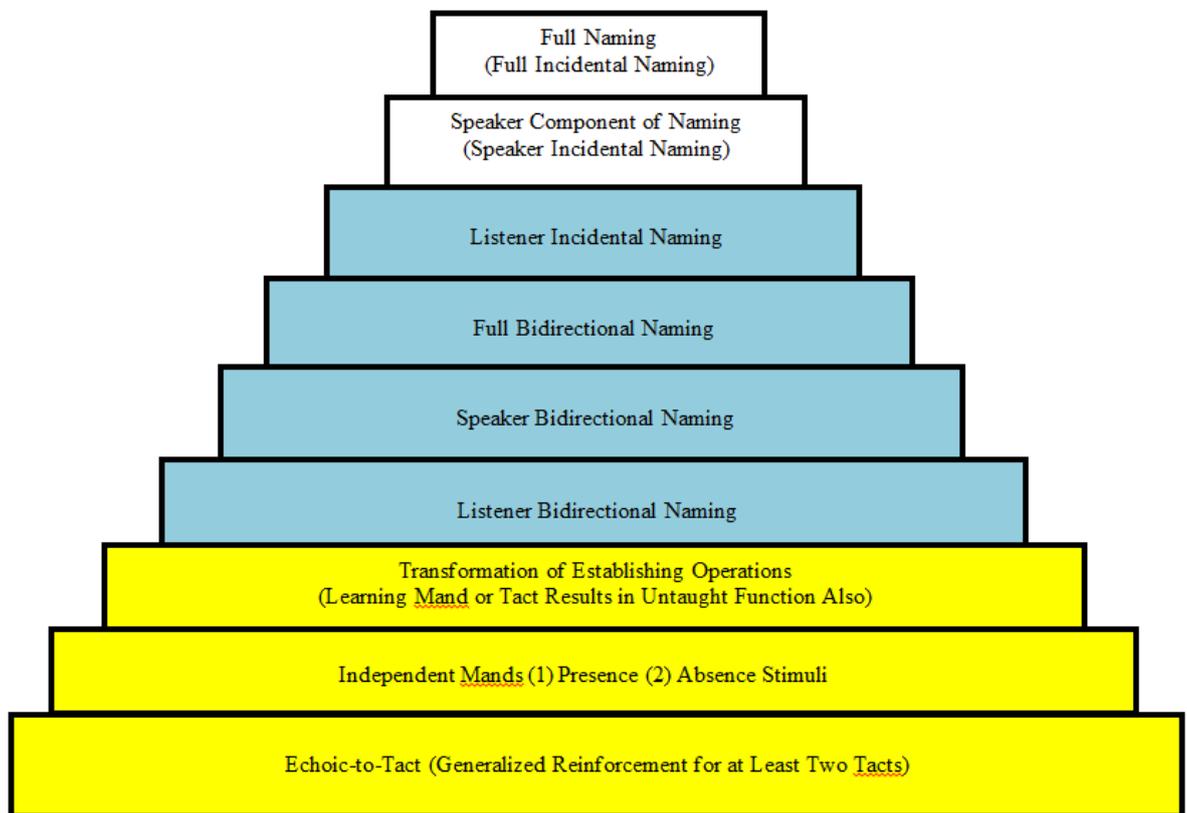


Figure 61: An updated section of the VBDT pre-reader pyramid of behavioural cusps.

Those behavioural cusps coloured blue illustrate the additional behavioural cusps recommended to be included within the pre-reader pyramid. These are in line with the analysis in Chapter 4 recommending that there are different sub-components of naming.

Those behavioural cusps in white include in brackets the suggested updated names for these behavioural cusps.

It is recommended that researchers utilise this updated section of the VBDT pre-reader pyramid of behavioural cusps to determine if individuals demonstrate the prerequisites to qualify for the implementation of MEI to induce FIN.

The VBDT (Greer & Keohane, 2005; Greer & Ross, 2008; Greer & Speckman, 2009), and specifically the pre-reader pyramid of behavioural cusps described within the VBDT, served as the foundation for procedures used in this work. The VBDT is organised by a hierarchical arrangement of behavioural cusps such that one behavioural cusp is considered to provide the foundational prerequisites for the next (higher) behavioural cusp. However, the arrangement of behavioural cusps as a linear hierarchy, with the implication that the sequence of the pyramid is fundamental to the theory, has not been empirically tested. More recent publications present the same behavioural cusps in a circular format, presented as four diagrams organising the behaviour cusps according to the following categories; ‘listener,’ ‘speaker,’ ‘pre-verbal’ and ‘joining of listener and speaker responses’ (Greer & Du, 2015). The speaker diagram is illustrated in Figure 62. This suggests the relationship between behavioural cusps may not be hierarchical in the sense that one cusp is not necessarily a prerequisite or a predictor of another. It is possible that some behavioural cusps develop concurrently and some emerge due to the acquisition of other behaviours.

A lack of research identifying an order of foundational behavioural cusps necessary for the development of higher behavioural cusps leaves open the possibility that the order of behavioural cusps may vary from that suggested by the VBDT pyramid. This approach provides an opportunity for considering the potential for additional prerequisites not identified by the VBDT. These are empirical questions yet to be answered. However, the current work did reveal findings with implications related to identifying additional prerequisite behavioural cusps for inducing FIN that are not present in the VBDT pyramid.

Speaker



Figure 62: Reinforcement and motivating operations for the speaker behavioural cusps as illustrated by Greer and Du (2015).

Procedural Recommendation

The recommendation from this body of work is that more than one test for FIN should always be conducted prior to implementing MEI (as per the latest published research on MEI and naming (Greer et al., 2011a)). It is also recommended that a final test for FIN is conducted with a novel set of stimuli and with a preceding MTS session. This was not included in the current body of work (discussed in Chapter 12 (Limitations)), but this final test for FIN with novel stimuli either confirms or negates the previous test for FIN and reduces the reliance of one test to determine whether an entire behavioural cusp has been induced. This additional test for FIN with novel stimuli was in place in the study by Greer et al. (2011a). To clarify, Figure 63 shows the procedure that was used in the study by Greer et al. (2011a).

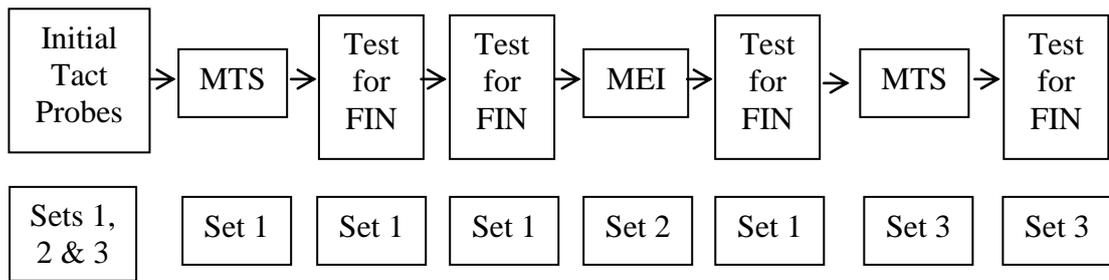


Figure 63: Experimental procedure utilised in the study by Greer et al. (2011a).

The results of the current body of work showed that more participants met the criteria for FIN following repeated tests (which included the repeated MTS sessions) than following the MEI procedure. It is therefore a recommendation of the current body of work that these additional MTS sessions are implemented prior to *each* test for FIN. *Additional* repeated testing pre-MEI may be warranted in some cases (beyond the two pre-MEI tests for FIN). The rationale for this additional repeated testing is generated from data from the current body of work. For example, Participant E (see page 195 in Chapter 10) produced ascending scores with the pre-MEI tests for FIN making it difficult to discern whether the scores in the final test for FIN (post-MEI) would have been produced without the MEI procedure. It is recommended that if a participant produces ascending scores on the pre-MEI tests for FIN then an additional test (with an additional MTS session) is conducted prior to the implementation of the MEI procedure. If the participant meets the mastery criteria for FIN on this third test for FIN then this is more efficient than exposing the individual to the intensive MEI procedure.

Figure 64 shows the recommended procedure for all future research on MEI and naming. It is clear that this recommended procedure is quite different to the last published procedure on MEI and naming (Figure 63). The recommended procedure in Figure 64 includes at least two tests for FIN with a preceding MTS procedure prior to implementing MEI. Figure 64 shows that if the criteria for FIN are met pre-MEI then an additional test for FIN is conducted (with the preceding MTS procedure) with a novel

set of stimuli (Set 3). These data will either confirm or negate the findings of the test for FIN with the Set 1 stimuli. Figure 64 shows that if the criteria for FIN are not met then the pre-MEI data are analysed and the MEI procedure is only implemented if the data from the tests for FIN are stable. If the data are ascending then it is recommended that an additional MTS procedure and test for FIN are conducted (with Set 1 stimuli). If the data are stable then the MEI procedure is implemented.

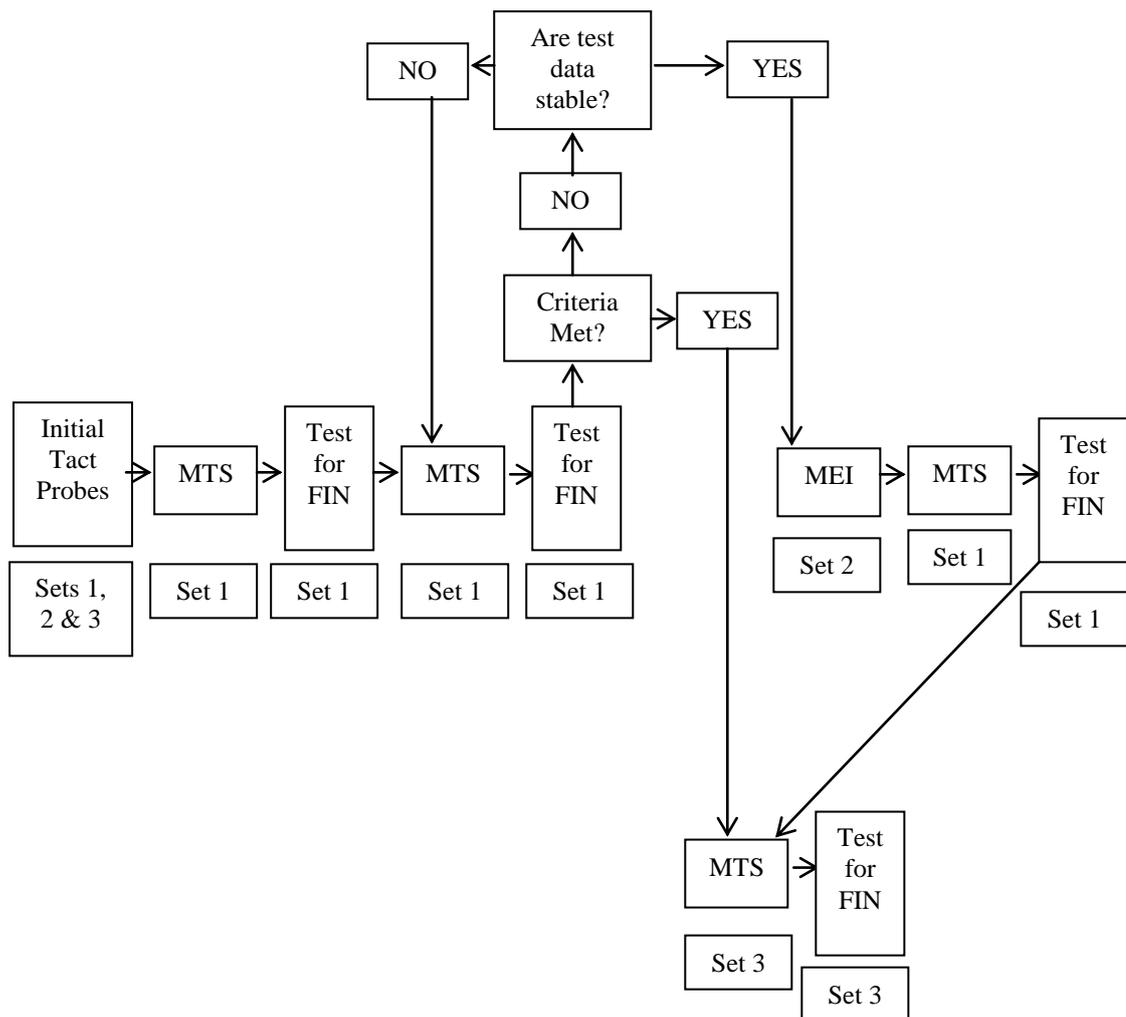


Figure 64: The recommended procedure for all future research on MEI and naming.

This recommended procedure is based on the results of the current body of work where more participants met the criteria for FIN pre-MEI following more than one test for FIN with preceding MTS procedures. This is a more efficient route to meeting the

criteria for FIN rather than implementing the intensive MEI procedure. As explained in Experiment 1 (page 118), this additional MTS procedure does not compromise the fidelity of the experimental sequence. Hypothetically, individuals may still demonstrate the acquisition of the names of new items incidentally. The final test for FIN with a novel set of stimuli confirms or negates the previous test result.

Furthermore, it may be necessary to examine the participants' performance on the initial test for FIN more closely. Initial test data with zero correct responses across untaught behaviours may indicate the individual is lacking the prerequisites to benefit from the intervention and those prerequisites may need to be taught first. This scenario may be prevented by implementing the previous recommendation about more specification of the prerequisite behavioural cusps. To be prudent, however, an additional recommendation could be that if two tests are conducted with zero correct responses (or less than five correct responses for untaught listener behaviour) then MEI is not implemented, but prerequisite behavioural cusps are targeted instead.

Determining the Effect of the Additional MTS Sessions

As already stated, the results of the current body of work showed that more participants met the criteria for FIN following repeated tests with repeated MTS procedures than following the MEI procedure. Germane to the previous discussion in Chapter 11 on the frequency of testing, it is unknown whether FIN was induced for these participants through repeated testing and repeated exposure to the MTS procedure, whether the initial test result was a false negative or whether the fourth test result was a false positive. Over the series of experiments, four participants (Participants B, C, F & J) met the criteria for FIN pre-MEI following repeated testing and repeated exposure to the MTS procedure. As stated previously in Chapter 11, research has shown that repeated testing improves test scores (e.g. Benedict & Zgaljardik, 2010; Hausknecht et al., 2002), but an improvement in the scores does not address whether the initial test is

false negative or whether the final test is false positive. The repeated test does provide additional language experiences, however, and this potentially explains why repeated testing may be responsible for inducing naming for Participants B, C, F and J.

It is important to note that these repeated MTS sessions did not compromise the fidelity of the multiple probe experimental sequence. This procedural adjustment did, however, raise another issue regarding the repeated MTS sessions. These sessions provided an increased exposure to language experiences before the MEI intervention procedure was implemented. Although this did not appear to be an issue with Experiment 2 (Chapter 6, see page 119), it did lead to a major finding when the results of all the experiments were analysed. As stated in Chapter 11, a major finding of the current body of work was that more participants met the criteria for FIN via repeated testing (with the repeated MTS procedure) than via the MEI procedure. This explanation for this unexpected finding could be accounted for by a RFT perspective due to the multiple exemplar training that is incorporated into the MTS procedure.

This phenomenon does possibly highlight the role of using MTS sessions prior to each test because they provided an additional language experience. However, it also brings about a discussion regarding the published research on MEI and FIN and whether MEI induced FIN or if participants could have met the mastery criteria for FIN by re-testing and including the MTS sessions. Discovering the answer to this question is germane to determining efficiency in curricular design. It is yet to be determined whether simply providing more MTS sessions and testing opportunities is more efficient than running a MEI procedure.

One way to possibly determine the effect of the MTS sessions is to use a delayed multiple probe design by arranging peers in groups of four based on level of verbal behaviour and presence of certain behavioural cusps. All four participants are tested for FIN on three occasions, two participants with MTS sessions prior to each test

for FIN and two participants with the MTS session prior to the first test for FIN only. Two individuals receive MEI after two pre-MEI tests for FIN and the remaining two individuals do not receive the MEI procedure, but are tested for FIN on three occasions. Figure 65 illustrates the design of this suggested experiment. This arrangement could be conducted across several groups of four individuals with matched levels of verbal behaviour and presence of certain behavioural cusps. Conducting an experiment using this suggested experimental design is a recommendation for future research.

Although this did not appear to be an issue with Experiment 2 (Chapter 6, see page 119), it did lead to a major finding when the results of all the experiments were analysed. As stated in Chapter 11, a major finding of the current body of work was that more participants met the criteria for FIN via repeated testing (with the repeated MTS procedure) than via the MEI procedure. As stated on page 248, this explanation for this unexpected finding could be accounted for from a RFT perspective due to the multiple exemplar training that is incorporated within the MTS procedure. It also needs to be considered that it may be more efficient to induce FIN with a *different* set of stimuli for each test. Using a different set of stimuli for each test may add to the intensity of the multiple exemplar training experience because even more multiple exemplars would be incorporated into the procedure. Thus, the test for FIN would not strictly be a test, but could be an alternative procedure for inducing naming. This recommendation warrants further research.

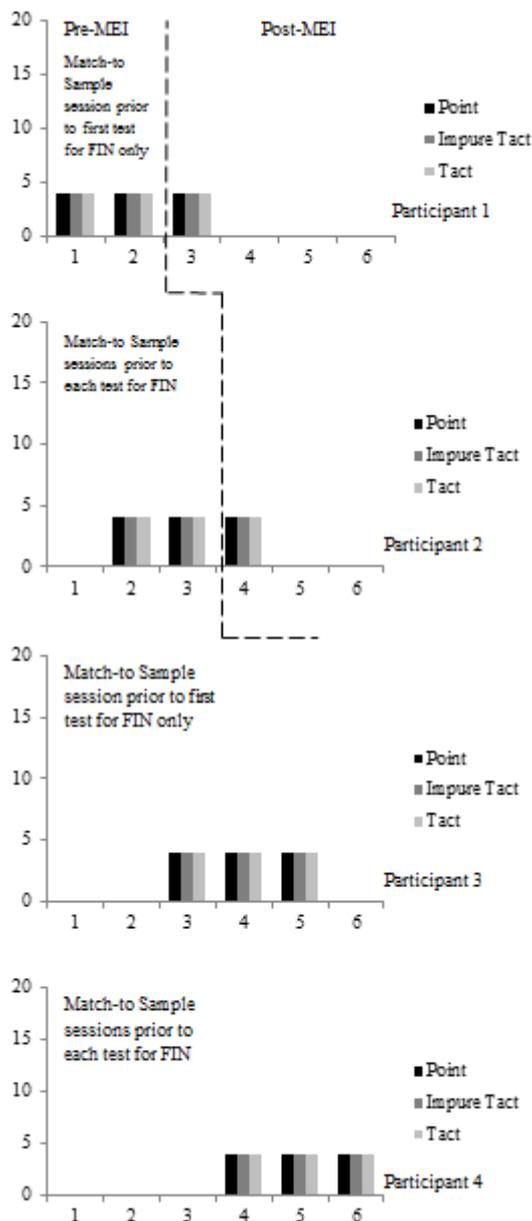


Figure 65: Experimental design for isolating whether additional testing or MTS sessions prior to each test for FIN impact test scores.

Sensitivity of Data Collection

As stated in Chapter 12, two participants may produce the same score on one of the experimental tests of untaught behaviour, yet the score may not truly reflect the actual outcomes. One participant may tact “moop” as “moo,” whereas another participant may not respond to the stimulus at all. To correct this loss of valuable information it is recommended that a data collection option to establish an acceptable range of correct responses, e.g. “Mup” or “mop” is also accepted for “moop,” such that

the incorrect responses are scored based on the shared properties of the correct responses. This adjustment may allow the data collected to be more sensitive to the participants' verbal behaviour at any point in time. For example if the correct response is "moop" then score as follows:

- 5/5 for "moop."
- 4/5 for "moo_" or "m_p."
- 3/5 for "_oop."
- 2/5 for "m" or "oo" or "p"
- 1/5 for an attempted response.
- 0/5 for a non-response.

Participant B did not meet the criterion for SBN when initially tested due to issues with data collection sensitivity. Approximations of the names were counted as incorrect responses, e.g. "mop" for "moop," "kock" for "kong" and "fem" for "nen." He scored 7/20 (35%) on the initial test for SBN due to these errors (and one additional incorrect response tacting "afe" as "jib"). If his data were scored as suggested above then all the correct responses would have scored 5/5, a response of "mop" for "moop" would have scored 4/5, "kock" for "kong" would have scored 4/5 and "fem" for "nen" would have scored 2/5. In summary, the initial test for SBN would have revealed a score of 76% rather than 35%. This comparison of the original data versus updated scores is shown in more detail in Appendix F. This new score would not have met the mastery criteria for SBN, but clearly more emergent verbal behaviour is demonstrated with this updated scoring system.

Similarly, Participant C did not meet the criteria for SIN when initially tested for FIN. The criterion for Listener Incidental Naming (LIN) was met at this point. For untaught speaker behaviour the participant consistently tacted the stimuli, but they were not correct responses. For example, he tacted "pidge" as "podge," "chob" as "mob" and

“gand” as “godge.” This pattern of responding mimicked the pattern of responding of Participant B. Participant C scored 7/20 (35%) on the initial test for SIN due to these errors (and other errors). If his data were scored as suggested above then he would have scored 5/5 for all correct responses, tacting “pidge” as “podge” would have scored 4/5, tacting “chob” as “mob” would have scored 3/5 and tacting “gand” as “godge” would have scored 2/5. This updated scoring reveals an initial score of 72% for impure tacts and 67% for pure tacts. As with Participant B, this comparison of the original data versus updated scores is shown in more detail in Appendix F. This updated score for SIN still did not meet the mastery criteria of 80% for SIN, but potentially provides a truer reflection of the emergence of untaught behaviour in comparison to the original score of 35%.

To clarify, it is recommended that future research on emergent verbal behaviour includes an updated scoring system as suggested above to ensure that the data collection system is more sensitive to the emergence of untaught verbal behaviour.

Selection of Stimuli

Even though contrived stimuli (e.g. Wingdings, Greek letters or combinations; see Appendix E) were used in the current work, the images used unintentionally contained some features that were actually structurally similar to common items (e.g. car, cupboard, letters of the alphabet). Some participants emitted a response associated with an acceptable name for the contrived stimulus based on what they resembled. For example, Participant K named a “dud” as a “wheel” and a “koop” as a “cabinet.” In both of these examples, some element of the contrived stimuli resembled the participant’s responses. Participant I also said, “It looks like a wobbly line,” or, “It looks like the front of a car.” These types of errors emitted by participants could be attributable to proactive inhibition⁹. In these instances, the phenomenon occurs when the instructional

⁹ Proactive inhibition is the tendency of earlier learning to interfere with new learning.

history of the individual with a stimulus or part of a stimulus interferes with the new way the individual is taught to respond to that stimulus. To minimise these effects it may be desirable to discard stimuli during the initial tact probes if participants attempted to provide a name to the item that did have an association with the stimulus and possibly reveal an instructional history with that stimulus. In addition, it may be prudent to consider that other researchers have used familiar stimuli (e.g. monsters) which were designed not to represent any known stimulus (e.g. Sully from Monsters Inc) and they were given contrived names (e.g. May, Hawkins, & Dymond, 2013). This type of stimuli is a consideration for future research.

The Use of Unconsequated Trials

As stated in Chapter 12 (see page 263), it appears that the number of unconsequated trials within the test for FIN possibly require modification. The test for FIN involved 60 unconsequated trials (12 for each stimulus) for untaught behaviours. These 60 trials included 20 trials for untaught listener behaviour and 40 trials for untaught speaker behaviour (20 for impure tacts and 20 for pure tacts). Within the test for FIN, correct responses were not reinforced, incorrect responses were not corrected and the participant was not told that the response was incorrect. This number of unconsequated trials raised the question of whether emergent behaviour was extinguished. For example, Participant K scored a total of 8/20 correct responses for untaught listener behaviour in the second pre-MEI test for FIN in Experiment 9. A more in-depth analysis revealed that, during the test for untaught listener behaviour, the first five responses by the participant were all correct. However, over the next 15 trials the participant only scored an additional 3 correct responses. Subsequently the participant scored zero correct responses when tested for untaught speaker behaviour. One possible recommendation of the current body of work is if a participant scores 5/5 correct responses for untaught listener behaviour, this should suffice for mastery and the

participant should be tested for untaught speaker behaviour. Alternatively, experimenters may consider reinforcing correct responses so that they are not extinguished.

To summarise, the danger of conducting numerous unsequenced trials is that correct responses to those trials are unreinforced, and can be put into extinction. Two alternative recommendations can be considered for future research.

1. Conduct 5 unsequenced trials for each untaught behaviour (5 listener trials and 10 speaker trials (5 pure tacts and 5 impure tacts)) instead of 60 unsequenced trials.
2. Conduct 60 trials (as per Greer and Ross's (2008) test for FIN), but reinforce the correct responses.

Criteria Levels

The criteria levels for the tests for naming in the published research and the current body of work were determined by the researchers by what has generally been accepted in the field as mastery criteria. It might, however, be more useful to examine the change in the data from the pre-MEI test for FIN and the post-MEI test for FIN (total gains or losses) rather than using an experimental criteria level for the post-MEI test. For example, if an individual scores 15/20 during the initial test for FIN and 16/20 during the post-MEI test for FIN, it is questionable whether the gain of one correct response truly represents the gain of FIN. Similarly, if an individual scores 5/20 during the initial test for FIN and 15/20 on the post-MEI test for FIN, the gain of 10 correct responses is potentially more substantial than the previous example despite the fact that technically the second individual did not meet the mastery criteria.

In this series of experiments, gains between tests for FIN were made in many cases, but the criteria levels were not met. For example, Participant G made substantial gains in Session 4 (see Figure 42 in Chapter 10) post-MEI. The data showed that the

MEI had an effect on untaught behaviour, but not to criteria levels. This, again, raises the question of whether the criteria levels require adjusting or whether the difference between the pre- and post-MEI data (gains or losses) is the more robust predictor.

In a further example, Participant E met the criteria for FIN post-MEI. Closer inspection of these data, however, (see Figure 37 in Chapter 10) showed that the difference pre-MEI (Session 6) compared to post-MEI (Session 7) is less than the difference pre- and post-MEI for Participant G.

It may also be possible that the initial tests for FIN with scores above a certain threshold may indicate the individual already has FIN, but the experimental test was not sensitive to gauge the presence of the behavioural cusp. An addition to the procedural recommendation that was made earlier in this chapter (Figure 64) could include that if a participant scores 14-15 correct responses in a pre-MEI test for FIN then a further test is conducted (with a preceding MTS session) before MEI is implemented. Similarly, if an individual scores 15/20 during the post-MEI test for FIN, it is also recommended that the individual is tested again for FIN.

Additional “Naturalistic” Post-Test for FIN

Specific experimental criteria for the test for FIN can be set, but it is unclear whether these mastery criteria are related to actual individual performance outside of the experimental conditions. Part of the focus of inducing FIN is to determine if individuals can learn in new ways. It is important to develop additional practical criteria related to the performance outside of the experimental conditions and correlate this with the experimental criteria required within the study. In addition to the suggested experimental sequence described earlier in this section (see Figure 64), it would potentially be beneficial to include another post-test to determine the emergence of untaught behaviours outside of the experimental conditions.

It was suggested by Rosales, Rehfeldt, and Lovett (2011) to use a more “naturalistic approach” (e.g. naming items in a picture book) to further evaluate the emergence of untaught verbal behaviour. To clarify, with regard to future research, it is recommended that participants who meet the experimental criteria for FIN should be tested again for FIN using this more naturalistic approach. This naturalistic approach could involve looking through a picture book with the participant where the researcher tacts novel stimuli within the book, but does not directly teach the tacts. The participant needs to attend to the researcher and look at the stimuli as the researcher tacts them. Following this series of tacts, the researcher tests for untaught behaviour by asking the participant to point to items in the book (untaught listener behaviour) and by asking the participant to tact items in the book (untaught speaker behaviour).

Solely relying on the experimental test for FIN may not have concurrent validity with what happens incidentally outside of the experiment, meaning that it may not be the most robust indicator of the acquisition of incidental learning. This additional post-test could also isolate whether the exposure to multiple tests is allowing for positive results on the FIN test. For example, if two participants meet the mastery criteria for FIN, but one received MEI and the other simply received multiple tests (with multiple MTS sessions), the additional post-test (naturalistic/incidental test) would allow the researcher to determine if the experimental mastery criteria are applicable to acquiring incidental learning outside of the experimental conditions.

This naturalistic and incidental test is important because it should be applicable across all age, disability and neuro-typical groups. If designed appropriately the additional post-test may also serve to provide more definitive information for those working with older children and young adults diagnosed with autism. If the criteria for FIN are to demonstrate emergent behaviour for two out of three occurrences or for four out of five occurrences, a naturalistic and incidental test for naming would determine

whether demonstrating emergent behaviour for those number of occurrences is a true predictor of FIN.

Summary

The review of the naming literature and the subsequent experimental work has led to two main conclusions. Firstly it is clear that there are potentially more components of naming than described in the VBDT. Secondly, based on the findings within this body of work, it does not appear that MEI has consistently induced FIN or FBN in older children and young adults diagnosed with autism.

It is recommended from this research that future researchers specify which sub-component of naming is being addressed. It is further recommended that more specificity is provided regarding prerequisite behavioural cusps on the VBDT pre-reader pyramid and that the sub-components of naming are included in the VBDT pre-reader pyramid.

The difference in the research findings reported herein, compared to the published research on MEI and naming, is potentially attributed to one of three reasons. First, the MEI procedures may not be effective in inducing FIN for older children and young adults diagnosed with autism. Second, modifications were made to the procedures within this body of work with MTS sessions preceding each test for FIN implemented in Experiments 2 and 4-9. These modifications led to four participants meeting the criteria for FIN prior to the implementation of the MEI procedure. Without these additional MTS sessions, these results may have possibly been more similar to the published research. This is unlikely, however, due to the lack of emergent behaviour demonstrated in Experiment 1 when MTS sessions were limited to only the first test. Third, the appropriate modifications and adaptations to the MEI procedures for older children diagnosed with autism have not been identified as of now.

To sum up, in terms of future research on using MEI to induce naming the following recommendations have been made specific to the procedure:

1. Researchers to utilise the updated section of the VBDDT pre-reader pyramid of behavioural cusps (see Figure 61) to determine if individuals demonstrate the prerequisites to implement MEI to induce FIN.
2. Stimuli are discarded in the initial tact probe if the participant provides a name for the stimulus that has an association with the stimulus.
3. MTS sessions are presented prior to each test for FIN.
4. An updated scoring system is implemented to address the issues around sensitivity of data collection.
5. At least two initial tests for FIN (pre-MEI) are conducted using the same stimuli. If data from first two pre-MEI tests for FIN are ascending then conduct an additional test (until tests produce stable data).
6. If data from first two pre-MEI tests for FIN produce zero scores for untaught verbal behaviour then do not implement MEI, but instead target prerequisite behavioural cusps.
7. If emergent behaviour is shown in the post-MEI test for FIN, but the criteria for FIN is not met then an additional test for FIN is conducted (with the preceding MTS session) with the same stimuli as the previous test.
8. An additional test for FIN with novel stimuli is conducted if the criteria for FIN are met.
9. An additional post-test for FIN designed around incidental or naturalistic experiences (e.g. testing for untaught verbal behaviour while looking at a picture book) is used to validate whether the experimental test is an authentic indicator of FIN.

In addition, researchers who find this body of work valuable could engage in research testing whether MEI induces all the sub-components of naming, testing whether individuals with FIN also meet the criteria for the other sub-components of naming, and conduct a direct replication of one of the previously-published studies on MEI and FIN using other specific participant groups. Finally, it is recommended that a study is conducted, which uses yoked participants with similar levels of verbal behaviour, to isolate the effects of additional MTS sessions and multiple pre-MEI tests for FIN (as per Figure 65).

Each of these research endeavours would provide fruitful contributions to the important and widening body of research on naming. The importance of this research is underscored by the rich contributions to the field in the area of naming (e.g. Greer et al., 2007, 2011a; Pérez-González et al., 2011; Rosales et al., 2011). In many ways their research has allowed variables to be uncovered that have been unknown up until this point. In order for there to be a full-bodied scientific account of complex and sophisticated language acquisition, researchers must continue to replicate and explore unknown variables related to naming.

References

- Agran, M., Salzberg, C. L., & Stowitschek, J. J. (1987). An analysis of the effects of a social skills training program using self-instructions on the acquisition and generalization of two social behaviors in a work setting. *Research and Practice for Persons with Severe Disabilities, 12*, 131-139.
- Alessi, G. (1987). Generative strategies and teaching for generalization. *The Analysis of Verbal Behavior, 5*, 15-27.
- Anderson-Inman, L. (1981). Transenvironmental programming: Promoting success in the regular class by maximizing the effect of resource room assistance. *Journal of Special Education Technology, 4*, 3-12.
- Andronis, P. T., Layng, T. J., & Goldiamond, I. (1997). Contingency adduction of “symbolic aggression” by pigeons. *The Analysis of Verbal Behavior, 14*, 5.
- Baer, D. M., Wolf, M. M., & Risley, T. R. (1968). Some current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis, 1*, 91-97.
- Barnes, D., McCullagh, P. D., & Keenan, M. (1990). Equivalence class formation in non-hearing impaired children and hearing impaired children. *The Analysis of Verbal Behavior, 8*, 19.
- Barnes-Holmes, D., Barnes-Holmes, Y., & Cullinan, V. (2000). Relational frame theory and Skinner's verbal behavior: A possible synthesis. *The Behavior Analyst, 23*, 69-84.
- Becker, W. C., Engelmann, W., & Thomas, D. R. (1975). *Teaching 2: Cognitive learning and instruction*. Chicago: Science Research Associates.
- Benedict, R. H. B., & Zgaljardic, D. J. (1998). Practice effects during repeated administrations of memory tests with and without alternate forms. *Journal of Clinical and Experimental Neuropsychology, 20*, 339-352

- Blank, M., Rose, S., & Berlin, L. (1978). *The language of learning: The pre-school years*. New York: Grune and Stratton Inc.
- Campbell, C. R., & Stremel-Campbell, K. (1982). Programming “loose-training” as a strategy to facilitate language generalization. *Journal of Applied Behavior Analysis*, *15*, 295-301.
- Carr, E. G., & Durand, V. M. (1985). Reducing behavior problems through functional communication training. *Journal of Applied Behavior Analysis*, *18*(2), 111-126.
- Catania, A. C. (1998). The taxonomy of verbal behavior. In Lattal, K. A., & Perone, M. (Eds), *Handbook of research methods in human operant behaviour* (pp. 405-433). New York: Springer.
- Catania, A. C., Horne, P., & Lowe, C. F. (1989). Transfer of function across members of an equivalence class. *The Analysis of Verbal Behavior*, *7*, 99.
- Chavez-Brown, M. (2005). *The effects of the acquisition of a generalized auditory word match-to-sample repertoire on the echoic repertoire under mand and tact conditions* (Unpublished doctoral dissertation). Columbia University, New York.
- Choi, J., Greer, R. D., & Keohane, D. D. (2015). The effects of an auditory match-to-sample procedure on listener literacy and echoic responses. *Behavioral Development Bulletin*, *20*(2), 186.
- Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). *Applied behavior analysis*. Upper Saddle River, NJ: Prentice-Hall.
- Cowley, B. J., Green, G., & Braunling-McMorrow, D. (1992). Using stimulus equivalence procedures to teach name-face matching to adults with brain injuries. *Journal of Applied Behavior Analysis*, *25*(2), 461-475.
- Crystal, D. (2006). *How language works: How babies babble, words change meaning, and language lives or dies*. Woodstock, NY: Overlook Press.

- Cuvo, A. J., & Riva, M. T. (1980). Generalization and transfer between comprehension and production: A comparison of retarded and nonretarded persons. *Journal of Applied Behavior Analysis, 13*, 315-331.
- Delfs, C. H., Conine, D. E., Frampton, S. E., Shillingsburg, M. A., & Robinson, H. C. (2014). Evaluation of the efficiency of listener and tact instruction for children with autism. *Journal of Applied Behavior Analysis, 47*, 793-809.
- Delgado, J. A. P., Greer, R. D., Speckman, J. M., & Goswami, A. (2009). Effects of conditioning reinforcement for print stimuli on match-to-sample responding in preschoolers. *The Journal of Speech and Language Pathology–Applied Behavior Analysis, 3*, 198.
- Du, L., Broto, J., & Greer, R. D. (2015). The effects of establishment of conditioned reinforcement for observing responses for 3D stimuli on generalized visual match-to-sample in children with autism spectrum disorders. *European Journal of Behavior Analysis, 16*, 82-98,
- Du, L., & Greer, R. D. (2014). Validation of adult generalized imitation topographies and the emergence of generalized imitation in young children with autism as a function of mirror training. *The Psychological Record, 64*, 161-177.
- Durand, V. M., & Carr, E. G. (1991). Functional communication training to reduce challenging behavior: Maintenance and application in new settings. *Journal of Applied Behavior Analysis, 24*(2), 251-264.
- Eikeseth, S., & Smith, T. (1992). The development of functional and equivalence classes in high-functioning autistic children: The role of naming. *Journal of the Experimental Analysis of Behavior, 58*, 123-133.
- Emurian, H. H. (2007). Programmed instruction for teaching Java: Consideration of learn unit frequency and rule-test performance. *The Behavior Analyst Today, 8*(1), 70-88.

- Engelmann, S., & Carnine, D. (1982). *Theory of instruction: Principles and applications*. New York: Irvington Publishers.
- Fiorile, C. A., & Greer, R. D. (2007). The induction of naming in children with no prior tact responses as a function of multiple exemplar histories of instruction. *The Analysis of Verbal Behavior, 23*, 71-87.
- Garcia-Albea, E., Reeve, S. A., Brothers, K. J., & Reeve, K. F. (2014). Using audio script fading and multiple-exemplar training to increase vocal interactions in children with autism. *Journal of Applied Behavior Analysis, 47*, 325-343.
- Gena, A., Krantz, P. J., McClannahan, L. E., & Poulson, C. L. (1996). Training and generalization of affective behavior displayed by youth with autism. *Journal of Applied Behavior Analysis, 29*, 291-304.
- Gilic, L., & Greer, R. D. (2011). Establishing naming in typically developing two-year-old children as a function of multiple exemplar speaker and listener experiences. *The Analysis of Verbal Behavior, 27*, 157-177.
- Green, G. (2001). Behavior analytic instruction for learners with autism: Advances in stimulus control technology. *Focus on Autism and other Developmental Disabilities, 16*, 72-85.
- Greenspan, S. I., & Wieder, S. (1997). Developmental patterns and outcomes in infants and children with disorders in relating and communicating: A chart review of 200 cases of children with autistic spectrum diagnoses. *Journal of Developmental and Learning Disorders, 1*, 87-142.
- Greer, R. D. (2002). *Designing teaching strategies: An applied behavior analysis systems approach*. New York: Academic Press.
- Greer, R. D., Chavez-Brown, M., Nirgudkar, A. S., Stolfi, L., & Rivera-Valdes, C. (2005a). Acquisition of fluent listener responses and the educational advancement

- of young children with autism and severe language delays. *European Journal of Behavior Analysis*, 6, 88-126.
- Greer, R. D., Corwin, A., & Buttigieg, S. (2011a). The effects of the verbal developmental capability of naming on how children can be taught. *Acta De Investigacion Psicologia*, 1, 23-54.
- Greer, R. D., & Du, L. (2010). Generic instruction versus intensive tact instruction and the emission of spontaneous speech. *The Journal of Speech and Language Pathology – Applied Behavior Analysis*, 5, 1-19.
- Greer, R. D., & Du, L. (2015). Identification and establishment of reinforcers that make the development of complex social language possible. *International Journal of Behavior Analysis and Autism Spectrum Disorders*, 1, 14-34.
- Greer, R. D., & Keohane, D. (2005). The evolution of verbal behavior in children. *Behavioral Development Bulletin*, 12, 31.
- Greer, R., Keohane, D., Ackerman, S., O'Sullivan, D., Park, H., Longano, J., & Wiehe, P. (2006). *Sensory matching protocol: Providing children with the capacity for sameness across the senses as a component of basic listener literacy*. Paper session presented at the meeting of the Association for Applied Behavior Analysis International, Atlanta, GA.
- Greer, R. D., & Longano, J. (2010). A rose by naming: How we may learn how to do it. *The Analysis of Verbal Behavior*, 26, 73-106.
- Greer, R. D., & McDonough, S. H. (1999). Is the learn unit a fundamental measure of pedagogy? *The Behavior Analyst*, 22, 5-16.
- Greer, R. D., Pistoljevic, N., Cahill, C., & Du, L. (2011b). Effects of conditioning voices as reinforcers for listener responses on rate of learning, awareness, and preferences for listening to stories in preschoolers with autism. *The Analysis of Verbal Behavior*, 27, 103-124.

- Greer, R. D., & Ross, D. E. (2008). *Verbal behavior analysis: Inducing and expanding new verbal capabilities in children with language delays*. Boston: Allyn & Bacon.
- Greer, R. D., & Speckman, J. (2009). The integration of speaker and listener responses: A theory of verbal development. *The Psychological Record, 59*, 449-488.
- Greer, R. D., Stolfi, L., Chavez-Brown, M., & Rivera-Valdes, C. (2005b). The emergence of the listener to speaker component of naming in children as a function of multiple exemplar instruction. *The Analysis of Verbal Behavior, 21*, 123-134.
- Greer, R. D., Stolfi, L., & Pistoljevic, N. (2007). Emergence of naming in preschoolers: A comparison of multiple and single exemplar instruction. *European Journal of Behavior Analysis, 8*, 109.
- Greer, R. D., Yuan, L., & Gautreaux, G. (2005c). Novel dictation and intraverbal responses as a function of a multiple exemplar instructional history. *Analysis of Verbal Behavior, 21*, 99-116.
- Guess, D. (1969). A functional analysis of receptive language and productive speech: Acquisition of the plural morpheme. *Journal of Applied Behavior Analysis, 2*, 55-64.
- Guess, D., & Baer, D. M. (1973). An analysis of individual differences in generalization between receptive and productive language in retarded children. *Journal of Applied Behavior Analysis, 6*, 311-329.
- Hall, G., & Sundberg, M. L. (1987). Teaching mands by manipulating conditioned establishing operations. *The Analysis of Verbal Behavior, 5*, 41-53.
- Hanna, E. S., de Souza, D. G., de Rose, J. C., & Fonseca, M. (2004). Effects of delayed constructed-response identity matching on spelling of dictated words. *Journal of Applied Behavior Analysis, 37*(2), 223-227.

- Hart, B., & Risley, T. (1995). *Meaningful differences in the everyday experience of young American children*. Baltimore: Brookes.
- Hausknecht, J. P., Trevor, C. O., & Farr, J. L. (2002). Retaking ability tests in a selection setting: Implications for practice effects, training performance, and turnover. *Journal of Applied Psychology, 87*, 243-254.
- Hawkins, E., Charnock, J., & Gautreaux, G. (2007). The Jigsaw CABAS® School: Protocols for increasing appropriate behaviour and evoking verbal capabilities. *European Journal of Behavior Analysis, 8*, 203-220.
- Hawkins, E., Kingsdorf, S., Charnock, J., Szabo, M., & Gautreaux, G. (2009). Effects of multiple exemplar instruction on naming. *European Journal of Behavior Analysis, 10*, 265-273.
- Hayes, S. C., Barnes-Holmes, D., & Roche, B. (2001). *Relational frame theory: A post-Skinnerian account of human language and cognition*. New York: Springer.
- Heward, W. L. (1994). Three “low-tech” strategies for increasing the frequency of active student response during group instruction. In R. Gardner III, D. M. Sainato, J. O. Cooper, T. E. Heron, W. L. Heward, J. W. Eshleman, & T. A. Grossi (Eds.), *Behavior analysis in education: Focus on measurably superior instruction* (pp. 283-320). Belmont, CA: Thomson Brooks/Cole.
- Horne, P. J., & Lowe, C. F. (1996). On the origins of naming and other symbolic behavior. *Journal of the Experimental Analysis of Behavior, 65*, 185-241.
- Horne, P. J., Lowe, C. F., & Randle, V. R. (2004). Naming and categorization in young children: II. Listener behavior training. *Journal of the Experimental Analysis of Behavior, 81*, 267-288.
- Horne, P. J., Hughes, J. C., & Lowe, C. F. (2006). Naming and categorization in young children: IV: Listener behavior training and transfer of function. *Journal of the Experimental Analysis of Behavior, 85*, 247-273.

- Horner, R. D., & Baer, D. M. (1978). Multiple-probe technique: a variation of the multiple baseline. *Journal of Applied Behavior Analysis, 11*(1), 189-196.
- Howard, J. S., Sparkman, C. R., Cohen, H. G., Green, G., & Stanislaw, H. (2005). A comparison of intensive behavior analytic and eclectic treatments for young children with autism. *Research in Developmental Disabilities, 26*, 359-383.
- Hughes, C., Harmer, M. L., Killian, D. J., & Niarhos, F. (1995). The effects of multiple-exemplar self-instructional training on high school students' generalized conversational interactions. *Journal of Applied Behavior Analysis, 28*, 201-218.
- Hughes, C., & Rusch, F. R. (1989). Teaching supported employees with severe mental retardation to solve problems. *Journal of Applied Behavior Analysis, 22*, 365-372.
- Ingham, P., & Greer, R.D. (1992). Changes in student and teacher responses in observed and generalized settings as a function of supervisor observations. *Journal of Applied Behavior Analysis, 25*, 153-164.
- Johnson, K. R., & Layng, T. J. (1992). Breaking the structuralist barrier: Literacy and numeracy with fluency. *American Psychologist, 47*, 1475-1490.
- Keller, M. F., & Bucher, B. D. (1979). Transfer between receptive and productive language in developmentally disabled children. *Journal of Applied Behavior Analysis, 12*, 311.
- Kennedy, C. H., Itkonen, T. and Lindquist, K. (1994). Nodality effects during equivalence class formation: an extension to sight-word reading and concept development. *The Journal of Applied Behavior Analysis, 27*, 673 - 683.
- Knowles, W., & Masdlover, M. (1982). *The Derbyshire Language Scheme*. Derbyshire County Council.
- Krantz, P. J., & McClannahan, L. E. (1993). Teaching children with autism to initiate to peers: Effects of a script-fading procedure. *Journal of Applied Behavior Analysis, 26*, 121-132.

- Lamarre, J., & Holland, J. G. (1985). The functional independence of mands and tacts. *Journal of the Experimental Analysis of Behavior*, 43, 5-19.
- LeBlanc, L. A., Miguel, C. F., Cummings, A. R., Goldsmith, T. R. and Carr, J. E. (2003). The effects of three stimulus-equivalence tests conditions on emergent US Geography relations of children diagnosed with autism. *Behavioural Intervention*, 18, 279 – 289.
- Lechago, S. A., Carr, J. E., Kisamore, A. N., & Grow, L. L. (2015). The effects of multiple exemplar instruction on the relation between listener and intraverbal categorization repertoires. *The Analysis of Verbal Behavior*, 31, 76-95.
- Lee, V. L. (1981). Prepositional phrases spoken and heard. *Journal of the Experimental Analysis of Behavior*, 35, 227-242.
- Longano, J. M. (2008). *The effects of echoic behavior and a second order classical conditioning procedure as a history of reinforcement for emergent naming* (Unpublished doctoral dissertation). Columbia University, New York.
- Lowe, C. F., Horne, P. J., Harris, F. D., & Randle, V. R. (2002). Naming and categorization in young children: Vocal tact training. *Journal of the Experimental Analysis of Behavior*, 78, 527-549.
- Lowe, C. F., Horne, P. J., & Hughes, J. C. (2005). Naming and categorization in young children: III. Vocal tact training and transfer of function. *Journal of the Experimental Analysis of Behavior*, 83, 47-65.
- Lynch, D. C., & Cuvo, A. J. (1995). Stimulus equivalence instruction of fraction-decimal relations. *Journal of Applied Behavior Analysis*, 28(2), 115-126.
- Mandell, C., & Sheen, V. (1994). Equivalence class formation as a function of the pronounceability of the sample stimulus. *Behavioural Processes*, 32(1), 29-46.

- Marzullo-Kerth, D., Reeve, S. A., Reeve, K. F., & Townsend, D. B. (2011). Using multiple-exemplar training to teach a generalized repertoire of sharing to children with autism. *Journal of Applied Behavior Analysis, 44*, 279-294.
- Matson, J. L., Hattier, M. A., & Belva, B. (2012). Treating adaptive living skills of persons with autism using applied behavior analysis: A review. *Research in Autism Spectrum Disorders, 6*, 271-276.
- May, R. J., Hawkins, E., & Dymond, S. (2013). Brief report: Effects of tact training on emergent intraverbal vocal responses in adolescents with autism. *Journal of Autism and Developmental Disorders, 43*(4), 996-1004.
- McLachlan, H., Elks, E. (2012). *Test of Abstract Language Comprehension*. Cornwall: Elklan
- Meltzoff, A. N., & Moore, M. K. (1983). Newborn infants imitate adult facial gestures. *Child Development, 54*, 702-709.
- Michael, J. (1988). Establishing operations and the mand. *The Analysis of Verbal Behavior, 6*, 3-9.
- Miguel, C. F., & Kobari-Wright, V. V. (2013). The effects of tact training on the emergence of categorization and listener behavior in children with autism. *Journal of Applied Behavior Analysis, 46*, 669-673.
- Miguel, C. F., Petursdottir, A. I., & Carr, J. E. (2005). The effects of multiple-tact and receptive-discrimination training on the acquisition of intraverbal behavior. *The Analysis of Verbal Behavior, 21*, 27-41.
- Mirenda, P. (1997). Supporting individuals with challenging behavior through functional communication training and AAC: Research review. *Augmentative and Alternative Communication, 13*(4), 207-225.
- Nelson, K. E., & Bonvillian, J. D. (1973). Concepts and words in the 18-month-old: Acquiring concept names under controlled conditions. *Cognition, 2*, 435-450.

- Nuzzolo-Gomez, R., & Greer, R. D. (2004). Emergence of untaught mands or tacts of novel adjective-object pairs as a function of instructional history. *The Analysis of Verbal Behavior, 20*, 63-76.
- Pérez-González, L. A., Cereijo-Blanco, N., & Carnerero, J. J. (2014). Emerging tacts and selections from previous learned skills: A comparison between two types of naming. *The Analysis of Verbal Behavior, 30*, 184-192.
- Pérez-González, L. A., García-Conde, A., & Carnerero, J. J. (2011). Naming completo con estímulos abstractos bidimensionales en niños de seis años. *Psichothema, 23*, 719-724.
- Petursdottir, A. I., & Carr, J. E. (2011). A review of recommendations for sequencing receptive and expressive language instruction. *Journal of Applied Behavior Analysis, 44*, 859-876.
- Pinker, S. (1998). Words and rules. *Lingua, 106*(1), 219-242.
- Pistoljevic, N. (2008). *The effects of multiple exemplar and intensive tact instruction on the acquisition of naming in pre-schoolers diagnosed with autism and other language delays* (Unpublished doctoral dissertation). Columbia University, New York.
- Pistoljevic, N., & Greer, R. D. (2006). The effects of daily intensive tact instruction on preschool students' emission of pure tacts and mands in non-instructional setting. *Journal of Early and Intensive Behavior Intervention, 3*, 103-120.
- Quill, K., Gurry, S., & Larkin, A. (1989). Daily life therapy: A Japanese model for educating children with autism. *Journal of Autism and Developmental Disorders, 19*, 625-635.
- Reeve, S. A., Reeve, K. F., Townsend, D. B., & Poulson, C. L. (2007). Establishing a generalized repertoire of helping behavior in children with autism. *Journal of Applied Behavior Analysis, 40*, 123-136.

- Rhode, G., Morgan, D. P., & Young, K. R. (1983). Generalization and maintenance of treatment gains of behaviorally handicapped students from resource rooms to regular classrooms using self-evaluation procedures. *Journal of Applied Behavior Analysis, 16*, 171-188.
- Rogers, S., & Dawson, G. (2009). *Play and engagement in early autism: The Early Start Denver Model*. New York: Guilford Press.
- Rosales, R., & Rehfeldt, R. A. (2007). Contriving transitive conditioned establishing operations to establish derived manding skills in adults with severe developmental disabilities. *Journal of Applied Behavior Analysis, 40*(1), 105-121.
- Rosales, R., Rehfeldt, R. A., & Lovett, S. (2011). Effects of multiple exemplar training on the emergence of derived relations in preschool children learning a second language. *The Analysis of Verbal Behavior, 27*, 61-74.
- Rosales-Ruiz, J., & Baer, D. M. (1996). A behaviour analytic view of development. In E. Ribes & S.W. Bijou (Eds.), *Recent approaches to behavioural development* (pp. 155–180). Reno, NV: Context Press.
- Ross, D. E., & Greer, R. D. (2003). Generalized imitation and the mand: Inducing first instances of speech in young children with autism. *Research in Developmental Disabilities, 24*, 58-74.
- Ross, D. E., Singer-Dudek, J. & Greer, R. D. (2005). The teacher performance rate accuracy scale (TPRA): Training as evaluation. *Education and Training in Developmental Disabilities, 40* (4), 411-423.
- Sautter, R. A., & LeBlanc, L. A. (2006). Empirical applications of Skinner's analysis of verbal behavior with humans. *The Analysis of Verbal Behavior, 22*, 35-48.
- Schauffler, G. & Greer, R. D. (2006). The effects of intensive tact instruction on audience-accurate tacts and conversational units. *Journal of Early and Intensive Behavior Intervention, 3*, 121-134.

- Schopler, E. (1994). A statewide program for the treatment and education of autistic and related communication handicapped children (TEACCH). *Psychoses and Pervasive Developmental Disorders*, 3, 91-103.
- Schwarz, M. M., & Hawkins, R. P. (1970). Application of delayed reinforcement procedures to the behavior of an elementary school child. *Journal of Applied Behavior Analysis*, 3, 85-96.
- Selinske, J. E., Greer, R. D., & Lodhi, S. (1991). A functional analysis of the comprehensive application of behavior analysis to schooling. *Journal of Applied Behavior Analysis*, 24, 107-117.
- Shiple-Benamou, R., Lutzker, J. R., & Taubman, M. (2002). Teaching daily living skills to children with autism through instructional video modeling. *Journal of Positive Behavior Interventions*, 4, 166-177.
- Sidman, M. (1971). Reading and auditory-visual equivalences. *Journal of Speech, Language, and Hearing Research*, 14, 5-13.
- Sidman, M. (1977). Teaching some basic prerequisites for reading. *Research to Practice in Mental Retardation*, 2, 353-360.
- Sidman, M. (1986). Functional analysis of emergent verbal classes. In T. Thompson & M. Zeiler (Eds), *Analysis and Integration of Behavioral Units* (pp. 213-245). Hillside, NJ: Erlbaum.
- Sidman, M. (1994). *Equivalence relations and behavior: A research story*. Boston: Authors Cooperative.
- Sidman, M., & Tailby, W. (1982). Conditional discrimination vs. matching to sample: an expansion of the testing paradigm. *The Journal of Applied Behavior Analysis*, 37, 5-22.

- Sigafoos, J. (2000). Communication development and aberrant behavior in children with developmental disabilities. *Education and Training in Mental Retardation and Developmental Disabilities*, 168-176.
- Singer-Dudek, J., Choi, J., & Lyons, L. (2013). The effects of an observational intervention on the emergence of two types of observational learning. *European Journal of Behavior Analysis*, 14, 329-347.
- Singer-Dudek, J., Speckman, J., & Nuzzolo, R. (2010). A comparative analysis of the CABAS® model of education at the Fred S. Keller School: A twenty-year review. *The Behavior Analyst Today*, 11(4), 253.
- Skinner, B. F. (1957). *Verbal behavior*. New York: Appleton-Century-Crofts.
- Speckman-Collins, J., Lee Park, H., & Greer, R. D. (2007). Generalized selection-based auditory matching and the emergence of the listener component of naming. *Journal of Early and Intensive Behavior Intervention*, 4, 412-429.
- Sprague, J. R., & Horner, R. H. (1984). The effects of single instance, multiple instance, and general case training on generalized vending machine use by moderately and severely handicapped students. *Journal of Applied Behavior Analysis*, 17, 273-278.
- Sprinkle, E. C., & Miguel, C. F. (2012). The effects of listener and speaker training on emergent relations in children with autism. *The Analysis of Verbal Behavior*, 28, 111-117.
- Stokes, T. F., & Baer, D. M. (1977). An implicit technology of generalization. *Journal of Applied Behavior Analysis*, 10, 349-367.
- Stokes, T. F., Fowler, S. A., & Baer, D. M. (1978). Training preschool children to recruit natural communities of reinforcement. *Journal of Applied Behavior Analysis*, 11, 285-303.

- Strain, P. S., & Schwartz, I. (2001). ABA and the development of meaningful social relations for young children with autism. *Focus on Autism and Other Developmental Disabilities, 16*, 120-128.
- Sundberg, M. L. (1991). 301 research topics from Skinner's book Verbal Behavior. *The Analysis of Verbal Behavior, 9*, 81.
- Tiemann, P. W., & Markle, S. M. (1985). *Analysing instructional content; A guide to instruction and evaluation*. Champagne, IL: Stipes Publishing.
- Tu, J. C. (2006). The role of joint control in the manded selection responses of both vocal and non-vocal children with autism. *The Analysis of Verbal Behavior, 22*, 191-207.
- Twyman, J. S. (1996). The functional independence of impure mands and tacts of abstract stimulus properties. *The Analysis of Verbal Behavior, 13*, 1-19.
- Walker, G. (2008). Constant and progressive time delay procedures for teaching children with autism: A literature review. *Journal of Autism and Developmental Disorders, 38*, 261-275.

Appendix A

Glossary of Terms

Appendix A includes a list of key technical terminology used within this thesis with a definition and example of each term. Each term was underlined within the thesis when it was used seminally.

Behavioural Cusp

A behavioural cusp is a “change that (1) is often difficult, tedious, subtle, or otherwise problematic to accomplish, yet (2) if not made, means little or no further development is possible in its realm (and perhaps in several realms); but (3) once it is made, a significant set of subsequent developments suddenly become easy or otherwise highly probable which (4) brings the developing organism into contact with other cusps crucial to further, more complex, or more refined development in a thereby steadily expanding, steadily more interactive realm” (Rosales-Ruiz & Baer, 1996, p. 166). For example, walking is a behavioural cusp in the sense that further behaviours are enabled such as exploratory behaviour, new kinds of play and improved accessibility to the environment. Accurate and fluent speaking and reading are behavioural cusps. Both behaviours open up pathways to a number of other developments such as learning more effectively and opening up parts of the environment that were inaccessible before.

Bidirectional Naming

Bidirectional Naming refers to the bidirectional relationship that occurs when listener behaviour is taught to an individual and speaker behaviour emerges for that same individual, and/or vice versa. For example, if speaker behaviour is taught and corresponding untaught listener behaviour emerges without further direct teaching *and* if listener behaviour is taught and corresponding untaught speaker behaviour emerges without further direct teaching then bidirectional naming is shown.

Direct Teaching

Direct teaching involves providing clear antecedents/instruction to individuals and reinforcement for correct responses. This reinforcement increases the likelihood of correct responses occurring again in the future in the presence of those same antecedents/ instructions. For example, providing an individual with a choice of three coloured stimuli; presenting the vocal antecedent, “Point to red;” and reinforcing the individual for pointing to the red stimulus.

Emergent Behaviour

The term ‘emergent behaviour’ is synonymous to ‘untaught behaviour.’ An example of emergent behaviour is to teach a child to point to a picture of a car when presented with a selection of pictures (listener behaviour) and the child tacts a car (speaker behaviour) without further direct teaching. Only the listener behaviour is taught and the corresponding speaker behaviour emerges without further teaching.

Establishing Operation

An establishing operation is defined as a set of environmental events that temporarily alter the value of other stimuli/events as reinforcers and therefore evoke all behaviours that have produced these events in the past. An establishing operation relates to conditions of deprivation. When an individual is deprived of something an establishing operation is in place because the “not having” makes the item more attractive. For example, if an individual has not had a drink and has eaten salty food then there is an establishing operation for drink in place. This establishing operation increases the likelihood of the mand, “Drink” being emitted.

Full Bidirectional Naming (FBN)

Full Bidirectional Naming includes both Listener Bidirectional Naming and Speaker Bidirectional Naming. Speaker behaviour is taught and corresponding untaught listener behaviour emerges and listener behaviour is taught and corresponding untaught

speaker behaviour emerges. For example, the tact "car" is taught (speaker behaviour) and the selection of a picture of a car from a choice of pictures emerges (untaught listener behaviour) *and* the selection of a "dog" from a choice of pictures is taught (listener behaviour) and the tact "dog" emerges (untaught speaker behaviour).

Full Incidental Naming (FIN)

Full Incidental Naming includes both Listener Incidental Naming and Speaker Incidental Naming. Following an incidental experience where the name of a novel item is provided, but no direct teaching or direct reinforcement, the novel name can be selected from a choice of items and the tact for the novel name is produced without any further teaching; the novel name emerges as listener behaviour and speaker behaviour. For example, a match-to sample procedure (e.g. "Match car") is presented and listener and speaker behaviour emerges without further direct teaching. To illustrate, picture of a car is selected from a choice of pictures and the tact "car" emerges having only heard the name "car" in the match-to-sample procedure.

Full Naming

For individuals to demonstrate 'full naming,' the selection and production of novel names of items occurs without direct teaching of those novel names. For example, following an incidental experience where the name of a novel item is provided, but without direct teaching, the novel name can be selected from a choice of items and the tact for the novel name is produced without any further instruction; the novel name emerges as listener behaviour and speaker behaviour. In this body of work, the term 'full naming' is synonymous with 'Full Incidental Naming.'

Functional Independence of Speaking and Listening

The presence of listener behaviour in the repertoire of a child may not predict the presence of speaker behaviour. For example, a child may not produce the word "ball" (speaker behaviour) even though they can locate the ball when asked to (listener

behaviour). It cannot be assumed that if an individual has listener behaviour they will automatically be able to use those words as a speaker and vice versa (Skinner, 1957).

General Case Analysis

General Case Analysis is a systematic method for selecting teaching examples that represent the full range of stimulus variations and response requirements in the generalization setting (Cooper, Heron, & Heward, 2007).

Generalisation

Generalisation occurs when previously taught behaviour is emitted at new times or in new places without having to be taught again in those new times or places (Stimulus Generalisation), or if functionally-related behaviours occur that were not directly taught (Response Generalisation; Cooper, Heron, & Heward, 2007). This is the ultimate aim of all teaching, ensuring the skill is demonstrated again outside the classroom and is functional.

Impure Tact

An impure tact occurs under verbal as well as non-verbal antecedent control. For example, a speaker might ask "What is it?" "What is the weather like?" or "What's that smell?" for an impure tact. When both verbal (the vocal question) and non-verbal (the presence of the item to be tacted) antecedents are present the response is known as an impure tact.

Incidental Naming

Incidental naming refers to the emergence of new listener and speaker behaviour following an incidental language experience without direct teaching. For example, if an individual is exposed to an incidental language experience, such as a match-to-sample procedure, and untaught listener behaviour and untaught speaker behaviour emerges without direct teaching then incidental naming is shown.

Incidental Teaching

Incidental teaching occurs when individuals are exposed to materials and instructions, but they are not reinforced for correct responses. For example, an individual is asked to get an atlas from the bookshelf, but is not reinforced for following this direction.

Intraverbal

An intraverbal is one of Skinner's (1957) verbal operants and is speaker behaviour evoked by speaker behaviour. An example of an intraverbal includes, "What month is it?" with the response of "January" or "Let's count down from 10..." with the correct response of "9, 8, 7..."

Learn Unit

A learn unit (Greer, 2002; Greer & McDonough, 1999) consists of a clear antecedent (e.g. "point to *car*"), a clearly defined expected behaviour and a contingent consequence (reinforcement for a correct response and a correction procedure of repeating the antecedent and modelling the required response). Learn units require that the instructor always ensures the participant is motivated to provide a correct response and is attending to the stimuli presented to them. For example, an individual is attending to the stimuli placed in front of them and is motivated to gain a further token for the token schedule; points to the picture of a cat when directed to, "Point to cat;" and receives a token for the schedule as a reinforcer.

Listener Behaviour

Listener behaviour involves listening to a speaker and subsequently responding to what the speaker has said. For example, if a teacher asks a child to "pass the ball" and the child locates the ball and passes it then the child has demonstrated listener behaviour.

Listener Bidirectional Naming (LBN)

Speaker behaviour is taught and corresponding untaught listener behaviour emerges. For example, the tact "car" is taught (speaker behaviour) and the selection of a picture of a car from a choice of pictures emerges (untaught listener behaviour).

Listener Half of Naming

Following an incidental experience where the name of a novel item is provided, but no direct teaching or direct reinforcement, the novel name can be selected from a choice of items without any further instruction; the novel name emerges as listener behaviour. In this body of work the term 'listener half of naming' is synonymous to 'Listener Incidental Naming.'

Listener Incidental Naming (LIN)

Following an incidental experience where the name of a novel item is provided, but no direct teaching or direct reinforcement, the novel name can be selected from a choice of items without any further instruction; the novel name emerges as listener behaviour. For example, a match-to sample procedure (e.g. "match car") is presented and listener behaviour emerges without further instruction e.g. a picture of a car is selected from a choice of pictures having only heard the name "car" in the match-to-sample procedure.

Mand

A mand is defined as "a verbal operant in which the response is reinforced by a characteristic consequence and is therefore under the control of relevant conditions of deprivation or aversive stimulation" (Skinner, 1957, pp.35-36). A mand is reinforced by receiving the item specified by a speaker. For example, an individual who is thirsty (the condition of deprivation) will mand for a drink by saying "drink," signing "drink" or pointing to a picture of a drink. A listener will then provide the speaker with a drink.

Match-to-Sample (MTS) Procedure

The purpose of a match-to-sample (MTS) procedure is to provide a novel language experience in which direct reinforcement or correction is linked to visual matching rather than listener or speaker behaviour. Participants hear the name of the novel item while seeing it and matching it and this pairing of seeing and matching is an essential element of this procedure. Seeing a novel item and hearing the corresponding tact for that item provides a novel language experience. Greer and Ross (2008) argued that this procedure simulates the natural environment that exists when new vocabulary is acquired incidentally (i.e. hearing and seeing the novel item simultaneously).

The teaching sequence for a MTS procedure is as follows: an array of contrived stimuli is presented which, for example, includes an exemplar of “zog” and a non-exemplar of “zog;” a corresponding stimulus of “zog” is given to the participant with the vocal antecedent, “Match zog” and reinforcement is provided for correctly matching “zog.” If an incorrect response occurs the vocal antecedent is repeated and a model showing the correct matching symbol is provided.

Multiple Exemplar Instruction (MEI)

Multiple Exemplar Instruction (MEI) involves randomly rotating multiple exemplars of stimuli and types of responding behaviour. The MEI procedure in the current body of work consisted of match-to-sample instruction randomly rotated with listener instruction (pointing to items following the vocal antecedent to find that item) and speaker instruction (impure and pure tact instruction with and without a vocal antecedent respectively) in a counterbalanced format so that the response from one presentation does not occasion the response to another presentation. Thus, with MEI the teacher’s delivery is multiple exemplar in nature. For example, the teacher delivers antecedents that require multiple types of responding (e.g. speaker, listener, reader, writer) all randomly rotated within one instructional session.

Multiple Exemplar Training (MET)

Multiple Exemplar Training (MET) ensures sufficient exemplars are taught, meaning multiple examples of the target stimuli are used when teaching a new skill. MET is designed to provide practice with a range of essential elements of the stimuli and response variations used in the instruction. For example, if teaching the stimulus class 'cars,' a teacher might include all the different variations of cars within the teaching set.

Naming

Horne and Lowe (1996) identified naming as “the basic unit of verbal behaviour” (p. 185) and defined naming as "a higher order bidirectional behavioural relation that combines conventional speaker and listener functions so that the presence of either one presupposes the other" (p. 207).

Pre-Reader Pyramid of Behavioural Cusps

The pre-reader pyramid of behavioural cusps is one of the pyramids included in the Verbal Behaviour Development Theory which distinguishes levels of behavioural cusps and suggests a developmental sequence for those cusps. The theory operates from a starting point at which individuals are tested to determine whether or not certain behavioural cusps are present. Subsequently, if a behavioural cusp is not present then specific protocols and procedures are implemented to induce that cusp (Greer & Ross, 2008; Greer & Speckman, 2009). The pre-reader pyramid of behavioural cusps is shown in Figure 2 in Chapter 4.

Pure Tact

Pure tacts are those that occur under non-verbal antecedent control. They do not follow a question or statement from another person. For example, an individual tacts an event such as “it’s raining” in the presence of rain or "hmmm, coffee" in the presence of the smell of coffee. These are examples of pure tacts.

Relational Frame Theory (RFT)

Relational Frame Theory (RFT) argues that the building block of human language and higher cognition is 'relating', i.e. the human ability to create bidirectional links between things. Relational Frame Theory is based on a similar paradigm to stimulus equivalence, but states that responses are related to each, rather than solely equivalent to each other, e.g. bigger/smaller, here/there, mine/yours, better/worse. According to RFT theorists, relations between stimuli can be bidirectional (i.e. responding to a relation in one direction (A to B) entails responding in the other direction (B to A)), some stimulus relations can be determined by combining other stimulus relations (i.e. responding to two combined relations (between A and B and between C and B) can entail a response to a third relation (between A and C)), and furthermore the function of a stimulus can be transformed on the basis of how it is related to the other stimuli. Naming is addressed within the bidirectional component of RFT (i.e. responding to a relation as a speaker entails responding as a listener and vice versa). To clarify, naming is acquired by a speaker naming an object and the listener deriving the reverse relationship, e.g. they are told an item is an 'umbrella' (listener) and derive the reverse relationship of stating an item is an 'umbrella' (speaker).

Response Generalisation

Response generalisation occurs if functionally-related behaviours occur that were not directly taught. For example, a child is taught to cut a sausage using a knife and then cuts a sausage with the side of a fork. Cutting with a fork has not been directly taught but is functionally equivalent to cutting soft food with a knife.

Speaker Behaviour

Speaker behaviour involves speaking to a listener. For example, "please pass me the ball" is an example of speaker behaviour and is also an example of a 'mand' where reinforcement is provided by the listener by providing the speaker with the ball.

Speaker Bidirectional Naming (SBN)

Listener behaviour is taught and corresponding untaught speaker behaviour emerges. For example, the selection of a picture of a car from a choice of pictures is taught (listener behaviour) and the tact "car" emerges (untaught speaker behaviour).

Speaker Component of Naming

For individuals to demonstrate the speaker component of naming, the production of novel names of items emerges without direct teaching of those novel names. To illustrate, following an incidental experience where the name of a novel item is provided, but without direct teaching, the tact for the novel item is produced without further instruction. In this body of work the term 'speaker component of naming' is synonymous with 'Speaker Incidental Naming.'

Speaker Half of Naming

This is a term used by Greer and Ross (2008) and is synonymous to the 'speaker component of naming.'

Speaker Incidental Naming (SIN)

Following an incidental experience where the name of a novel item is provided, but no direct teaching or direct reinforcement, the tact for the novel name is produced without any further instruction; the novel name emerges as speaker behaviour. For example, a match-to sample procedure (e.g. "Match car") is presented and speaker behaviour emerges without further instruction e.g. the tact "car" emerges having only heard the name "car" in the match-to-sample procedure.

Stimulus Equivalence

The emergence of untaught behaviour (untrained and non-reinforced stimulus-stimulus relations) following the reinforcement of responses to some stimulus-stimulus relations. The stimulus-stimulus relations are equivalent to one another, e.g. the text "car," a picture of a car and the vocalization "car."

Stimulus Generalisation

Stimulus generalisation occurs when previously taught behaviour is emitted at new times or in new places without having to be taught again in those new times or places. For example, a child is taught to tact a picture of a car as a “car;” they are then able to either tact the same picture of a car in a different environment a “car,” or seeing their own car at home are able to tact it is a “car.” The response is not directly taught in the novel setting or with the novel stimulus, but when a child responds in a similar way to different stimuli or to the same stimuli across different settings then stimulus generalisation has occurred. The child correctly responds to the concept or stimulus class “car.”

Tact

A tact is defined by Skinner (1957) as “a verbal operant in which a response of a given form is evoked (or at least strengthened) by a particular object or event or the property of an object or event” (pp. 81-82). The tact is reinforced “with many different reinforcers or with a generalised reinforcer” (p. 83). For example, a tact occurs if an individual says “it’s raining” in the presence of rain and a listener responds with a nod, "yes" or “I hope it clears up soon.”

Transformation of Establishing Operations across Mands and Tacts

This behavioural cusp involves learning a new mand and using that same word as a tact (or vice versa) without further direct teaching. This is the first identified behavioural cusp in the VBDT pre-reader pyramid related to emergent verbal behaviour. If transformation of establishing operations across mands and tacts is not present then Multiple Exemplar Instruction (MEI) is implemented to induce this behavioural cusp (Nuzzolo-Gomez & Greer, 2004).

Untaught Behaviour

The term 'untaught behaviour' is synonymous to 'emergent behaviour.' An example of untaught behaviour is to teach a child the names of 5 different cars (speaker behaviour) and without further teaching the child points to pictures of those cars when shown a car magazine (listener behaviour). Only the speaker behaviour is taught and the corresponding listener behaviour emerges without further teaching.

Verbal Behaviour Development Theory (VBDT)

The Verbal Behaviour Development Theory (VBDT) evolved from research conducted by Greer and Keohane (2005), Greer and Ross (2008) and Greer and Speckman (2009). The VBDT is an empirically-based updated account of Skinner's (1957) analysis of verbal behaviour. According to Greer and Speckman (2009) the theory builds upon and complements research related to stimulus equivalence (Sidman, 1986; Sidman, 1994), relational frame theory (Hayes, Barnes-Holmes, & Roche, 2001) and naming (Horne & Lowe, 1996). The VBDT is based on experimental findings from research conducted with children with and without language delays (Greer & Ross, 2008).

Appendix B

Participant Information Sheets and Consent Forms

Appendix B provides information about the consent forms and information sheets sent to the parents of the children and young adults diagnosed with autism and the adult participants in Experiments 3-5,

The information on page 315 was provided to the parents of pupils diagnosed with autism (Experiments 1, 2, 6-9):

To: Parents
From: Emma Hawkins

Date:
Ref: CONSENT FOR RESEARCH (WITH PUPILS)

I am currently working on a part-time PhD with the University of Kent and I am carrying out a research project on using multiple exemplar instruction (rotating match, point & tact instructions) to induce naming (the joining of listener and speaker responses) in children with an autism spectrum disorder. I would be grateful if you would provide consent for your child, NAME OF CHILD, to participate in this study.

Your child will be required to complete about 15 minutes per day of multiple exemplar instruction and their usual reinforcement schedule and token economy will be in place during this time. The research will be carried out at some point over the Autumn term and will run for about 2 weeks. This will be a daily activity until the specified criterion is met and I will then test whether the speaker and listener responses are joined.

All data collected will be kept strictly confidential. If the data are disseminated in a forum outside of the school then your child's name will not be used, instead he will be assigned an identity name e.g. Participant 1. If you agree for your child to take part and then change your mind, you are free to do so at any time. If you have further questions, please feel free to contact me at school: emmahawkins@jigsawschool.co.uk

If you agree for your child to take part in the research, please sign the consent form below and return it to me. Thank you.

TO BE RETURNED TO: EMMA HAWKINS

I have read the enclosed information. I understand that all the data collected are confidential and that I am free to withdraw my consent at any time.

I do not wish for my son/daughter to participate in the research/ I would like my son/daughter to participate in the research*

(*Please delete appropriately)

Name of Pupil: (Block capitals please)

Name of Parent/Guardian: (Block capitals please)

Signature of Parent/Guardian:

Date:

This information sheet & consent form was provided to participants in Experiments 3-5:

Participant Information Sheet

My name is Emma Hawkins and I am a part-time PhD student at the University of Kent, Canterbury. As part of the PhD I am carrying out a project on language development in children with autism. I would be grateful if you would be willing to participate in my research to act as part of a pilot group to determine the complexity of the tasks.

You will be required to participate in a short matching task. This will take no more than 10 minutes to complete. You will be required to participate in a maximum of 5 tasks over the next 2 months.

All data collected will be kept strictly confidential. Your name will not be used, instead you will be assigned an identity name e.g. Participant 1. If you agree to take part and then change your mind, you are free to do so at any time. If you have further questions, please feel free to contact me on the address or email given below.

If you agree to take part in the research, please sign the enclosed consent form and return it to me. Thank you for your time and I look forward to working with you.

I have read the enclosed information. I understand that all the data collected are confidential and that I am free withdraw my consent at any time.

I do not wish to participate in the research/ I would like to participate in the research*

(*Please delete appropriately)

Name: (Block capitals please)

Signed:

Date:

Appendix C

P-Level and National Curriculum Level Descriptors

Appendix C includes two Tables to show:

- Table 67: The P-Level Descriptors for English (Speaking) and English (Listening).
- Table 68: The National Curriculum Level Descriptors for English (Speaking and Listening).

Table 67

The P-Level Descriptors for English (Speaking) and English (Listening)

P-Level	English (Speaking) Description	English (Listening) Description
P4	Pupils repeat, copy and imitate between 10 and 50 single words, signs or phrases or use a repertoire of objects of reference or symbols. They use single words, signs and symbols for familiar objects, for example, cup, biscuit, and to communicate about events and feelings, for example, likes and dislikes.	Pupils demonstrate an understanding of at least 50 words, including the names of familiar objects. Pupils respond appropriately to simple requests which contain one key word, sign or symbol in familiar situations, for example, 'Get your coat', 'Stand up' or 'Clap your hands.'
P5	Pupils combine two key ideas or concepts. They combine single words, signs or symbols to communicate meaning to a range of listeners, for example, 'Mummy gone' or 'more drink'. They make attempts to repair misunderstandings without changing the words used, for example, by repeating a word with a different intonation or facial expression. Pupils use a vocabulary of over 50 words.	Pupils respond appropriately to questions about familiar or immediate events or experiences for example, 'Where is the ball?', 'What are you doing?', 'Is it yellow?' They follow requests and instructions containing at least two key words, signs or symbols, for example, 'Put the spoon in the dish', 'Give the book to Johnny.'
P6	Pupils initiate and maintain short conversations using their preferred medium of communication. They ask simple questions to obtain information, for example, 'Where's cat?' They can use prepositions, such as 'in' or 'on,' and pronouns, such as 'my' or 'it,' correctly.	Pupils respond to others in group situations, for example, taking turns appropriately in a game such as 'Pass the parcel.' They follow requests and instructions with three key words, signs or symbols, for example, 'Give me the little red book.'

P7	<p>Pupils use phrases with up to three key words, signs or symbols to communicate simple ideas, events or stories to others, for example, 'I want big chocolate muffin.' They use regular plurals correctly. They communicate ideas about present, past and future events and experiences, using simple phrases and statements, for example, 'We going cinema on Friday.' They contribute appropriately one-to-one and in small group discussions and role play. They use the conjunction and to link ideas or add new information beyond what is asked.</p>	<p>Pupils listen, attend to and follow stories for short stretches of time. They follow requests and instructions with four key words, signs or symbols, for example, 'Get the big book about dinosaurs from the library.' They attend to, and respond to, questions from adults and their peers about experiences, events and stories, for example, 'Where has the boy gone?'</p>
P8	<p>They link up to four key words, signs or symbols in communicating about their own experiences or in telling familiar stories, both in groups and one-to-one, for example, 'The hairy giant shouted at Finn.' They use an extensive vocabulary to convey meaning to the listener. They can use possessives, for example, 'Johnny's coat.' They take part in role play with confidence. They use conjunctions that suggest cause for example, 'cos,' to link ideas.</p>	<p>Pupils take part in role play with confidence. Pupils listen attentively. They respond appropriately to questions about why or how, for example 'Why does a bird make a nest?', 'How do we copy this picture?'</p>

Table 68

The National Curriculum Level Descriptors for English (Speaking and Listening)

National Curriculum	
Level	English (Speaking and Listening) Description
Level 1	Pupils talk about matters of immediate interest. They listen to others and usually respond appropriately. They convey simple meanings to a range of listeners, speaking audibly, and begin to extend their ideas or accounts by providing some detail.
Level 2	Pupils begin to show confidence in talking and listening, particularly where the topics interest them. On occasions, they show awareness of the needs of the listener by including relevant detail. In developing and explaining their ideas they speak clearly and use a growing vocabulary. They usually listen carefully and respond with increasing appropriateness to what others say. They are beginning to be aware that in some situations a more formal vocabulary and tone of voice are used.
Level 3	Pupils talk and listen confidently in different contexts, exploring and communicating ideas. In discussion, they show understanding of the main points. Through relevant comments and questions, they show they have listened carefully. They begin to adapt what they say to the needs of the listener, varying the use of vocabulary and the level of detail. They are beginning to be aware of standard English and when it is used.
Level 4	Pupils talk and listen with confidence in an increasing range of contexts. Their talk is adapted to the purpose: developing ideas thoughtfully, describing events and conveying their opinions clearly. They listen carefully in discussions, making contributions and asking questions that are responsive to others' ideas and views. They adapt their spoken language appropriately and use some of the features of standard English vocabulary and grammar.

Appendix D

Speech and Language Therapy Tests

Appendix D provides additional information about the two speech and language therapy tests utilised throughout this thesis.

The Derbyshire Language Scheme (DLS)

The Derbyshire Language Scheme (DLS) is a developmental language programme produced by Knowles and Masdlover (1982). It covers skills that develop in the average child between the ages of seven months and five years.

In the current body of work, participants were assessed at the Single Word Level which covered pre-lingual communication skills and use of single word utterances. The test checked the ability of the participants to understand vocabulary (for example object names, body parts and actions) in relation to real objects, toys, and pictures and assessed the ability of the participants to use a similar vocabulary themselves. Participants were also assessed at the Simple Sentence Stage which is split into two, three and four word levels, covering different types of sentence used in the present tense. Each test checked whether the participant understood a range of different types of sentence.

The Test of Abstract Language Comprehension (TALC)

The Test of Abstract Language Comprehension (TALC) was developed by McLachlan and Elks (2012). It is a test for children with speech, language and communication needs. The TALC is based on the Language of Learning Model proposed by Blank, Rose, and Berlin (1978). Blank et al. (1978) presented a model which facilitates the classification of abstract questions and directions into four levels. The four levels follow a developmental sequence so the model can be used to ascertain the level of abstract language a child can understand. These four levels are: Naming (language matches materials), Describing (language relates to materials but must focus selectively), Re-Telling (language does not map directly to materials; have to use

language and materials to reorganise a response), Justifying (demands go beyond materials; have to use language to justify and solve problems).

Competency is achieved at each level when 80% of the answers are correct. This means that if the child correctly answers 80% of the questions at Level 1, 2, 3 or 4 then he or she can be said to be functioning at that level. The reported figures in the experimental chapters state the percentage of competency in each named area. Table 69 shows the typical pattern of development.

Table 69

Test of Abstract Language Comprehension typical pattern of development

Level	Description of level	Typical pattern of development
Level 1	Naming things	60% of 3 year olds understand level 1 and level 2 questions
Level 2	Describing things Answering Who? What? Where?	
Level 3	Talking about stories and events	65% of 5 year olds understand level 3 and level 4 questions
Level 4	Solving problems and answering Why? Questions	

Appendix E

Examples of Stimuli

Appendix E provides examples of all the stimuli used throughout this thesis.

They are presented in Table 70.

Table 70

The sets of five stimuli used throughout the thesis

Set	Symbol	Contrived Name
Set 1	ϣ	Tesh
	¥	Mip
	∞	Bozz
	∂	Cag
	Ӓ	Fed
Set 2	ʔ	Desh
	ℓ	Fip
	Ⅲ	Kozz
	Ю	Mag
	Ж	Jed
Set 3	Ц	Kop
	∫	Gub
	Φ	Jell
	л:	Sot
	д	Fash
Set 4	İ	Jip
	Ĭ	Gozz
	Ḃ	Han
	ς	Kell
	:λ:	Bish
Set 5	.Ξ.	Bip
	ξ	Mish
	ζ	Fazz
	Ψ	Dag
	⊖	Kell
Set 6	⌘	Piff
	.Ø.	Toon
	∴	Gom
	⌘	Hub
	Ḃ	Lat

Set 7		Koop
		Dud
		Gill
		Hoff
		Beez
Set 8		Yug
		Chob
		Pidge
		Tet
		Gand
Set 9		Gock
		Hudge
		Leet
		Mob
		Zing
Set 10		Moop
		Kong
		Jib
		Nen
		Afe

Appendix F

Raw Data and Updated Scores for Participants B and C

Appendix F provides information about the raw data for Participant B's initial test for Speaker Bidirectional Naming (SBN) and Participant C's initial test for Speaker Incidental Naming (SIN) in Experiment 6 (Tables 71 and 72). The scores are compared to new scores using an updated scoring system as described in Chapter 13 in the sub-section Sensitivity of Data Collection (see page 290).

Table 71

Original test scores and updated test scores for Participant B's initial test for Speaker Bidirectional Naming (SBN) in Experiment 6

Stimulus	Original Score in Test for SBN	Actual Response	Updated Score
Moop	-	Mop	4
Kong	-	Kock	4
Jib	+	Jib	5
Nen	-	Fem	2
Afe	+	Afe	5
Moop	-	Mop	4
Kong	-	Kock	4
Jib	+	Jib	5
Nen	-	Fem	2
Afe	-	Jib	1
Moop	-	Mop	4
Kong	-	Kock	4
Jib	+	Jib	5
Nen	-	Fem	2
Afe	+	Afe	5
Moop	-	Mop	4
Kong	-	Kock	4
Jib	+	Jib	5
Nen	+	Fem	2
Afe	-	Afe	5
TOTAL	7/20	TOTAL	76/100
% Correct	35%	% Correct	76%

Table 72

Original test scores and updated test scores for Participant C's initial test for Speaker Incidental Naming (SIN) in Experiment 6

Stimulus	Original Score in Test for SIN (Impure Tacts)			Original Score in Test for SIN (Pure Tacts)		
	Actual Response	Updated Score		Actual Response	Updated Score	
Yug	+	Yug	5	+	Yug	5
Chob	-	Mob	3	-	Mob	3
Pidge	-	Podge	4	-	Podge	4
Tet	-	Tet	5	+	Tet	5
Gand	-	Gotch	2	-	Godge	2
Yug	+	Yug	5	-	Yog	4
Chob	-	Mob	3	-	Mob	3
Pidge	-	Codge	2	-	Podge	4
Tet	+	Tet	5	+	Tet	5
Gand	-	Godge	2	-	Godge	2
Yug	+	Yug	5	-	Zag	2
Chob	-	Mob	3	-	Mob	3
Pidge	-	Podge	4	-	Potch	2
Tet	+	Tet	5	+	Tet	5
Gand	-	Godge	2	-	Gotch	2
Yug	+	Yug	5	-	Yog	4
Chob	-	Mob	3	-	Mob	3
Pidge	-	Podge	4	-	Potch	2
Tet	+	Tet	5	+	Tet	5
Gand	-	Godge	2	-	Gotch	2
TOTAL	7/20		72/100	5/20		67/100
% Correct	35%		72%	25%		67%